Potential Fuel Savings of General-Freight Carriers Operating Under Bridge Formula B Gross Vehicle Weight Limits

ROGER W. KOLINS

The number of gallons of diesel fuel that could be saved if 65-ft twin-trailer operations were permitted to operate under state weight limits designated on the basis of Bridge Formula B is estimated. This formula, developed by the American Association of State Transportation and Highway Officials, would only be applied to 65-ft twin-trailer operations and would permit them to operate at up to 85 500-lb gross vehicle weight as opposed to the arbitrary ceiling of 80 000 lb now established as the federal limit. The analysis indicates that application of Bridge Formula B to define the gross vehicle weight limit of 65-ft twin-trailer operations would save the United States 229 927 000 gal of diesel fuel annually.

This paper presents an estimate of the fuel savings that could result if Bridge Formula B, developed by the American Association of State Highway and Transportation Officials, were applied to define the gross vehicle weight (GVW) limits of five-axle trucks, as is the case in many states today (1). Bridge Formula B would not affect the permissible GVWs of all five-axle tractor-semitrailer combinations traveling under the formula's single- and tandem-axle weight limits of 20 000 and 34 000 lb, respectively. Five-axle tractor-semitrailers would still be restricted to 78 500 lb as under current federal vehicle weight limits. But without the arbitrary ceiling of 80 000 lb, now imposed by many states, 65-ft twin-trailer combinations operating under an uncapped Bridge Formula B would be permitted to reach a GVW of 85 500 lb. Twin-trailer combinations would still be restricted to single- and tandem-axle weights less than or equal to 20 000 and 34 000 lb, respectively.

If 65-ft twin trailers were permitted to operate in all states, it is conservatively estimated that 16.34 percent of intercity truck tonnage would be transported in twin-trailer vehicles. This figure is derived under the assumption that, at minimum, the proportion of less-than-truckload (LTL) motor freight tonnage traveling under "cube-out" conditions (in which motor carriers reach their cubic load capacity prior to reaching the allowable GVW) is potential twin-trailer traffic. LTL freight tonnage has been estimated to constitute 34.4 percent of all intercity motor freight tonnage (2), and A.T. Kearney has estimated that 47.5 percent of LTL motor-carrier trips travel under cube-out conditions (3, p. iv-i). The 16.34 percent potential twin-trailer freight estimate is the product of 0.344 and 0.475.

In the analysis presented in this paper, data on carrier line-haul operations are used to develop a probability function that, in turn, is used to predict the average payload weights a general-freight carrier will experience under given size and weight limits. The method used was first developed for presentation at the 1977 Transportation Research Forum (4).

The logic or model underlying this research is as follows: The impact of liberalized size and/or weight limits on truck payloads is, predominantly, a function of three factors: (a) the practical (or loadable) trailer cubic capacity, (b) increases in payload weight capacity, and (c) the availability of freight sufficiently dense to exploit payload weight capacities.

TRUCK-WEIGHT-LIMIT IMPACT MODEL

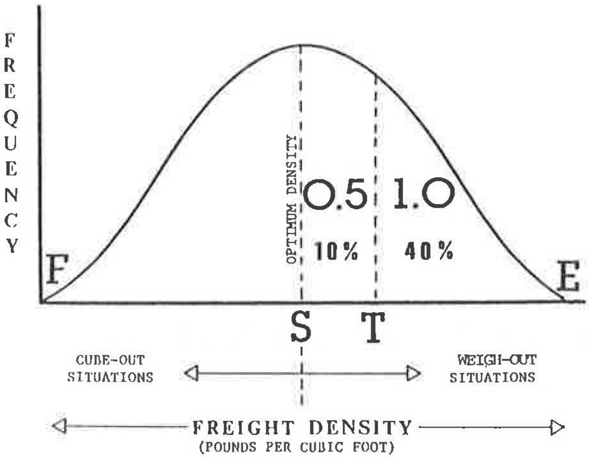
At any given truck size and weight limit, there is a freight density at which both size and weight capacities are fully used--the "optimal density". To the extent that the freight hauled is less or more than this optimum density, cubing- or weighing-out situations occur; that is, either cubic size or weight capacity is reached before the alternative capacity can be fully used.

To predict the average payload change in response to an altered weight limit, the probability of weighing-out must be estimated. If it is assumed, for illustration, that freight densities hauled by common carriers of general freight are normally distributed, with the optimal density for a representative truck equaling the mean, the probability of cubing- or weighing-out by assumption would be 50 percent, as reflected by the FE curve in Figure 1.

An increase in weight limits would produce an increase in payload capacity and cause the optimal density to shift in favor of denser, less frequently encountered freight. The shift from optimal density decreases the frequency of weighing-out by 10 percent. Only when densities T to E are hauled (40 percent of the time) can the full potential of the added capacity be exploited. When those densities that lie between the old and new optima, S and T, are hauled, cubing-out situations will occur but with heavier freight.

The impact of an increased weight limit over the range from S to T, which decreases the rate of weighing-out, may be approximated by reducing by half the frequency with which the freight densities occur. A factor of 0.5 appears appropriate since tonnage lost, due to the cubic constraint, approaches zero as the density of the freight ap-

Figure 1. Truck-weight-limit impact model.



proaches T and, conversely, the tonnage loss factor approaches 1.0 as the density of freight approaches S. The median effect between zero and 1.0 is 0.5.

The range of densities, F to S, bounded by cubic limitations prior to the change in weight-limit policy, would still be bounded after weight increases are permitted. Consequently, any added payload capacity would have no impact whatever on the cube-out rate, hence payload consisting of densities less than S.

For general-freight common carriers then, facing a market where their shipments are of an LTL nature and occur with a random frequency of densities, the probable average payload increase, stemming from an increase in the weight limit, will not have a one-to-one correspondence with the increase in the limits. In the illustration, the impact of the weight limit increase would be, on average, only 45 percent of the maximum potential weight increase.

To review the calculation procedures, the impact factor of 1.0 times the probability of experiencing a density between T and E is 40 percent (1.0 x 40), the impact factor of 0.5 times the probability of experiencing a density between S and T is 5 percent (0.5 x 10), and the impact factor of zero times the probability of experiencing the densities between F and S, 50 percent, is zero. In sum, the average maximum potential weight increase would be 40 percent plus 5 percent, or 45 percent.

DATA DEVELOPMENT: DISTRIBUTION OF GENERAL FREIGHT DENSITIES

Estimation of the distribution of general-freight densities is the first step in estimating the probable payload increases general-freight common carriers will experience for single-trailer (a tractor-semitrailer combination, 55-ft long with a 45-ft trailer) and double-trailer (twin-trailer combination, 65-ft long with two 27-ft trailers) operations, given an increased GVW limit. The distribution of freight densities can be derived from carrier outbound dispatch records, where the carrier records the following data: trailer length, weight, and cubic capacity use and traffic-leg origin and destination. From these data, trailer cargo density can be computed as follows:

$$\text{Trailer cargo density} = P/(L)(H)(W)(U) \qquad (1)$$

where

P = cargo weight (lb),
L = trailer inside length,
H = loaded trailer inside height,
W = trailer inside width, and
U = cubic capacity use.

Note that the estimates of trailer cargo density pertain to the average density of trailer cargos rather than individual bills of lading. This averaging should give the derived density distribution a very slight leptokurtic bias.

In June 1980, 19 carriers were contacted to obtain terminal outbound dispatch records for the first week of July 1980. The previous study by Kolins (4) indicated no seasonal variation in the distribution of freight densities experienced by general-freight common carriers. Seven carriers provided the required data in usable form. Each of the seven carriers had broad regional or nationwide authority.

The seven carrier data sets comprised nearly 200 000 trailer movements. To reduce this number to a more manageable size, a 3 percent sample of all dispatch records was taken for each carrier according to its origin terminal. A computerized random number generator program produced 6561 records, of which 2227 were 27-ft trailer movements and 4334 were 45-ft trailer movements. The number of trailer-movement records used from each carrier ranged from 567 to 1719. To facilitate ease of data manipulation and consistency among the seven data sets, each carrier's terminals were assigned to Census production areas (as defined by the U.S. Bureau of the Census) nearest them.

For the seven carriers as a group, there appeared to be no effort on the part of carriers to favor one trailer length over another to receive light or dense freight. Both the T-test and Kolmogorov-Smirnov two-sample tests were used to test the hypotheses of dissimilar means and dissimilar distributions. Both hypotheses were rejected at the 0.05 level.

Trailer cargo densities were then computed for the 6561 trailer loads and arrayed according to their movements between Census production areas. Since a 45-ft trailer represents 1.67 times the cubic capacity of a 27-ft trailer (45 ÷ 27 = 1.666), the equipment capacities were adjusted to reflect equivalent units. Thus, an appropriate conversion was made to the 45-ft-trailer records so that each density observation within the sampled freight-movement data would represent an equivalent unit of cargo. The sample program from the Statistical Package for the Social Sciences (5) was used to randomly sample approximately 67 percent of the 4334 freight-density observations for 45-ft trailers, or 2882 observations. This sampled set was then added to the original 6561 observations to create a freight-density data base of 9443 equivalent unit observations for 27-ft trailers.

STUDY REGIONS

The following Census production areas were chosen to represent three study regions: areas 26-35, omitting 32, for the Southeast; areas 3-21 for the Northeast; and areas 37-49, omitting 44 and 45, for the Southwest. Census production areas 24, 25, and 32 (Baltimore, Washington, D.C., and Louisville, respectively) were omitted in order to provide clearly defined borders between the regions. The sample sizes for the three regions were 2262, 3546, and 2135, respectively.

The shape of the freight-density distribution curve, as well as line-haul operating conditions, will vary from region to region. Hence, the impact of a given weight-limit change can be expected to differ between regions. As a consequence, two modifications were made to the survey data to construct freight-density distribution (probability) curves that reflect regional variations in general-freight traffic. First, the production-area sample sizes were normalized so that each production area contributed the same weight or influence to the derivation of the regional freight-density distribution curve. Second, the normalized production-area samples were weighted to reflect their relative output contribution to the region under examination. The relative production-area output levels were derived from estimates of the outbound tonnage originating in the production areas for the weeks ending August 16, 1980, and September 13, 1980, as derived from data of American Trucking Associations, Inc. (6).

IMPACT OF WEIGHT LIMITS ON TRUCK PAYLOADS

The survey freight-density data indicated that, as a rule, LTL general-freight carriers do not frequently experience sufficiently dense freight to make full use of GVW limit increases from 73 280 to 80 000 lb or 80 000 to 90 000 lb. Table 1 gives the marginal increases in average five-axle payload weights, by truck type and region, derived by the truck-weight-limit impact model, for increases in the GVW limit from 73 280 to 80 000 lb and from 80 000 to 90 000 lb, calculated from the following formula:

$$\text{Marginal payload weight increase} = M_r U_r \, (\text{Max}_n - \text{Max}_o) \quad (2)$$

where

M_r = regional weight-limit increase impact factor derived from freight-density distribution data,
U_r = regional average trailer cubic capacity utilization rate,
Max_n = new maximum payload weight (GVW limit - tare weight), and
Max_o = old maximum payload weight.

Table 1 also presents the maximum payloads, optimal densities, and impact factors (M_r) used. Tare weight can be derived from the data in Table 1. The typical percentages of trailer cubic capacity used (U_r) in over-the-road LTL operations for the southeastern, northeastern, and southwestern regions are 84, 79, and 80 percent, respectively, as found from the survey data (1).

From the survey data, initial average payload weights by vehicle type were also developed for general-freight carriers operating under the 73 280-lb weight limits in each region (4). To develop the expected average general-freight payload and GVWs reported in Table 2, the marginal payload increases of Table 1 are added to the 73 280-lb weight limit base payload estimate and then tare-weight estimates are added to these. This provides the data necessary to calculate the impact of increased truck weight limits on LTL fuel productivity for general-freight carriers.

IMPACT OF INCREASED TRUCK SIZE AND WEIGHT LIMITS ON CARRIER FUEL PRODUCTIVITY

The fuel consumption formulas reported below indicate the 1981 relation between fuel consumption rates and vehicle gross weight at a maximum speed of 55 mph for single-trailer and twin-trailer combinations, respectively (7):

$$\text{GPM} = 0.000\,93(\text{K}) + 0.137\,88 \quad (3)$$

$$\text{GPM} = 0.000\,90(\text{K}) + 0.135\,20 \quad (4)$$

where GPM is gallons per mile and K is GVW in thousands of pounds.

The fuel formulas provide estimates of the fuel consumption rates of individual trucks, but for this analysis a systemwide average fuel consumption rate is required that incorporates an assumed ratio of empty to loaded miles, as follows:

$$\text{BTU/ton mile} = [S(\text{GVW}) + C] + \phi[S(T)]\,[\text{BTU}/(1/2)P] \quad (5)$$

where

S = slope of the appropriate fuel consumption curve;
GVW = tractor-trailer combination GVW (lb 000s);
C = constant of the appropriate fuel consumption formula;
ϕ = empty to loaded miles allocation ratio, expressed as percentage of empty miles over percentage of loaded miles [general-freight carriers average an empty mileage rate of 10 percent (8, p. 6; 9); therefore, $\phi = 0.10/0.90 = 0.1111$];
T = tractor-trailer combination tare (empty) weight (lb 000s); and
(1/2) P = payload weight, expressed in thousand-pound units converted to tons.

The expected average Btu per ton mile energy consumption rates, by region and vehicle type, under GVW limits of 73 280, 80 000, and 90 000 lb are given in Table 3.

BRIDGE FORMULA B ANALYSIS

To estimate the state-by-state potential fuel

Table 1. Derivation of marginal payload weight increases.

		Maximum Payload[a] by GVW (lb)			Optimal Density[b] by GVW Limit (lb/ft^2)			Impact Factor by GVW Limit			Marginal-Payload Weight Increase by GVW Limit (lb)	
Vehicle Size	Region	73 280 lb	80 000 lb	90 000 lb	73 280 lb	80 000 lb	90 000 lb	73 280 lb	80 000 lb	90 000 lb	73 280 to 80 000 lb	80 000 to 90 000 lb
Single, 55 ft	Northeast	43 980	50 250	NA	15.17	17.33	NA	Base	0.2021	NA	1001	NA
	Southeast	43 980	50 250	NA	15.17	17.33	NA		0.1617	NA	852	NA
	Southwest	43 980	50 250	NA	15.17	17.33	NA		0.1518	NA	1154	NA
Double, 65 ft	Northeast	42 180	48 300	56 800	11.72	13.42	15.78	Base	0.4559	0.2972	2204	1996
	Southeast	42 180	48 300	56 800	11.72	13.42	15.78		0.3997	0.2565	2055	1831
	Southwest	42 180	48 300	56 800	11.72	13.42	15.78		0.4339	0.3081	2124	2095

[a] Tare weight may be derived by subtracting maximum payload from maximum vehicle weight limit. Tare weight included fuel (1400 lb) and driver (200 lb) weight.
[b] Optimum density calculations based on 2900-, 3600-, and 5400-ft^3 dry freight capacities.

Table 2. General-freight average payload and GVW estimates.

		Estimated Payload by GVW Limit (lb)			Estimated Gross Weight by GVW Limit (lb)		
Vehicle Size	Region	73 280 lb	80 000 lb	90 000 lb	73 280 lb	80 000 lb	90 000 lb
Single, 55 ft	Northeast	27 236	28 237	NA	56 536	57 987	NA
	Southeast	28 600	29 452	NA	57 900	59 202	NA
	Southwest	29 105	30 259	NA	58 405	60 009	NA
Double, 65 ft	Northeast	32 683	34 887	36 883	63 783	66 587	70 085
	Southeast	34 320	36 375	38 406	65 420	68 075	71 405
	Southwest	34 187	36 311	38 406	65 287	68 011	71 605

Table 3. Energy consumption rates for single- and double-trailer operations under various weight limits.

		Energy Consumption by GVW Limit (Btu/ton mile)		
Vehicle Size	Region	73 280 lb	80 000 lb	90 000 lb
Double	Northeast	1754	1663	1597
	Southeast	1682	1605	1551
	Southwest	1687	1608	1544
Single	Northeast	2085	2025	NA
	Southeast	1998	1952	NA
	Southwest	1968	1906	NA

savings resulting from permitting twin-trailer combinations to operate nationwide under 85 500-lb Bridge Formula B weight limits, it must be recognized that current state truck size and weight limits fall into five categories:

1. States where 65-ft twin trailers are permitted to operate under GVW limits of 80 000 lb,
2. States where 65-ft twin trailers are permitted to operate under GVW limits of 73 280 lb,
3. States with GVW limits of 80 000 lb where 65-ft twin-trailer operations are not permitted,
4. States with GVW limits of 73 280 lb where 65-ft twin-trailer operations are not permitted, and
5. States where 65-ft twin trailers are permitted to operate under "grandfathered" GVW limits of 85 500 lb or more.

The states and the District of Columbia are categorized below with respect to these five conditions as of August 1981:

1. Category 1--Arizona, California, Delaware, Florida, Iowa, Kentucky, Maryland, Michigan, Minnesota, Nebraska, Ohio, Texas, and Wisconsin;
2. Category 2--Arkansas, Illinois, Indiana, and Missouri;
3. Category 3--Alabama, Connecticut, District of Columbia, Georgia, Maine, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, South Carolina, Vermont, Virginia, and West Virginia;
4. Category 4--Mississippi and Tennessee; and
5. Category 5--Alaska, Colorado, Hawaii, Idaho, Kansas, Louisiana, Montana, New Mexico, Nevada, North Dakota, Oklahoma, Oregon, South Dakota, Utah, Washington, and Wyoming.

In Louisiana weight limits are 83 400 lb on Interstates and 88 000 lb on other highways.

The estimation procedures for each category are similar in that they assume a potential twin-trailer use rate of 16.34 percent and they interpolate from the regional productivity analysis the increase in fuel productivity brought about by moving from the base truck size and weight conditions to conditions in which twin trailers are permitted to operate under Bridge Formula B 85 500-lb weight limits.

Category 1 and 2 States

The computations in this section are composed of three steps. Step 1 estimates the fuel productivity increases (per state) derived from an increase in the use of 65-ft twin-trailer combinations from current levels to the 16.34 percent use rate. Table 4 presents the stepwise calculation results. A weighted average of percentage of twin-trailer traffic over the period 1975-1979 was developed for each state, from the Federal Highway Administration's Rural Interstate Station Truck Count data base (column 3). The expected increase in twin-trailer traffic (column 4) was determined by subtracting actual use from the potential use level of 16.3 percent. The increase in fuel productivity that accrues from moving freight in twin trailers as opposed to tractor-semitrailers (assuming no change in the current weight limit) is calculated from Table 3 and reported in column 5, Table 4. The net productivity increase resulting from the expected increased use of twins (column 6) is the product of columns 4 and 5.

Step 2 estimates the energy consumption savings derived from 65-ft twin-trailer combinations operating under 85 500-lb weight limits as opposed to 80 000- or 73 280-lb GVW weight limits. The data for step 2 are presented in Table 3. To estimate the energy consumption rates (Btu per ton mile), by region, of twin-trailer operations operating under 85 500-lb weight limits from the energy consumption rates at 80 000 and 90 000 lb, the data presented in Table 3 are interpolated. Five substeps are required.

The first substep is to calculate the strength of the nonlinear relation between the energy consumption ratio and GVW limits. The actual deviation in

Table 4. Fuel productivity increase deriving from an increase in trailer use rate.

					Fuel Productivity	
Category	State	Analysis Region	Current Twin-Trailer Traffic[a] (%)	Expected Increase in Twin-Trailer Traffic[b] (%)	Increase (%)	Net Increase (%)
1	Arizona	Southwest	16.3	0	15.6	0
	California	Southwest	41.9	0	15.6	0
	Delaware	Northeast	0	16.3	17.9	2.92
	Florida	Southeast	0	16.3	17.8	2.90
	Iowa	Northeast	1.4	14.9	17.9	2.67
	Kentucky	Southeast	0	16.3	17.8	2.90
	Maryland	Northeast	0	16.3	17.9	2.92
	Michigan	Northeast	2.0	14.3	17.9	2.55
	Minnesota	Northeast	0.7	15.6	17.9	2.79
	Nebraska	Northeast	7.8	8.5	17.9	1.52
	Ohio	Northeast	1.5	14.8	17.9	2.65
	Texas	Southwest	3.8	12.5	15.6	1.95
	Wisconsin	Northeast	1.3	15.0	17.9	2.69
2	Arizona	Southeast	0	16.3	15.8	2.58
	Illinois	Northeast	3.9	12.4	15.9	1.97
	Indiana	Southeast	2.0	14.3	15.9	2.27
	Missouri	Northeast	6.2	10.1	15.9	1.61

[a] Taken from FHWA Rural Interstate Station truck counts, weighted average of 1975-1979 period.
[b] Column 4 = 16.3 - column 3, if the answer is positive.

Table 5. Fuel productivity gains of permitting twin-trailer combinations to operate under 85 500-lb gross vehicle weight limits versus 80 000-lb and 73 280-lb limits and its impact.

		Fuel Productivity		Expected Percentage of Twin Trailers	Productivity Impact of Weight Limit Change (%)
Category	Region	Calculation of Increase (Btu/ton mile)	Increase (%)		
1	Northeast	(1663 - 1610)/1663	3.19	16.34	0.52
	Southeast	(1605 - 1560)/1605	2.80	16.34	0.46
	Southwest	(1608 - 1557)/1608	3.17	16.34	0.52
2	Southeast	(1682 - 1560)/1682	7.25	16.34	1.18
	Northeast	(1754 - 1610)/1754	8.21	16.34	1.34

Table 6. Estimation of potential fuel savings for category 1 and 2 states.

	Productivity Change (%)				
State	Increased Size	Increased Weight	Total Impact	Diesel Fuel (gal 000s)	Fuel Savings (gal 000s)
Arizona	0	0.52	0.52	154 709	804
California	0	0.52	0.52	799 682	4 158
Delaware	2.92	0.52	3.44	18 410	633
Florida	2.90	0.46	3.36	312 637	10 505
Iowa	2.67	0.52	3.19	195 467	6 235
Kentucky	2.90	0.46	3.36	155 097	5 211
Maryland	2.92	0.52	3.44	103 811	3 571
Michigan	2.55	0.52	3.07	246 481	7 567
Minnesota	2.79	0.52	3.31	202 032	6 687
Nebraska	1.52	0.52	2.04	100 542	2 051
Ohio	2.65	0.52	3.17	526 281	16 683
Texas	1.95	0.52	2.47	838 280	20 706
Wisconsin	2.69	0.52	2.21	213 208	4 712
Arkansas	2.58	1.18	3.76	143 633	5 401
Illinois	1.97	1.34	3.31	471 900	15 620
Indiana	2.27	1.34	3.61	376 108	13 577
Missouri	1.61	1.34	2.95	264 616	7 806

Note: Based on Table MF-25 of FHWA Highway Statistics, adjusted to represent diesel fuel used by trucks with five or more axles; derivation technique from Kolins and Selva (10).

Btu per ton mile from the mean value is approximately 1 percent, since a minor curvilinear relation is observed between the range of GVW values. This relation holds true up to 10 000-lb differences. If one uses the Northeast as an example, the calculation of bias of straight-line interpolation is as follows:

$$1597/[(1/2)(1663 + 1566)] = 0.989 \approx 0.99 \qquad (6)$$

This factor remains at 0.99 for all regions.

The next three substeps are as follows:

1. Calculate the difference between the Btu per ton mile consumption rates for twins operating under 80 000-lb versus 90 000-lb GVW limits:

Region	Calculation
Northeast	1663 - 1597 = 66
Southeast	1605 - 1551 = 54
Southwest	1608 - 1544 - 64

2. Calculate the portion that would account for the 5500-lb increase in GVW limit, if weight limits defined by Bridge Formula B were adopted (55 percent of the difference calculated in item 1):

Region	Calculation
Northeast	66x0.55 = 36.3
Southeast	54x0.55 = 29.7
Southwest	64x0.55 = 35.2

3. Estimate the energy consumption rate of twin-trailer combinations operating under an 85 500-lb GVW limit by subtracting the Btu per ton mile range from the 80 000-lb energy consumption rate estimate, and multiply the net Btu per ton mile estimate by 0.99:

Region	Calculation
Northeast	(1663 - 36.3) 0.99 ≈ 1610
Southeast	(1605 - 29.7) 0.99 ≈ 1560
Southwest	(1608 - 35.2) 0.99 ≈ 1557

The final substep of step 2 is to calculate the fuel productivity impact on interstate motor-carrier traffic that would result from twin-trailer weight limits being increased from 73 280 to 85 500 lb. These estimates, for the relevant analysis regions are presented in Table 5.

Step 3 (Table 6) combines the estimated fuel productivity benefits calculated in steps 1 and 2 and applies the percentage productivity increases, by state, to their diesel fuel consumption for the year 1979 in order to estimate the potential fuel savings in gallons.

Category 3 States

For the states that fall in category 3, the productivity gains of a simultaneous increase in size and weight limits must be considered. Table 3 reports the estimated average energy consumption rates for single-tractor-trailer combinations operated by general-freight carriers under 80 000-lb GVW limits in the Southeast and the Northeast to be 1952 and 2025 Btu/ton mile, respectively. In the category 1 states, the expected energy consumption rates of 65-ft twin-trailer combinations operating under 85 500-lb GVW limits for the Southeast and the Northeast were estimated to be 1560 and 1610 Btu/ton mile, respectively.

Therefore, it can be expected that, for those general-freight carriers that take advantage of twin-trailer combinations under 85 500-lb GVW limits in the category 3 states, the increase in carrier fuel use productivity will be 20.08 percent (1952 - 1560) ÷ 1952 in the Southeast and 20.49 percent (2025 - 1610) ÷ 2025 in the Northeast. Assuming that 16.34 percent of motor-carrier tonnage will be moved in twin-trailer combinations, the expected productivity impact of increased weight limits and removed restrictions on the use of twin-trailer combinations for the category 3 states with respect to total truck fuel use is 3.28 percent for the southeastern states and 3.35 percent for the northeastern states.

Table 7 presents estimates of the fuel savings that would result if twin-trailer combinations were permitted to operate nationwide under Bridge Formula B weight limits for those states in category 3.

Category 4 States

The computations for category 4 states are identical to those for category 3 states except that the base GVW limit is 73 280 lb. The energy consumption rate for single-tractor-trailer combinations operating in the Southeast under 73 280-lb GVW limits has been estimated at 1998 Btu/ton mile. This increases the fuel productivity gains to be enjoyed by carriers that convert their present operations to twin-trailer operations under 85 500-lb GVW limits for

Table 7. Estimation of potential fuel savings for category 3 and 4 states.

Category	State	Analysis Region	Productivity Impact of Increased Weight Limits and Removed Restrictions on Operation of Twin-Trailer Combinations (%)	State Diesel Fuel Consumption (gal 000s)	Fuel Savings (gal 000s)
3	Alabama	Southeast	3.28	199 385	6 540
	Connecticut	Northeast	3.35	72 803	2 439
	District of Columbia	Northeast	3.35	18 410	617
	Georgia	Southeast	3.28	311 367	10 213
	Maine	Northeast	3.35	38 732	1 298
	Massachusetts	Northeast	3.35	123 965	4 153
	New Hampshire	Northeast	3.35	18 048	604
	New Jersey	Northeast	3.35	231 577	7 758
	New York	Northeast	3.35	232 739	7 797
	North Carolina	Southeast	3.28	271 429	8 903
	Pennsylvania	Northeast	3.35	514 810	17 246
	Rhode Island	Northeast	3.35	16 184	542
	South Carolina	Southeast	3.28	162 649	5 335
	Vermont	Northeast	3.35	21 461	719
	Virginia	Southeast	3.28	225 961	7 412
	West Virginia	Northeast	3.35	67 420	2 259
4	Mississippi	Southeast	3.58	125 780	4 506
	Tennessee	Southeast	3.58	269 816	9 659

the Southeast to 21.92 percent (1998 - 1560) ÷ 1998. With 16.34 percent expected twin-trailer use, if Mississippi and Tennessee were to adopt the Bridge Formula B twin-trailer GVW limits and permit twin-trailer operations, their anticipated fuel savings would be 3.58 percent of the fuel currently consumed by trucks with five or more axles within their borders. Table 7 summarizes the calculations to derive the estimated fuel savings for the two category 4 states. No estimation procedures are necessary for the fifth category.

SUMMARY

If 65-ft twin trailers were permitted to operate nationwide under the Bridge Formula B GVW limits of 85 500 lb at 60-ft axle spacing, diesel fuel savings totaling 229 927 000 gal would be expected in 34 states and the District of Columbia, based on 1979 diesel fuel consumption rates.

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