Characteristics of
HIGHWAY FREIGHT TRANSPORTATION
in Texas

A Study of
Applications of Loadometer Data
in Transport Economics

By
J. NELSON SLATER
Texas Transportation Institute

This Report Covers a
Co-operative Research Project Between the
Texas Highway Department
and the
Texas A. and M. College System

THD and TTI Research Project 2 January, 1957

TEXAS TRANSPORTATION INSTITUTE
(A Part of the Texas A. & M. College System)
College Station, Texas

CONTENTS

DIGEST

Field records and punched cards covering observations made at vehicle weight stations in Texas form the basis of this investigation. The plan of the study involved three objectives: (1) to investigate vehicle types, weights, distances, and carried loads in general; (2) to complete statistics regarding the commodities being hauled over main rural roads and the industries engaging in intercity trucking; and (3) to evaluate this use of loadometer data.

Industries Engaged in Intercity Trucking

A unique set of data reported here has to do with the incidence of highway freight use by various classes of industries. Some 4380 loaded and empty trips were identified as to the industry being served. The heaviest users of the private trucking privilege were merchant wholesalers. The highest average carried load among private haulers was a 11.5 ton average recorded for manufacturers of fabricated metal products.

Private and for-hire distinctions also appear in the industry section. Sixty-six percent of the 12,009 loaded trips were made by private motor trucks as opposed to 34 percent by for-hire trucks. The average carried load for all hired trucks, 9.4 tons, is 54 percent more than the private trucks average of 6.1 tons. The average trip length (unadjusted) for private vehicles in the sample was 243 miles, while the for-hire average was 410 miles. Thus, with heavier loads

Figure 1 — Interviewing a truck driver.

and longer trips, the for-hire vehicles accounted for 47 percent of total ton-miles accumulated in the sample but represented only 34 percent of the total number of vehicles.

Commodities Hauled in Intercity Trucking

Part II gives freight commodity data applying to intercity trucking in Texas and the Southwest. In several respects these are comparable with railroad commodity statistics. Tonnage, ton-miles, trip frequency, average loads, and average trip lengths are given. Both rail and truck depend rather heavily on "manufacturers and miscellaneous" traffic, but the differences in average loads and hauls are striking. For none of the principal commodity groups does the average load of motor trucks approach that of railroads. For products of agriculture the average haul of trucks exceeded that of railroads, but in all other respects the average rail hauls in miles far exceeded truck averages.

Vehicle Weights and Loads

When vehicles are grouped in the familiar way, according to number of axles, there are wide ranges between the highest and lowest empty weight values. The need of subclassification for the purpose of reducing such ranges is apparent. Empty weight values used in this study were generally derived by grouping vehicles according to rated capacity within body type, and body type within axle type. It was concluded that average empty weights of more precision must await a comprehensive multiple correlation analysis or the development of different estimating procedures.

When loaded and empty samples are taken of vehicles grouped by axle type alone the empty samples do not appear to be representative of the loaded samples with respect to average empty weight. A larger proportion of light-weight vehicle classes occur in the empty sample. This difference was found to be significant by employing the chi-square test. Grouping vehicles by body type (within axle type) is especially productive with respect to average carried loads. The covered body type which is the most numerous, is significantly below the other types in average carried load.

Trip Distances and Ton-Miles

Available trip length data was in the form of a mileage block distribution. A trip length bias occurs in loadometer data due to the greater probability of longer trips being included in a sample. When adjusted for correction of this bias, average trips lengths derived directly from loadometer records are considerably reduced, although loaded vehicles still exceed empty vehicles in average trip length. An empty to loaded trip ratio was devised (based on frequency) showing the effect of trip length on empty or loaded status. Trip length also appears to affect the size of carried loads. Average loads frequently increase with increases in average distance. This gives occasion for errors in estimates of "average carried load" which are in addition to those caused by a too general classification of vehicles. Ton-miles were calculated separately for smaller groups (mileage blocks, vehicle types, industry class, etc.) and then summed to make up grand totals. Some of the errors inherent in the multiplication of two estimated variables (weight times distance) are thus reduced.

Uses of Loadometer Data in Transport Economics

Motor trucking is diverse in nature, and much of it is only nominally regulated. However, the motor haul of specific commodities is customarily estimated on the basis of the reported operations of Class I regulated carriers, and industry uses of motor trucking are seldom reported in any form other than an occasional study of a specific industry. Loadometer and other roadside operations therefore appear to offer the most practical basis for obtaining random freight traffic data applying to a uni-

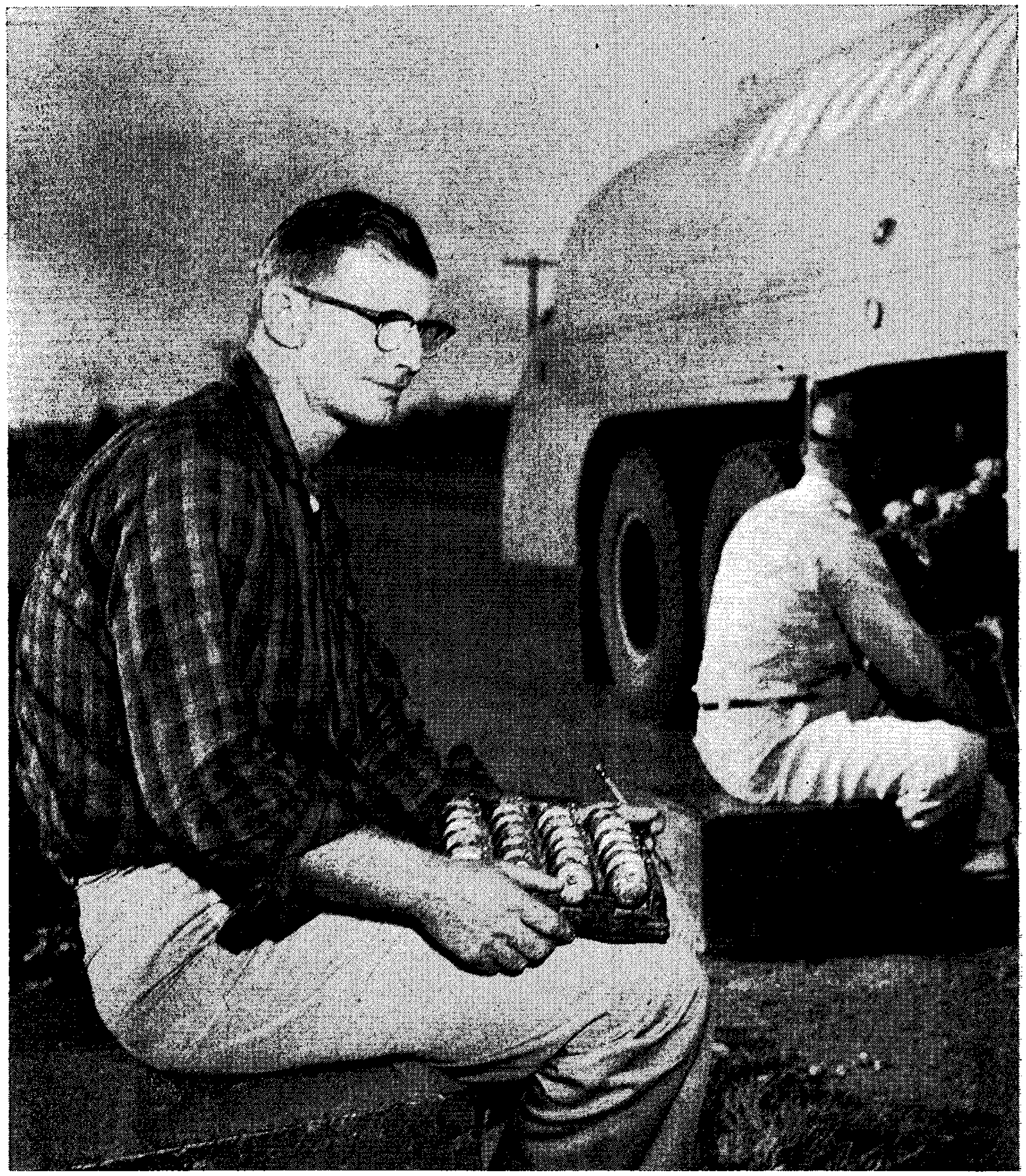


Figure 2 — Making manual classified counts.

verse. Traffic studies of this nature would be based more on the details of sample trips than on the "stream of traffic" basis generally used in highway traffic and mileage estimates.

Although the trip length values reported here are given in mileage blocks they can as easily be expressed to the nearest "short line" mile. There remain only the problems of estimating the probable empty weight of individual loaded vehicles and of adjusting mileage data to correct the trip length bias. An adjustment described in this report may be the solution to the trip length bias but this has not been established. The uses of loadometer data in transport economics would appear to depend on the extent to which these problems are overcome.

INTRODUCTION

This report describes a study of some of the characteristics of intercity trucking that are significant in transport economics. The investigation was based on data recorded during 1955 at the 21 loadometer stations operated by the Highway Planning Survey of the Texas Highway Department. Information available for analysis covered some 19,000 trips by trucks and truck combinations on main rural roads.

The study is rather broad in scope. The basic topics of vehicle classification, loads, distances, and trip frequencies were first examined in a general way; then they were considered in connection with the type and volume of commodities hauled, and the industrial classification of firms engaged in private (not for hire) motor trucking. A general objective was to give a preliminary test to the expediency of applying loadometer data to questions of this type.

The need for finding a better measurement of highway freight hauling has increased with the notable growth of this mode of transport. Inter-city motor vehicle ton-miles have more than doubled since 1947, and the 1954 total was estimated to be more than four times that of 1939.[1] In view of such recent and extensive growth it is not surprising to find that the attributes of truck transport which are also common to automobile transport, such as fuel uses, traffic densities and average speeds, are being measured and reported in considerable detail. However, other attributes, such as tonnage and ton-miles, that motor trucks share in common with railroads, waterways, and pipelines are estimated and reported with less certainty. The existence of good and sufficient reasons for such differences does not alter the observation that transport economics data regarding motor trucking is generally less precise than for the other important forms of freight transportation. Therefore, the study reported here was an attempt to gain new information about certain basic economic charactertistics of intercity trucking, using as source material the field records and punched cards containing observations made at weighing stations.

Since 1936 the highway agencies of various states, in cooperation with the Bureau of Public Roads, have conducted periodic weighing programs which provide information about vehicle types, weights, and loading habits. These data are combined with classified counts of all vehicles passing the weighing stations, and with classifications and traffic densities obtained from a number of other manual count stations, in order to derive current estimates of the traffic frequencies and load characteristics of the vehicle classes. These estimates are then used in correlation with data obtained from automatic traffic recorders, and from other continuing operations, to obtain classified estimates of total intercity vehicle miles and ton-miles.

The Texas loadometer program operates on a year-round basis. Operations are conducted at a different station each weekday. The approximate locations of the stations are indicated in Figure 3. A daily sampling period of eight hours is divided into four intervals of two hours duration, with inbound and outbound traffic being sampled at alternate intervals. To provide representation of a 24-hour day, the sampling periods of each station alternate during the year. One period is from 6 A.M. to 2 P.M., another from 2 P.M. to 10 P.M., and a third from 10 P.M. to 6 A.M. Activities are suspended during inclement weather.

The following data are obtained for every vehicle weighed:

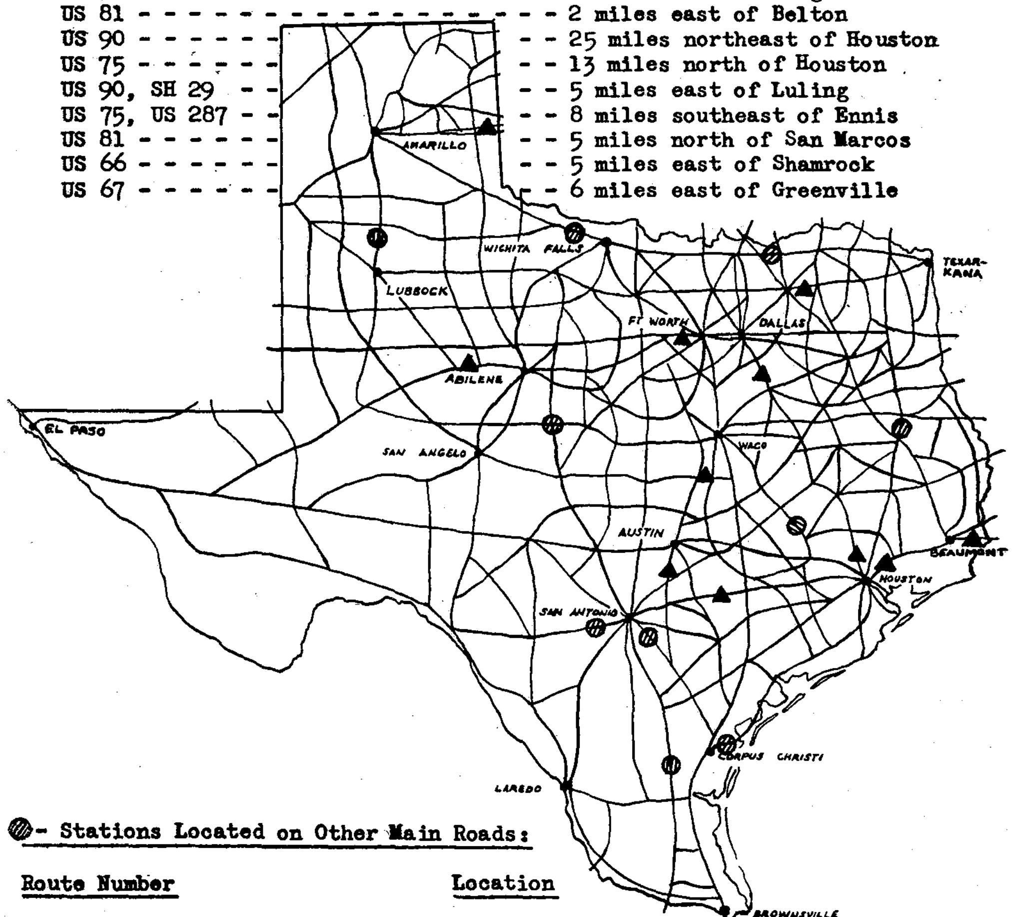
Date, day of the week, and hour weighed. Location of station. Di-

[1] "Intercity Ton-Miles, 1939-1954," Statement No. 568, Interstate Commerce Commission, Bureau of Transport Economics and Statistics.

LOCATIONS OF LOADOMETER STATIONS IN TEXAS

▲- Stations Located on the Interstate Highway System:

Route Number	Location:
US 80	6 miles west of Sweetwater
US 80	8 miles west of Fort Worth
US 90	1 mile west of Orange
US 81	2 miles east of Belton
US 90	25 miles northeast of Houston
US 75	13 miles north of Houston
US 90, SH 29	5 miles east of Luling
US 75, US 287	8 miles southeast of Ennis
US 81	5 miles north of San Marcos
US 66	5 miles east of Shamrock
US 67	6 miles east of Greenville



⊘- Stations Located on Other Main Roads:

Route Number	Location
US 67, US 84, US 183	2 miles southeast of Coleman
US 87	9 miles north of Lubbock
US 287	10 miles northwest of Wichita Falls
US 82	2 miles west of Bonham
US 59	8 miles south of Nacogdoches
SH 6	5 miles south of College Station
US 181	8 miles southeast of San Antonio
US 281	14 miles south of Alice
US 181	1 mile northeast of Corpus Christi causeway
US 90	4 miles west of San Antonio

Figure 3 — Locations of loadometer stations on interstate highway system and on other main roads in Texas.

rection of travel from station. Origin and destination of trip. Length of trip (computed in the office and grouped into mileage blocks).

Loaded or empty status. Commodity carried if loaded. Interstate or intrastate status of trip. Operating classification: whether common carrier, contract carrier, specialized commodity carrier, or private hauler; type of operating license; and whether or not licensed by the Interstate Commerce Commission.

Manufacturers' rated capacity of prime mover and trailer. Type of fuel used. Vehicle axle type and body type. Wheel loads and axle spacings. Total weight of the vehicle. Vehicle wheelbase, height, and width.

In addition to the above, and in order to facilitate the present study, the loadometer party also noted the state license numbers and the business identification, if any, appearing on the vehicles. Such information was used, in a manner to be described in the following section, to obtain the industrial classifications of the firms engaging in private hauling.

It should perhaps be mentioned here that the Texas Highway Department distributes an annual series of loadometer tables based on observations recorded during the three summer months. Therefore, certain types of analyses that might otherwise be included in this report are omitted. The loadometer tables for the summer of 1955 pertain to a total of 6979 vehicles weighed. The same subjects were pursued in this study only when it seemed that additional value could be expected due to the larger sample with which we were working. The 18,887 vehicles which are the basis of this report were weighed during a period extending from April 18, 1955, to the end of the year.

We have elected to present averages, totals, and other generalizations that apply only to the trips in the loadometer sample rather than attempt to expand the data.[2] Comparisons between commodities, industries, and vehicle types are believed to be little affected by this decision. Since (as will be shown) average payloads tend to increase with trip distance, correction of the sample to include more short trips would have the effect of reducing the computed average loads. Also, a correction of this nature would result in reduced estimates of both miles and ton-miles per trip. Therefore, these unadjusted data are presented as relative values which are meant to be useful in making various comparisons.

---

[2]Several difficulties are encountered in attempting to expand a loadometer sample to represent the universe of motor truck movements in a state or other area. The distance factor (average trip length, etc.) is quite uncertain. Since vehicles are weighed at fixed locations on main rural roads, it can be assumed that motor trucks making longer trips have a greater probability of passing a weighing station than those making short trips along the same route. If one assumes that the probability of a trip being sampled varies in direct proportion to its length it is possible to work out an adjustment of raw loadometer data to derive an estimate of "average trip length" for the universe. An adjustment of this "trip length bias" is described in Part III.

Another necessary adjustment factor is the "percentage weighed of total counted," which varies with type of vehicle. Only 5 percent of the panel and pick-up trucks passing the stations during weighing operations were actually stopped and weighed, whereas 41 percent of the observed 4-axle combination vehicles were stopped for weighing. These percentages for the principal vehicle types are given in Part III (see note at end of Table 18). Other adjustments would need to be made to account for the time of observation, location of station, etc.

PART I

INDUSTRIES ENGAGED IN HIGHWAY FREIGHT TRANSPORTATION

An investigation was made of the uses of motor trucking by various industries as reflected in loadometer data. The purpose was to determine the variations in average loads and distances and the frequency of trips that are associated with different classes of producing and distributing enterprises.

The business identity of the owners or operators of vehicles is not usually determined at the loadometer stations. It was therefore necessary to devise special procedures for establishing the industrial classification of the enterprises in which the vehicles were being used. In cooperation with officials of the Texas Highway Planning Survey a plan to accomplish this objective was put into operation. Under this plan the loadometer crew made notation of the license numbers of trucks and tractors being weighed. In addition, any business identification appearing on a vehicle was recorded.

Since adequate operating classifications were being obtained for the trips of for-hire vehicles it was decided to restrict the additional investigation to the "private" operating class. By the use of standard business references and directories it was possible to identify the appropriate industrial classification of many vehicles from their external markings other than licenses. The owner identification of more than three thousand vehicles for which only the license number was available was obtained through the cooperation of officials of the Motor Vehicle Division of the Texas Highway Department. Most of these identities were then located in business directories and the proper industrial classifications were assigned to the trips. In cases when the industrial classification of a trip could not be determined from business reference books a brief questionnaire was sent to the registered owner of the vehicle, seeking to determine the type of business involved in the trip. Texas vehicles registered primarily for farm use are assigned separate license prefix numbers, and no further identification was attempted for these "farm licensed vericles." No attempt was made to ascertain the industrial classification of trips made by vehicles not licensed in Texas. A number of out-of-state vehicles, however, could be classified on the basis of their external marking.

Some 4380 loaded and empty trips (private operation) were thus identified as to the industry being served. The Standard Industrial Classification published by the Bureau of the Budget, Executive Office of the President, was followed in every case. Under this familiar four-digit classification system a single industry is assigned a four-digit number, which number is based on a three-digit minor group and a two-digit major industry group. Each major group in turn belongs to an industry division such as mining, contract construction, etc. For example, in the manufacturing division (D) we have:

Major Group 22—TEXTILE MILL PRODUCTS

(Minor Group) 225—Knitting mills

Industry 2251—Full-fashioned hosiery mills

Industry 2252—Seamless-hosiery mills

Etc.

Although the complete S.I.C. number was punched into our loadometer cards, the classifications used in this

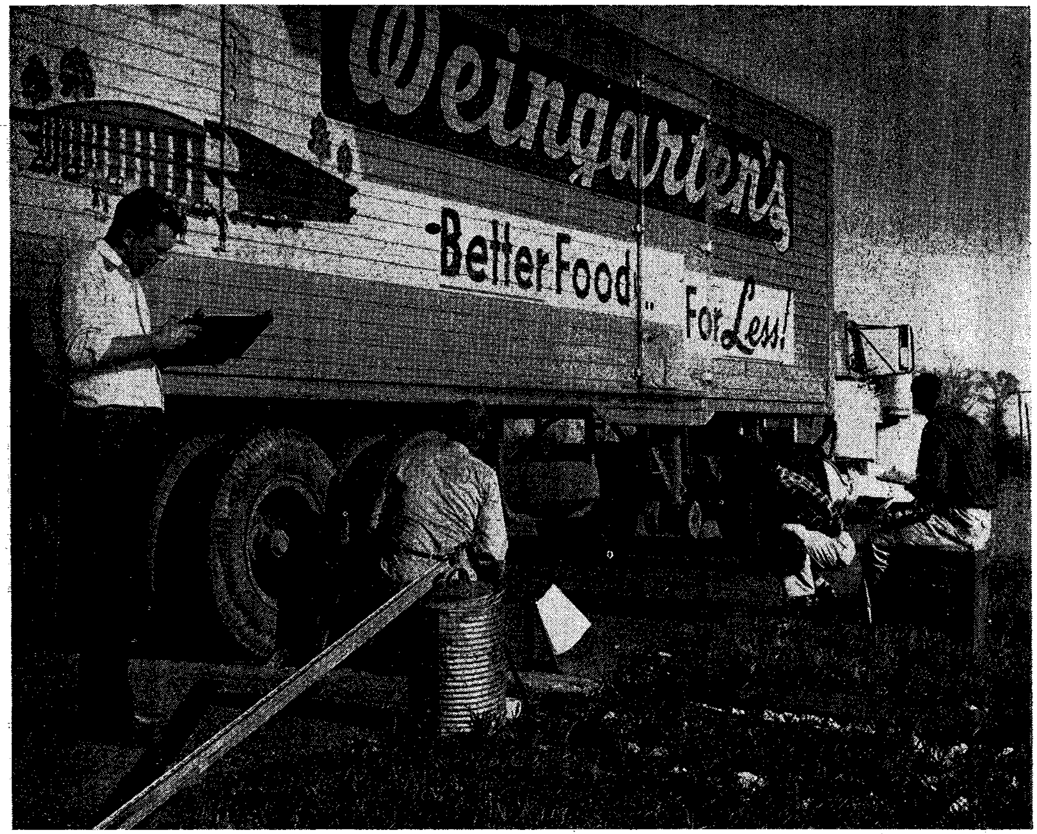


Figure 4 — Recording data relating to a privately-operated vehicle.

report are the broad industry divisions and the two- and three-digit groups. Table 5 gives trip characteristics of loaded and empty vehicles, listed for three-digit groups. Table 1 on the following page gives certain of these characteristics for industry divisions and major (two-digit) groups.

Data for both private and for-hire transportation appear in Table 1, which is organized so that column (1) multiplied by column (2) gives total tonnage for a classification, and column (3) times column (4) yields total ton-miles. Ton-miles in these and other tables were calculated separately for smaller units (in this case mileage blocks) and then summed to make up the group totals. The grand total of ton-miles for an industry class was then divided by the total vehicle miles to obtain the value given in column (4) as "tons per mile".[1] For comparative purposes, column (5) gives the average trip length in miles for loaded vehicles. The vehicle trips for which industry identity could not be determined are grouped below the sub-total for all identified (private) industries. Trip characteristics appear to vary but little between the "known" and "unknown" groups. Differences that exist are likely due to the fact that most of the "out of state" private vehicles, those not registered in Texas, are included in the "industry unknown" group.

It should be emphasized that all of these relationships are based on data that have not been adjusted to

[1]In presenting the data for industries no subclassification is given by vehicle type. Estimates of carried load and vehicle miles were made for each individual trip. These values were then combined for all trips assigned to a specific industry to arrive at industry totals.

TABLE 1

CHARACTERISTICS OF LOADED AND EMPTY TRIPS, BOTH PRIVATE AND FOR-HIRE OPERATION, BY CLASSIFIED INDUSTRY GROUPS

S.I.C. Group	INDUSTRY GROUP	LOADED VEHICLES* Number of Trips	Average Loads (Tons)	Vehicle Miles	Tons per Mile	Average Trip (Miles)	EMPTY VEHICLES Number of Trips	Average Weight (Tons)
		(1)	(2)	(3)	(4)	(5)		
A.	AGRICULTURE, FORESTRY, AND FISHERIES	163	3.352	21,311	5.233	131	219	3.17
B.	MINING	101	7.377	11,438	8.304	113	55	8.84
C.	CONTRACT CONSTRUCTION	172	4.948	18,343	6.642	107	34	5.71
D.	MANUFACTURING	887	7.010	172,166	9.418	194	365	9.17
-20	Food and Kindred Products	468	4.440	74,058	7.862	158	108	8.90
-24	Lumber and Wood Products, not furniture	36	9.163	8,468	9.563	235	30	8.06
-25	Furniture and Fixtures	31	5.075	11,574	6.313	373	17	8.01
-28	Chemicals and Allied Products	40	9.379	10,746	12.216	267	24	9.31
-29	Products of Petroleum and Coal	112	10.091	17,228	10.762	154	70	10.76
-32	Stone, Clay, and Glass Products	75	10.800	12,873	11.668	172	49	9.06
-34	Fabricated Metal Products	34	11.540	8,862	12.892	261	29	9.47
F.	WHOLESALE TRADE	977	6.263	198,603	9.765	203	436	7.78
-50	Merchant Wholesalers	835	5.980	168,108	9.482	201	347	7.54
-51	Wholesale Trade, other than merchants	142	7.910	30,495	11.324	215	89	8.74
G.	RETAIL TRADE	344	5.854	58,724	8.205	171	221	6.30
-52	Building Materials and Farm Equipment	70	6.628	8,946	9.574	128	68	5.78
-53	General Merchandise - Retail Trade	37	4.523	9,030	7.585	244	15	6.72
-54	Food - Retail	75	5.962	10,684	6.573	142	29	8.29
-55	Automotive	60	6.357	16,225	9.374	270	41	5.71
H-I-J	FINANCE, SERVICE, AND MISCELLANEOUS	85	4.843	19,160	5.361	225	57	6.75
(E.)	PUBLIC UTILITIES EXCEPT FOR-HIRE TRUCKING	91	4.914	12,801	10.862	141	44	7.52
	VEHICLES USED FOR PERSONAL TRANSPORTATION	12	0.824	4,246	1.871	354	18	2.01
	Sub-Total: All Industries Identified Above	2832	6.130	516,792	8.941	182	1549	6.99
	OTHER PRIVATE VEHICLES, INDUSTRY UNKNOWN	5080	6.051	1,406,325	9.452	277	3596	6.67
	Sub-Total: All Private Industry Trips	7912	6.079	1,923,117	9.315	243	5145	6.77
	FOR-HIRE MOTOR TRANSPORTATION	4097	9.405	1,677,806	9.486	410	1729	10.30
	Common Carrier, not I.C.C. Licensed	41	3.903	8,434	6.108	206	15	8.10
	Common Carrier, with I.C.C. License	1835	8.519	688,750	9.559	375	250	10.82
	Specialized Carrier, no I.C.C. License	1011	11.506	277,671	12.111	275	720	10.80
	Specialized Carrier, with I.C.C. License	996	9.086	628,499	8.321	631	543	10.54
	Contract Carrier, not I.C.C. Licensed	91	11.740	22,994	12.180	253	89	10.59
	Contract Carrier, with I.C.C. License	123	8.058	51,458	7.926	418	112	9.52
Grand Total:	All Private and For-Hire Trips	12009	7.214	3,600,923	9.395	300	6,874	7.66

* Note: Column (1) multiplied by Column (2) gives total tonnage. Column (3) multiplied by Column (4) gives total ton-miles.

correct the trip-length bias, and the percent-weighed-of total-counted bias, discussed in footnote 2 of the Introduction. Since vehicles making short trips are less likely to pass a loadometer station than those making longer trips along the same route, the average trip lengths given here are greater than the true or "universe" averages. Also it could be expected that the proportion of all trips attributed to private trucks (69 percent) would be increased with the inclusion of more short trips in the sample. Adjustments in the same direction would occur if the "percent weighed" factor were balanced, that is if adjustments were made to give more significance to sample trips made by pick-up trucks and other light vehicles.

It can be estimated from Table 1 that 69 percent of the 18,883 trips were made by private trucks as opposed to 31 percent by for-hire vehicles. The average payload of hired trucks, 9.4 tons, is 54 percent more than the private truck average of 6.1 tons. The average trip length for loaded private vehicles in the sample was 243 miles, while the for-hire average was 410 miles. Thus with heavier loads and longer distances the for-hire vehicles accounted for 47 percent of the total ton-miles while making only 31 percent of the total number of trips. The lowest average trip length shown is 107 miles, attributed to Contract Construction industries, and the highest is the 631 miles noted for Specialized Carriers licensed by the ICC. Differences in the general size of vehicles used by the various industry classes are reflected in the column devoted to average weight of empty vehicles.

TABLE 2
NUMBER OF TRIPS IN LOADOMETER SAMPLE BY INDUSTRY GROUPS, AND PERCENT OF LOADED TRIPS TO TOTAL

Industry Group	Total Trips	Loaded Trips
		(Percent)
Private		
Agriculture, Forestry, and Fisheries	382	42.7
Mining	156	64.7
Contract Construction	306	56.2
Manufacturing	1,252	70.8
Food and Kindred Products	576	81.2
Wholesale Trade	1,413	69.1
Retail Trade	565	60.9
For Hire		
Common Carrier (ICC licensed)	2,085	86.4
Specialized Carrier (no ICC license)	1,731	58.4
Specialized Carrier (ICC licensed)	1,539	64.7
Contract Carriers	415	51.6

Source: Computed from Table 1.

Of the 5826 trips made by for-hire vehicles, 70.3 percent were attributed to loaded vehicles (carrying some commodity but not necessarily loaded to capacity) while only 60.6 percent of the 13,057 trips recorded for private trucks were credited to loaded vehicles. The percent of total trips made by loaded vehicles is given in Table 2 for some of the principal industry groups.

The nature of common carrier operation, i.e., grouping shipments for scheduled trips, no doubt accounts for their high efficiency (86.4 per cent) with respect to loaded trips. A separate study now in progress at the Texas Transportation Institute indicates that the private trucking of food manufacturing industries is characterized by a high degree of backhauling, and this would account for the high loaded trip ratio (81.2 percent) of this industry. The low ratio shown in Table 2 for agriculture and related industries probably reflects the one-way haul which is typical of farm and ranch trucks. Most of the panel and pick-up trucks in the sample belonged to this industry group, and if the sample were truly proportional with respect to these light trucks the loaded trip ratio shown in the table (42.7 percent) would be reduced accordingly.[2] In the for-hire group the lowest loaded trip ratio was 51.6 percent, noted for contract carriers. These regulated carriers are restricted in the number of contracts they may negotiate, and their low loaded trip efficiency may

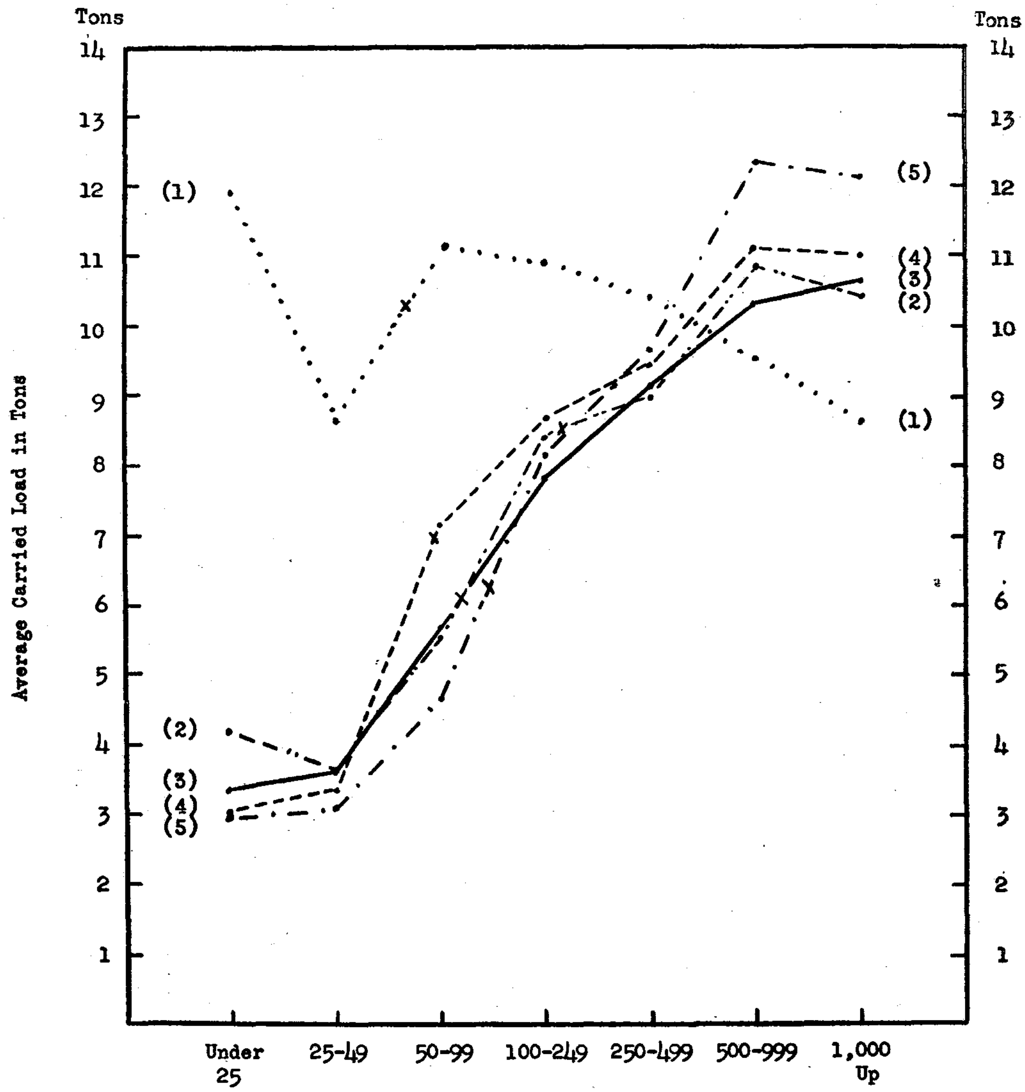
[2]Tables 13 and 14 of Part III show that only 41 percent of the light trucks were carrying a load when they were stopped for weighing.

TABLE 3

CHARACTERISTICS OF LOADED TRIPS BY CLASSIFIED INDUSTRY GROUPS AT VARIOUS MILEAGE BLOCKS

S.I.C. Group	INDUSTRY GROUP	NUMBER OF LOADED TRIPS AND AVERAGE LOADS CARRIED AT STATED TRIP LENGTHS													
		Under 25 Miles		25 - 49 Miles		50 - 99 Miles		100 - 249 Miles		250 - 499 Miles		500 - 999 Miles		1000 - Up Miles	
		No.	Tons	No.	Tons	No.	Tons	No.	Tons	No.	Tons	No.	Tons	No.	Tons
A.	AGRICULTURE, FORESTRY, AND FISHERIES	54	2.61	40	2.25	20	3.67	28	4.30	15	4.85	3	10.02	3	6.28
B.	MINING	21	6.15	33	5.96	16	6.37	22	10.14	7	11.79	1	7.71	1	2.28
C.	CONTRACT CONSTRUCTION	54	3.40	36	3.70	26	6.11	40	6.44	11	6.55	5	9.22		
D.	MANUFACTURING	111	3.04	155	3.39	178	7.17	264	8.70	122	9.42	34	11.13	23	11.06
-20	Food and Kindred Products	73	2.17	113	2.24	101	3.81	109	5.65	48	7.90	16	11.62	8	12.32
-24	Lumber and Wood Products, not furniture	1	4.19	2	5.52	6	9.70	14	9.27	11	9.74			2	9.82
-25	Furniture and Fixtures			2	3.79	1	0.58	13	6.16	10	6.42	3	4.14	2	5.39
-28	Chemicals and Allied Products	2	1.67	4	4.29	6	8.18	13	9.42	11	10.64	3	16.47	1	16.72
-29	Products of Petroleum and Coal	16	5.17	16	5.27	28	16.07	39	13.62	11	12.50			2	1.94
-32	Stone, Clay, and Glass Products	15	5.56	8	8.14	17	14.22	21	12.49	10	11.57	3	10.16	1	11.18
-34	Fabricated Metal Products					3	10.32	23	10.71	6	13.48	1	18.68	1	15.32
F.	WHOLESALE TRADE	150	3.00	172	3.11	202	4.68	258	8.12	117	9.66	45	12.38	33	12.18
-50	Merchant Wholesalers	126	2.99	150	2.76	178	4.25	211	7.72	105	9.82	38	12.45	27	11.59
-51	Wholesale Trade, Other than Merchants	24	3.08	22	5.48	24	7.88	47	9.94	12	8.28	7	11.99	6	14.84
G.	RETAIL TRADE	49	2.54	71	4.04	66	5.81	98	7.11	46	8.58	8	6.89	6	12.03
-52	Building Materials and Farm Equipment	8	0.35	25	5.52	7	4.96	19	7.95	11	12.48				
-53	General Merchandise - Retail Trade	1	1.20	5	0.45	9	4.96	5	5.60	14	5.17	3	6.26		
-54	Food - Retail	4	1.93	10	1.46	23	6.53	30	7.04	7	8.07	1	7.14		
-55	Automotive	5	3.68	19	5.50	8	8.57	17	5.14	4	7.36	2	6.32	5	12.13
H-I-J	FINANCE, SERVICE, AND MISCELLANEOUS	11	1.77	9	2.64	12	1.35	28	4.62	20	8.15	3	3.93	2	2.75
(E.)	PUBLIC UTILITIES EXCEPT FOR-HIRE TRUCKING	38	2.38	14	2.67	15	4.26	11	8.43	7	10.77	4	14.93	2	13.86
	VEHICLES USED FOR PERSONAL TRANSPORTATION			3	0.70	4	0.40	2	0.82	1	0.04			2	2.24
	Sub-Total: All Industries Identified Above	488	3.02	533	3.43	539	5.60	751	7.87	346	9.07	103	11.13	72	10.94
	OTHER PRIVATE VEHICLES, INDUSTRY UNKNOWN	916	3.57	795	3.70	915	5.71	1065	7.82	676	9.15	342	10.08	371	10.59
	Sub-Total: All Private Industry Trips	1404	3.38	1328	3.59	1454	5.70	1816	7.84	1022	9.12	445	10.32	443	10.65
	FOR-HIRE MOTOR TRUCK TRANSPORTATION	99	8.71	179	6.94	441	9.63	1380	9.45	1181	9.53	421	10.00	396	9.27
	Common Carrier, not I.C.C. Licensed			4	1.21	9	3.24	21	4.10	6	4.23			1	14.56
	Common Carrier, with I.C.C. License	40	4.20	57	3.63	121	5.52	709	8.37	635	9.04	144	10.86	129	10.47
	Specialized Carrier, no I.C.C. License	42	14.59	72	9.16	214	11.35	374	11.35	201	11.44	64	12.29	44	13.64
	Specialized Carrier, with I.C.C. License	12	2.66	40	7.77	70	10.96	216	10.23	253	9.67	192	8.67	213	7.60
	Contract Carrier, not I.C.C. Licensed	5	9.98	2	6.28	22	14.31	33	11.24	24	10.23	2	13.66	3	15.76
	Contract Carrier, with I.C.C. License			4	11.95	5	7.97	27	7.27	62	8.04	19	8.86	6	6.73

LOADS INCREASE WITH DISTANCE



(1) Specialized Carrier
(2) Common Carrier, with I.C.C. License
(3) All Private Industry Trips
(4) Manufacturing
(5) Wholesale Trade

Figure 5 — Relation of average carried load to distance hauled for selected industry groups, all types of motor trucks.

be due to their inability to arrange for back-hauls.

Table 3, following the same industry grouping used in Table 1, gives the number of loaded trips and average loads carried at stated mileage blocks. It is interesting to observe in this table the rather consistent way average loads increase as trip distances increase. With the loaded trips distributed thusly among the nine mileage or distance brackets, a more significant pattern of transportation use is revealed than would be afforded by over-all averages of loads and hauls. The general pattern seems to be that average payloads increase steadily with successive mileage blocks, although a number of industries show a slight drop in average loads at the 1000-mile-and up block. Trip frequencies increase with successive blocks until a tapering point is reached, usually beginning with the 250-499 mileage block. Tonnage (trips times average loads) appears to follow the trip-frequency curve. Ton-miles, however, appear to increase with successive mileage blocks regardless of the drop in number of trips sampled, due to the mileage multiplier. For example, in the Wholesale Trade group, 45 trips in the 500-999 mile class (mid-point value, 750 miles) at a 12.38-ton average load accumulate some 418,000 ton-miles, while 258 trips in the 100-249 mile class (mid-point, 175 miles) at an 8.12-ton average load account for only 367,000 ton-miles. The trip-length bias is here operating to skew the actual ton-mile distribution.

The relation of carried load to distance hauled, mentioned above, is graphically portrayed in Figure 5, for selected classes from Table 3. Except for specialized commodity haulers there is apparently a marked positive correlation of loads and distances. This illustration reveals an economic fact which can be obscured when investigations are based only on axle-type groupings of vehicles. It will be shown in Part III that if all 4-axle 4-ton tractor-semitrailer trips are combined there is no clear pattern of loads increasing or decreasing with distance. However, if an axle group is subdivided by vehicle body-type (which has the effect of grouping similar commodities) a similar pattern of loads increasing with distance again emerges.

Table 5 contains, for the three-digit or minor industry classes, the type of information appearing in the preceding Tables, 1 and 3. Illustrative of the great variety and diversity of commercial enterprises engaged in highway freight transportation in Texas is the fact that this table lists data relating to no less than 160 groups of industries. If separate (four-digit) industries were listed the table would be much longer, since the listed groups each contain from one to nine separate industries. In fact there were more than 350 separate industries identified from the loadometer data as users of highway freight transportation.

In concluding this discussion of highway uses by industries it is of interest to consider the incidence and volume of highway use by an industry in relation to some measure of industry size. It could be expected that intercity trucking is of more basic importance to some industries than to others. By using the loadometer sample as refined by the added industry data it is possible to identify the industries that are important contributors to total traffic by private motor trucks.

Choosing as an indicator of size the approximate number of non-farm employees of a given industry or group of industries in Texas, and relating this to the number of loaded and empty trips observed for the subject class, we derive the basis of comparison used in Table 4 and Figure 6.

In column (1) of the table the percent of non-farm employment is given for a number of industries.[3] It was necessary to exclude farm employment because of lack of comparable data. In addition to farm employment, the employment of transportation industries was also deleted from the state total, giving a base of 1,661,807 for the percentages in column (1). Table 4, therefore, is an analysis of private, non-farm trucking.[4]

[3]Source of the employment data is "County Business Patterns, First Quarter, 1953," part 8, page 83, U. S. Department of Commerce, Department of Health, Education, and Welfare.

[4]Strictly speaking the employment and trips attributed to vehicle rental firms, listed under "Services," should perhaps be excluded since their vehicles are operated in the private trucking of other industries. Column (2) of Table 4 shows that two-percent of the loadometer trips are thus involved. However, this does not include trips made by rented vehicles which were attributed to other industries on the basis of advertising (operator identity) appearing on the vehicles. Neither does the two percent include trips by vehicles rented out or leased to for-hire operators.

TABLE 4

USES OF PRIVATE TRUCKING IN RELATION TO INDUSTRY SIZE, SELECTED NON-FARM AND NON-TRANSPORT INDUSTRIES IN TEXAS AS OBSERVED AT 21 LOADOMETER STATIONS LOCATED ON MAIN RURAL ROADS

Group	Description	Percent of Non-Farm Employment	Percent of Private Trips	Loadometer Trips Per 1000 Employees
		(1)	(2)	(3)
07-09	Agricultural Services, Forestry, and Fisheries	0.32	0.59	4.34*
	MINING	7.60	3.98	1.23
13	Crude Petroleum and Natural Gas	7.13	3.44	1.13*
	CONTRACT CONSTRUCTION	10.63	7.80	1.72*
15	General Contractor, Building	3.44	1.22	0.83
16	General Contractor, Other Construction	3.33	3.98	2.83
17	Special Trade Contractors	3.87	2.60	1.58
	MANUFACTURING	25.98	31.93	2.90*
20	Food and Kindred Products	3.37	14.69	10.29*
24	Lumber and Wood Products, not furniture	1.57	1.68	2.52
25	Furniture and Fixtures	0.58	1.22	4.95*
28	Chemicals and Allied Products	2.25	1.63	1.70
29	Products of Petroleum and Coal	2.56	4.64	4.27*
32	Stone, Clay, and Glass Products	0.90	3.16	8.28*
34	Fabricated Metal Products	1.10	1.61	3.44*
48-49	Public Utilities, not transportation	4.70	1.63	0.83*
	WHOLESALE TRADE	9.11	36.04	9.34
50	Merchant Wholesalers	5.54	30.15	12.84*
51	Wholesale Trade, not merchants	3.56	5.89	3.89*
	RETAIL TRADE	24.38	14.41	1.39*
52	Building Material and Farm Equipment	1.84	3.52	4.51*
53	General Merchandise	4.45	1.33	0.71
54	Food - Retail Store	3.98	2.65	1.58
55	Auto Dealers and Service Stations	4.45	2.58	1.37
57	Furniture, Furnishings, and Appliances	1.10	0.82	1.77
58	Eating and Drinking Places	4.01	0.36	0.21
59	Miscellaneous Retail Stores	2.86	3.16	2.60
60-67	FINANCE, INSURANCE, AND REAL ESTATE	5.82	0.18	0.07*
	SERVICES	11.46	3.44	0.71
75	Auto and Truck Repair and Rentals	0.67	1.99	7.01*
	Other Services	10.80	1.45	0.31*
	ALL INDUSTRIES ABOVE	100.00	100.00	2.36*

Source: See text and footnote 3.

Column (2) of this table gives the percent of the total private, non-farm trips that is contributed by each industry class. The percentages are based on a total of 3921 trips.

Column (3) of the table lists "Loadometer Trips per 1000 Employees" for the industry groups. The over-all average for all industries was 2.36 trips in the sample per one thousand employees, based on the employment and trip totals given above. When a value in column (3) is less than 2.36 it means that the industry's percent of total employment was larger than its share of the trips sampled on main rural roads. When a column (3) value exceeds 2.36 it means that the percent of trips exceeded the industry's proportion of Texas non-farm employment. Thus the trips-per-thousand-employees is an indication of the relative importance of private trucking to the ordinary operations of an industry.

The column (3) values which are marked with an asterisk are illustrated in Figure 6. An outstanding example of industries which make relatively light use of their private trucking privilege is the Finance, Insurance, and Real Estate division. Only seven of the trips in the loadometer sample were credited to this class which, nevertheless, gives employment to nearly 100,000 Texans. At the opposite extreme, among the heavy users of private trucking, are the Merchant Wholesaler industries. These show nearly 13 sample trips per 1000 employees. The group accounts for 30.2 percent of the trips in the sample but only 5.5 percent of the State's total non-farm and non-transport employment.

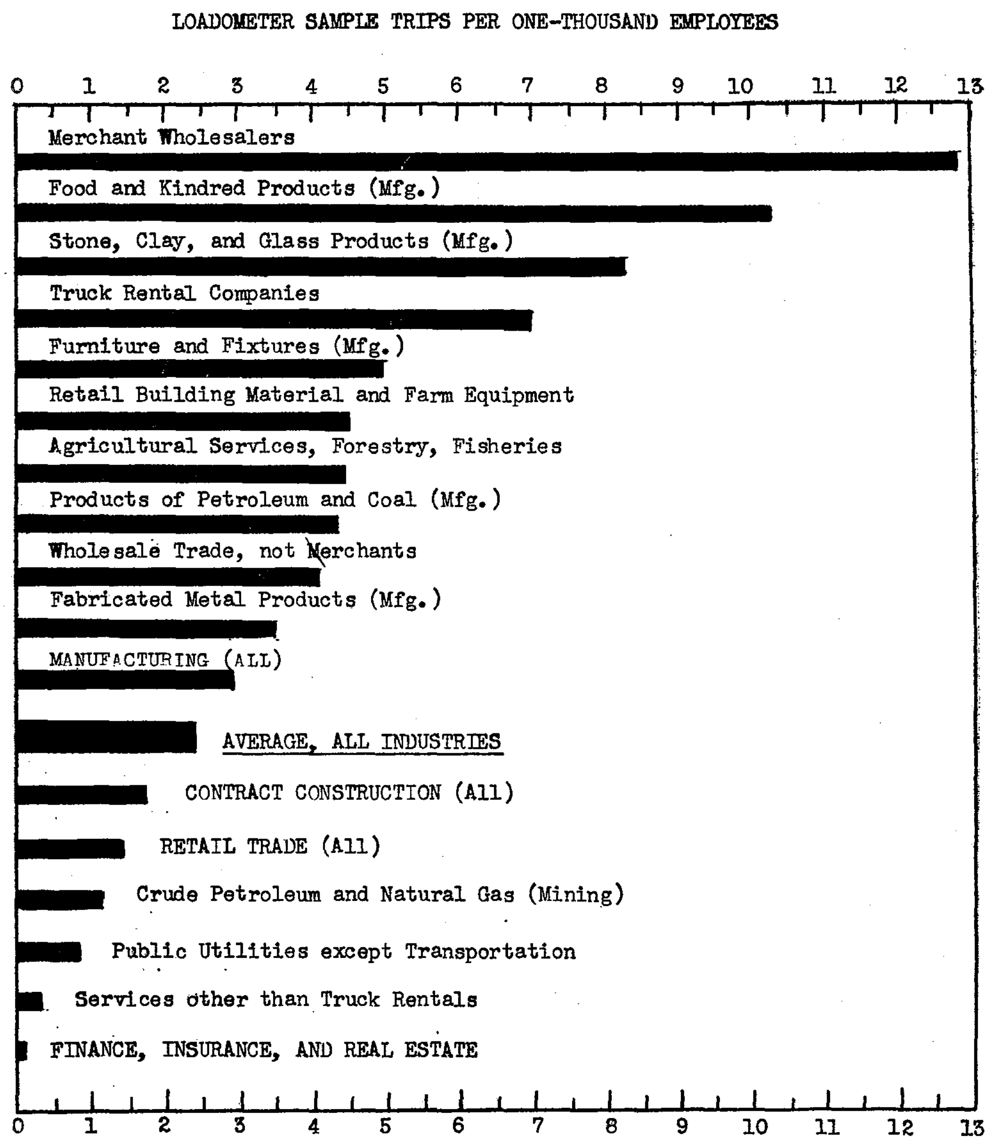


Figure 6 — Number of private trucking trips in the loadometer sample by selected industry groups, per 1000 employees. Data refer to both loaded and empty trips on main rural roads in Texas. Source: Column (3) of Table 4.

TABLE 5

TRIP CHARACTERISTICS OF LOADED AND EMPTY VEHICLES, LISTED BY INDUSTRY GROUPS

S.I.C. Number	Industry Group	Number of Loaded Trips and Average Loads Carried at Stated Trip Lengths														All Loaded Trips				Empty Data	
		Under 25 Miles		25 - 49 Miles		50 - 99 Miles		100 - 249 Miles		250 - 499 Miles		500 - 999 Miles		1000 - Up Miles		All Distances		Vehicle Miles	Tons per Mile	Trips	Avg. Weight
		No.	Tons	No.	Tons	No.	Tons	No.	Tons	No.	Tons	No.	Tons	No.	Tons	No.	Tons	No.	Mile	No.	Tons
																(1)	(2)	(3)	(4)		
	AGRICULTURE, FORESTRY, AND FISHERIES																				
	Farm Licensed Vehicles	42	2.44	29	1.50	12	3.04	16	2.71	9	5.88	2	9.57			110	2.709	10,076	4.607	159	2.78
011	Commercial Farms	10	3.78	4	2.99	5	2.46	10	7.09	5	3.04	1	10.92	3	6.28	38	4.682	10,002	5.917	48	3.85
012	Noncommercial Farms	1	0.25	1	0.58											2	0.417	44	0.545	2	5.42
071	Agricultural Services	1	0.48	3	7.12					1	4.57					5	5.282	503	4.994	7	5.96
072	Animal Husbandry Services			2	5.61			2	3.09							4	4.352	424	3.531	2	5.62
073	Horticultural Services			1	1.32	1	1.74									2	1.527	112	1.598	1	4.60
081	Timber Tracts					1	22.60									1	22.600	75	22.600		
098	Fishery Services					1	0.25									1	0.250	75	0.250		
	MINING																				
131	Crude Petroleum and Natural Gas	2	1.97	5	4.73	1	12.28	10	11.62	3	15.69					21	9.673	3,159	12.612	13	9.93
133	Oil and Gas Field Contract Services	16	6.51	21	4.02	14	6.28	11	9.29	4	8.86	1	7.71	1	2.28	68	6.237	7,749	6.553	33	8.36
141	Dimension Stone																			1	1.95
142	Crushed and Broken Stone			5	13.95											5	13.952	185	13.952	1	13.10
144	Sand and Gravel	3	7.00	2	9.44											5	7.979	95	8.905	7	9.41
145	Clay, Ceramic, and Refractory Minerals					1	1.70									1	1.695	75	1.695		
147	Chemical and Fertilizer Mineral Mining							1	4.64							1	4.640	175	4.640		
	CONTRACT CONSTRUCTION																				
151	General Building Contractors	9	4.10	3	3.16	4	1.49	5	7.03	1	5.54					22	4.228	1,780	5.351	26	4.25
161	Highway and Street Construction	21	4.50	12	1.56	5	9.00	11	9.17	3	7.59	2	14.94			54	6.438	5,368	9.767	49	5.58
162	Heavy Construction	8	4.18	8	4.75	5	4.16	9	5,95	3	10.85	2	1.78			35	5.198	4,809	5.668	18	10.37
171	Plumbing, Heating, and Air Conditioning	2	0.24	2	1.08	1	10.84			1	3.42					6	2.815	558	3.912	4	2.21
172	Painting, Paper Hanging, and Decorating							1	0.25	1	5.24					2	2.748	550	3.656	3	5.92
173	Electrical Work	1	0.08	1	0.43	2	0.66	2	0.42							6	0.445	544	0.485	2	3.62
174	Masonry, Tile Setting, and Plastering					1	1.52	2	6.00							3	4.570	425	5.287	7	2.98
175	Carpentering and Wood Flooring	4	0.25					3	8.23			1	12.67			8	4.796	1,241	10.392	3	2.12
176	Roofing and Sheet Metal Work	2	2.62	5	0.41	1	3.34	2	2.89							10	1.644	644	2.217	1	4.05
177	Concrete Work	1	1.43													1	1.428	7	1.428	2	2.58
178	Water Well Drilling	1	1.50	2	6.23	1	8.82	3	3.63							7	4.811	691	4.421	7	3.56
179	Miscellaneous Special Trade Contractors	5	1.78	3	4.58	6	10.20	2	6.72	2	1.27					18	5.546	1,726	4.943	12	8.31
	MANUFACTURING INDUSTRIES																				
192	Ammunition, Except for Small Arms							2	7.67							2	7.669	350	7.669		
201	Meat Products	6	0.92	4	0.80	13	3.43	25	3.12	13	6.57	1	11.34	1	14.77	63	3.852	12,797	6.385	29	8.84
202	Dairy Products	3	1.81	12	2.33	23	6.01	6	7.74	5	6.78					49	5.145	5,145	6.286	4	8.70
203	Canning Fruits, Vegetables, and Sea Food	1	1.01			2	6.45	9	4.84	9	9.88	6	14.57	3	11.27	30	8.923	14,221	11.116	8	9.29
204	Grain Mill Products	1	6.43	6	3.67	8	7.47	10	11.18	4	12.58	1	14.14			30	8.817	4,755	11.217	19	9.58
205	Bakery Products	19	0.25	27	0.94	39	1.33	20	2.89	6	5.18			1	11.52	112	1.629	11,549	3.988	28	8.49
206	Sugar							1	6.96	1	14.52	3	8.43	1	14.61	6	10.228	4,264	11.347	4	10.40
207	Confectionery and Related Items			1	6.41									1	9.98	2	8.198	1,723	9.908		
208	Beverage Industries	34	3.26	55	2.89	15	4.81	27	7.10	6	7.57	1	8.06	1	13.85	139	4.322	12,981	7.116	6	6.08
209	Miscellaneous Food Preparations	9	2.69	8	1.22	1	5.41	11	7.24	4	7.40	4	9.92			37	5.084	6,623	7.986	10	7.65
223	Broad-Woven Fabric Mills					1	1.72									1	1.720	75	1.720		

TABLE 5—Continued

S.I.C. Number	Industry Group	Number of Loaded Trips and Average Loads Carried at Stated Trip Lengths: Under 25 Miles		25 - 49 Miles		50 - 99 Miles		100 - 249 Miles		250 - 499 Miles		500 - 999 Miles		1000 - Up Miles		All Loaded Trips: All Distances		Vehicle Miles	Tons per Mile	Empty Data: Trips	Avg. Weight
		No.	Tons	No.	Tons	No.	Tons	No.	Tons	No.	Tons	No.	Tons	No.	Tons	No.	Tons	No.	Tons	No.	Tons
																(1)	(2)	(3)	(4)		
229	Miscellaneous Textile Goods											1	14.86	1	13.26	2	14.065	2,362	13.723		
232	Men's, Youths', and Boys' Furnishings											1	9.22	2	13.06	3	11.782	4,048	12.422	1	9.25
239	Miscellaneous Fabricated Textile Products							1	1.44					1	9.76	2	5.602	1,861	8.982		
241	Logging Camps and Logging Contractors																			1	1.90
242	Sawmills and Planing Mills					4	13.40	6	12.46	7	12.39			1	7.84	18	12.384	4,651	11.810	20	8.45
243	Millwork and Plywood Products	1	4.19	1	0.19	2	2.30	7	6.84	3	4.90					14	5.114	2,554	5.607	6	8.50
244	Wooden Containers							1	7.07							1	7.069	175	7.069	2	5.85
249	Miscellaneous Wood Products			1	10.84					1	5.66			1	11.79	3	9.432	1,088	9.645	1	8.10
251	Household Furniture			2	3.79	1	0.58	11	3.06	8	5.10	1	2.18	2	5.39	25	3.822	9,122	4.517	10	8.78
253	Public Building and Professional Furniture							1	15.82	2	11.72	1	5.56			4	11.203	1,601	16.600	6	6.69
254	Shelving, Lockers, Office, and Store Fixtures																			17	8.25
256	Window and Door Screens and Shades							1	12.14			1	4.68			2	8.408	851	6.214		
267	Paperboard Containers and Boxes	1	0.76			2	11.96	3	6.07	4	4.73	3	11.68			13	7.449	4,210	8.495	5	7.31
271	Newspapers					6	1.15	1	0.25							7	1.023	625	0.899	3	2.45
277	Greeting Cards			2	11.28											2	11.283	74	11.283		
281	Industrial Inorganic Chemicals							2	14.49	1	14.76			1	16.72	4	15.113	2,411	16.088	2	10.20
282	Industrial Organic Chemicals							1	14.62							1	14.617	175	14.617		
284	Soap and Glycerin							1	18.16	1	11.00					2	14.582	550	13.282	1	10.20
285	Paints and Enamels and Wood Fillers							1	1.70	1	2.26					2	1.980	550	2.084		
287	Fertilizers					1	9.96									1	9.960	75	9.960	1	3.50
288	Vegetable and Animal Oil and Fats	1	1.24	4	4.29	2	6.02	2	11.12	3	9.81	1	17.06			13	7.627	2,466	11.362	11	9.27
289	Miscellaneous Chemicals	1	2.10			3	9.03	6	6.12	5	11.92	2	16.17			17	9.285	4,519	11.664	9	9.72
291	Petroleum Refining	15	3.35	16	5.27	27	11.39	33	14.00	10	12.03			2	1.94	103	9.986	15,711	10.144	64	10.72
295	Paving and Roofing Materials	1	1.47			1	13.82	6	11.54	1	17.16					9	11.298	1,517	17.165	5	11.63
299	Miscellaneous Products of Petroleum and Coal																			1	9.05
316	Luggage					1	13.01			1	13.50					2	13.252	450	13.416	2	11.40
317	Handbags and Small Leather Goods																			1	4.15
321	Flat Glass																			1	9.80
322	Glass and Glassware, Pressed or Blown																			1	12.35
323	Glass Products Made of Purchased Glass																			1	2.05
324	Cement, Hydraulic	1	4.24			10	17.67									11	16.445	767	17.369	9	11.73
325	Structural Clay Products	3	7.54	3	9.56	4	9.44	12	12.10	5	13.39	3	10.16			30	11.057	6,465	11.665	18	8.09
326	Pottery and Related Products													1	11.18	1	11.185	1,686	11.185		
327	Concrete, Gypsum, and Plaster Products	11	5.14	5	7.29	3	9.11	6	11.58	2	9.26					27	7.715	2,305	9.960	10	7.82
328	Cut-Stone and Stone Products																			1	3.05
329	Abrasive, Asbestos, and Miscellaneous							3	15.88	3	10.06					6	12.969	1,650	11.910	8	10.89
331	Blast Furnaces, Steel Work, and Rolling Mills	1	1.27	1	20.92			5	12.75							7	12.279	929	12.868	2	12.02
322	Iron and Steel Foundries					2	3.07	4	14.99	2	15.06	1	14.26	1	15.76	10	12.624	3,962	14.758	3	11.33
333	Primary Smelting and Refining			1	13.82			4	15.80	1	10.06					6	14.509	1,112	13.793	3	10.93
335	Rolling, Drawing, and Alloying			2	6.43	1	2.21	2	4.20					1	13.46	6	6.152	2,185	11.348	1	4.90
343	Heating Apparatus and Plumbers' Supplies							2	7.18							2	7.183	350	7.183	3	12.28
344	Fabricated Structural Metal Products					3	10.32	19	11.41	6	13.48	1	18.68			29	11.979	6,476	12.853	21	9.46
346	Metal Stamping, Coating, and Engraving							1	10.62							1	10.617	175	10.617	2	6.12
348	Fabricated Wire Products													1	15.32	1	15.315	1,686	15.315	1	7.00
349	Miscellaneous Fabricated Metal Products							1	4.67							1	4.668	175	4.668	2	10.00

TABLE 5—Continued

S.I.C. Number	Industry Group	Number of Loaded Trips and Average Loads Carried at Stated Trip Lengths														All Loaded Trips				Empty Data	
		Under 25 Miles		25 - 49 Miles		50 - 99 Miles		100 - 249 Miles		250 - 499 Miles		500 - 999 Miles		1000 - Up Miles		All Distances		Vehicle Miles	Tons per Mile	Trips	Avg. Weight
		No.	Tons	No.	Tons	No.	Tons	No.	Tons	No.	Tons	No.	Tons	No.	Tons	No.	Tons	No.	Mile	No.	Tons
																(1)	(2)	(3)	(4)		
352	Agricultural Machinery and Tractors									1	11.15					1	11.149	375	11.149		
353	Construction and Mining Machinery	1	1.85	3	2.16	2	3.22	1	9.02	1	16.87					8	5.081	818	10.562	6	11.42
354	Metalworking Machinery							3	10.42	2	13.90					5	11.812	1,275	12.465		
355	Special Industry Machinery			1	10.44					1	6.90					2	8.670	412	7.221		
356	General Industry Machinery and Equipment							2	4.08							2	4.077	350	4.077	1	2.75
358	Service Industry and Household Machines					1	1.02	1	5.78							2	3.402	250	4.352	2	3.20
359	Miscellaneous Machinery Parts	1	1.76					1	9.72	1	9.32					3	6.933	557	9.350	2	10.48
369	Miscellaneous Electrical Products																			1	15.10
371	Motor Vehicles and Equipment							1	11.52	1	6.37					2	8.914	851	7.429		
373	Ship and Boat Building and Repairing									1	2.64	1	0.96			2	1.805	1,051	1.564	1	7.45
381	Laboratory, Scientific, and Engineering Instruments																			2	11.35
382	Measuring and Controlling Instruments																			2	6.75
398	Miscellaneous Manufacturing Industries							1	3.73							1	3.731	175	3.731		
	UTILITIES, OTHER THAN TRANSPORATION																				
473	Stockyards													1	12.62	1	12.625	1,686	12.625	1	7.05
481	Telephone Communications	2	2.44	3	1.10	3	1.09									8	1.433	350	1.146	1	5.45
491	Electric Light and Power	15	2.18	3	2.45	3	0.48	2	6.48	1	6.72					24	2.546	1,276	4.444	3	6.73
492	Gas	15	2.46	1	0.22	3	4.89	2	2.21	1	10.22					22	3.022	1,198	5.210	6	8.64
	WHOLESALE TRADE																				
501	Motor Vehicles and Automotive Equipment	3	0.99	1	1.50	3	4.65	5	3.98	5	3.45	1	8.35	3	7.48	21	4.114	8,787	6.213	7	6.08
502	Drugs, Chemicals, and Allied Products	3	1.02	2	2.00	3	5.12	9	4.72	3	5.07	2	7.40			22	4.318	4,402	5.566	14	6.39
503	Dry Goods and Apparel					2	4.07							1	12.05	3	6.729	1,836	11.398	1	5.65
504	Groceries and Food Specialties	16	1.02	28	2.76	52	3.38	35	7.18	23	7.23	4	10.86	3	14.90	161	4.817	27,690	8.214	71	7.39
505	Farm Products—For Immediate Consumption	37	1.86	63	1.94	63	3.02	45	5.66	18	9.98	11	14.98	10	12.50	247	4.476	46,466	9.767	68	7.45
506	Electrical Goods	1	0.25											1	0.25	2	0.250	1,693	0.250	1	2.55
507	Hardware, Plumbing, and Heating Equipment	1	2.02	3	0.37	2	3.25	14	6.67	3	10.06	1	9.12			24	5.932	4,529	7.595	10	7.43
508	Machinery, Equipment, and Supplies	10	2.82	12	2.33	9	6.83	19	7.87	4	9.68	1	10.37	3	8.57	58	5.895	11,828	8.212	28	7.56
509	Miscellaneous Merchant Wholesalers	54	4.64	41	4.40	44	6.47	84	9.74	49	11.91	18	12.34	6	13.79	296	8.181	60,877	11.183	147	7.88
511	Sales Branches of Mfg. and Mining Companies	2	6.69	2	6.30	5	4.99	6	9.89	4	13.23	2	15.59	1	15.27	22	9.531	6,061	13.116	17	9.62
512	Petroleum Bulk Stations	9	1.37	12	4.93	13	10.29	16	10.78			1	1.60			51	7.436	5,038	8.672	42	9.01
513	Agent and Brokers	11	3.77	7	6.57	3	4.77	16	9.90	5	5.65	2	9.74	4	14.87	48	7.657	13,362	11.592	22	7.74
514	Assemblers, Mainly of Farm Products	2	3.42	1	2.79	3	5.36	9	8.55	3	6.07	2	15.83	1	14.30	21	7.945	6,034	11.143	8	8.20
	RETAIL TRADE																				
521	Lumber and Other Building Material Dealers	7	0.37	23	5.83	7	4.96	16	9.29	10	12.82					63	7.115	7,955	10.265	52	6.21
522	Heating and Plumbing Equipment Dealers																			1	2.85
524	Electrical Supplies Stores							1	0.11							1	0.108	175	0.108		
525	Hardware and Farm Equipment	1	0.24	2	1.98			2	1.16	1	9.12					6	2.605	816	4.869	11	4.11
531	Department Stores			1	0.25	3	1.09	1	2.58	6	4.27	2	7.38			13	3.577	4,039	5.026	6	6.71
532	Mail Order Houses, General Merchandise	1	1.20	2	0.25			3	6.68	6	4.64	1	4.03			13	4.122	3,542	10.446	7	7.92
533	Variety Stores									2	9.46					2	9.455	750	9.455		
539	Miscellaneous General Merchandise Stores			2	0.76	6	6.90	1	5.39							9	5.370	699	5.874	2	2.52
541	Grocery Stores	2	0.59	1	6.18	21	6.99	29	7.21	5	10.27					58	7.146	8,576	7.280	28	8.26
542	Meat and Fish Markets			2	2.43											2	2.432	74	2.432		

TABLE 5—Continued

S.I.C. Number	Industry Group	Under 25 Miles No.	Under 25 Miles Tons	25 - 49 Miles No.	25 - 49 Miles Tons	50 - 99 Miles No.	50 - 99 Miles Tons	100 - 249 Miles No.	100 - 249 Miles Tons	250 - 499 Miles No.	250 - 499 Miles Tons	500 - 999 Miles No.	500 - 999 Miles Tons	1000 - Up Miles No.	1000 - Up Miles Tons	All Loaded Trips: All Distances No.	All Distances Tons	Vehicle Miles No.	Tons per Mile	Empty Data: Trips No.	Avg. Weight Tons
		Number of Loaded Trips and Average Loads Carried at Stated Trip Lengths														(1)	(2)	(3)	(4)		
543	Fruit Stores and Vegetable Markets							1	2.14			1	7.14			2	4.640	851	6.112	1	9.10
545	Dairy Products Stores and Milk Dealers	2	3.26	4	0.25	2	1.67			2	2.57					10	1.599	1,072	2.165		
546	Retail Bakeries			3	0.85											3	0.847	111	0.847		
551	Major Vehicle Dealers (New and Used Cars)	3	2.07	1	0.25	2	9.20							1	15.87	7	5.816	1,914	14.745	13	4.44
552	Motor Vehicle Dealers (Used Cars Only)	1	0.25							1	6.44	1	6.85	1	6.18	4	4.930	2,744	6.368	4	4.22
553	Tire, Battery, and Accessory Dealers			10	2.33	2	1.30	4	5.41	2	3.73					18	3.054	1,970	3.878	4	2.71
554	Gasoline Service Stations	1	11.96	7	9.66	4	11.88	12	4.75	1	15.52	1	5.78	3	12.87	29	8.413	8,785	10.364	20	7.43
559	Miscellaneous Automotive Dealers			1	13.35			1	8.67							2	11.010	812	9.486		
571	Furniture and Home Furnishings	5	0.27	2	0.25	1	0.40	2	1.22							10	0.469	564	0.876	6	3.52
572	Household Appliance and Radio Stores	1	2.75	3	0.02	3	3.45			1	0.48					8	1.706	728	1.382	8	5.12
581	Eating and Drinking Places	3	11.89			1	0.25	2	11.92							6	9.961	476	10.078	8	4.58
591	Drug Stores and Proprietary Stores																			1	7.45
592	Liquor Stores					1	3.57									1	3.573	75	3.573	1	3.65
593	Antique Stores and Secondhand Stores					2	1.32									2	1.320	150	1.320	3	3.27
594	Book and Stationery Stores											1	2.70			1	2.695	676	2.695		
596	Farm and Garden Supply Stores	3	2.62	5	4.14	8	6.43	15	10.51	8	11.81	1	13.82			40	8.649	7,127	10.818	31	7.45
598	Fuel and Ice Dealers	16	2.07	1	5.68	1	15.08	3	8.45							21	3.773	869	7.188	5	10.93
599	Retail Stores, Not Elsewhere Classified	3	4.46	1	0.70	2	0.80	5	2.02	1	4.29			1	11.52	13	3.199	3,174	4.240	5	3.88
	FINANCE, SERVICE, AND MISCELLANEOUS																				
614	Personal Credit Institutions													1	1.39	1	1.390	1,686	1.390	1	4.10
622	Commodity Contracts Brokers and Dealers							1	10.14							1	10.137	175	10.137		
656	Operative Builders					2	9.25									2	9.247	150	9.247	2	3.95
721	Laundries and Laundry Services	2	1.00			1	1.02	7	1.06							10	1.044	1,334	1.058	1	5.75
722	Cleaning and Dyeing Plants																			2	3.40
729	Miscellaneous Personal Services			1	10.81											1	10.811	37	10.811	2	10.30
731	Advertising									1	0.73					1	0.731	375	0.731		
734	Services to Dwelling and Other Buildings					1	0.08	1	0.48							2	0.280	250	0.360		
739	Business Services, Not Elsewhere Classified	1	0.68	1	1.70			1	3.90							3	2.090	229	3.306	1	2.05
751	Automobile Rentals, Without Drivers	1	0.81	4	1.39	3	3.28	14	5.98	16	8.32	3	3.93	1	4.10	42	5.929	12,554	6.407	31	9.08
753	Automobile Repair	1	0.57					1	0.65	2	7.57					4	4.091	932	4.110	1	1.75
761	Blacksmith Shops																			1	2.65
762	Electrical Repair Shops			1	0.25											1	0.250	7	0.250	5	2.61
763	Watch, Clock, and Jewelry Repair	1	0.06													1	0.059	17	0.059		
764	Upholstery and Furniture Repair					1	0.03									1	0.027	75	0.027		
769	Miscellaneous Repair Shops	5	3.08	2	2.73	3	0.08	3	7.71							13	3.406	889	4.950	4	4.12
771	Radio and T.V. Broadcasting																			1	3.65
794	Sports Promoters and Commercial Operators									1	14.05					1	14.051	375	14.051		
866	Religious Organizations																			3	2.85
901	U. S. Mail			1	4.52											1	4.520	75	4.520	2	4.95

PART II

COMMODITIES HAULED ON MAIN RURAL ROADS

Freight commodity statistics relating to Class I railroads have been regularly collected and reported in the United States for more than 30 years. The two principal sources of these statistics are annual reports on revenue tonnage submitted by these railroads to the Interstate Commerce Commission[1], and a continuous one percent sample of waybill terminations. The Railroad Commission of Texas also requires annual reports of revenue tonnage by commodity classes from lines operating within the State.[2] The manifold commodities moving from producer to consumer are organized into 262 reporting classes, organized into seven groups (products of agriculture, products of mines, etc.)[3]

No similar body of data is presently available regarding goods transported by motor trucks. Effective January 1, 1956, the Commission has ordered the compilation and annual

[1]"Freight Commodity Statistics, 1954," Statement No. 55100, Interstate Commerce Commission, Bureau of Transport Economics and Statistics.

[2]See "Railroad Statistical Section of the Sixty-Fourth Annual Report, Railroad Commission of Texas," Austin, Texas.

[3]The classifications are published by the Accounting Division, Association of American Railroads, and were prepared by a committee of the Association with the co-operation of the Bureau of Transport Economics and Statistics and the Bureau of Traffic of the Interstate Commerce Commission.

Figure 7 — Measuring height and front axle load, and identifying the vehicle.

reporting of freight commodity statistics on 10,000-pound shipments by Class I common and contract carriers.[4] However, the trucking industry is opposing this order in current I.C.C. hearings on the subject, and status of the order is at present uncertain. The order requires that data be assembled and reported on the basis of the same commodity groups and classes that are used by railroads. However, were it in effect this order would not close the gap between rail and motor commodity

[4]Sections 206.1 to 206.6, I.C.C. rules and regulations, as reported in **Transport Topics**, December 26, 1955.

COMMODITIES HAULED BY MOTOR TRUCKS

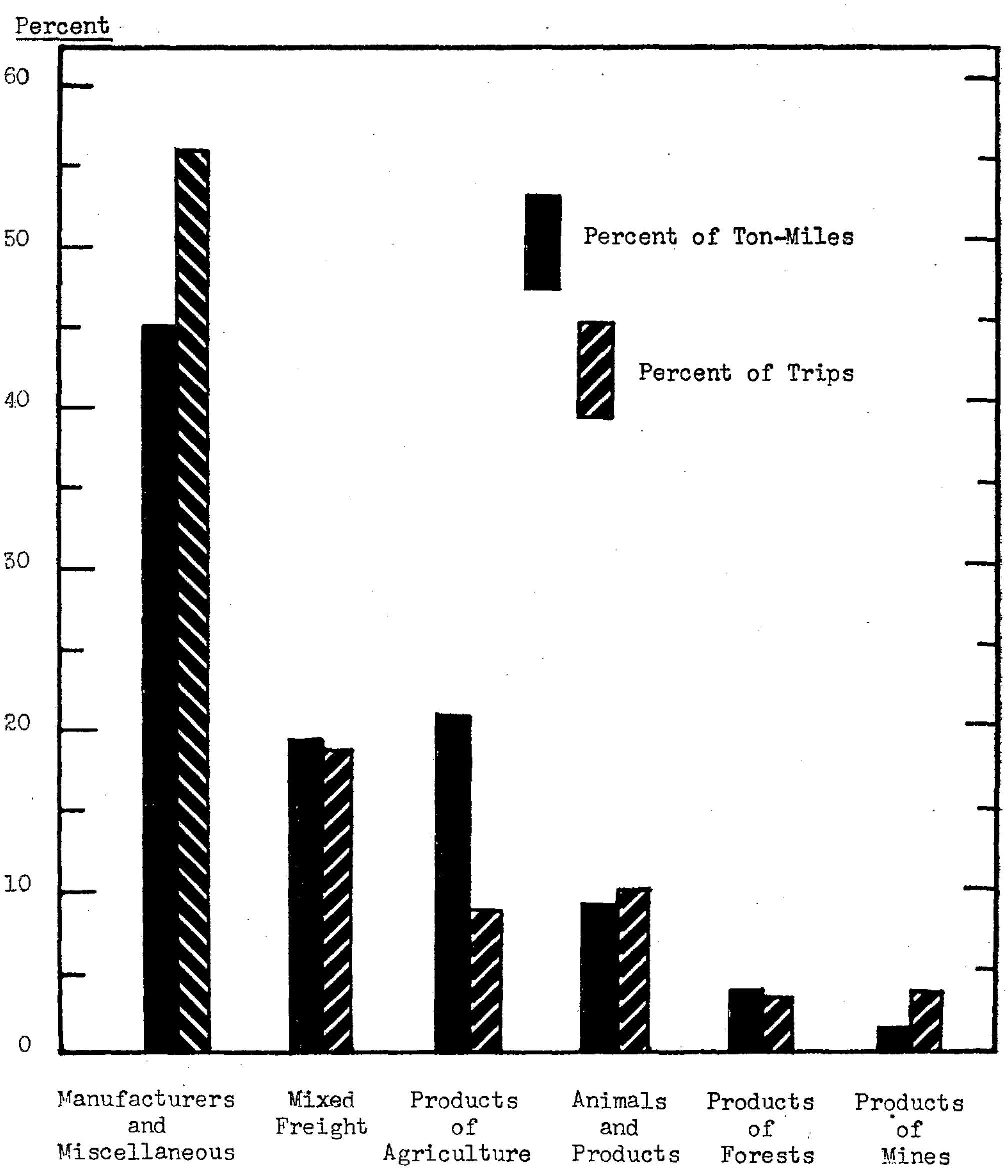


Figure 8 — **Distribution of motor truck trips and ton-miles by commodity classes. Source: Computed from Table 6 and Table 8.**

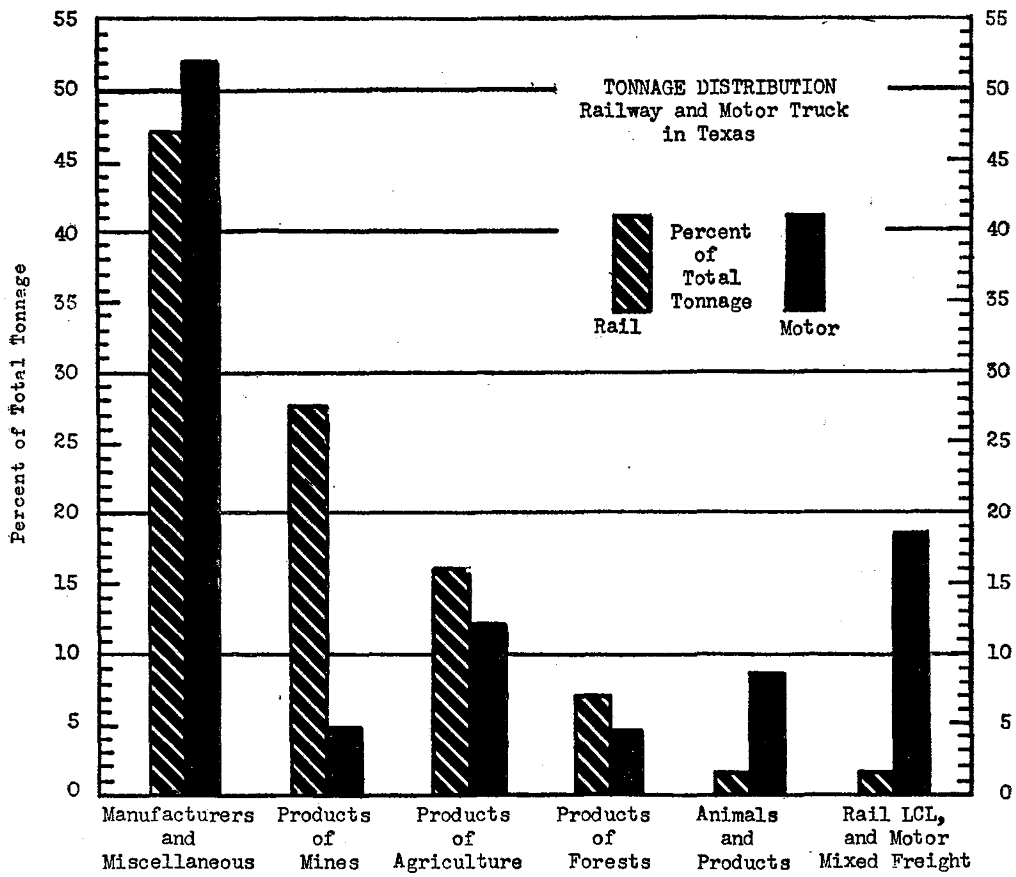


Figure 9 — Tonnage distribution of freight commodities as percents of total railway tonnage in Texas and as percents of total motor truck tonnage recorded at 21 loadometer stations on main rural roads. Source: For railway tonnage: Railroad Statistical Section of the Sixty-Fourth Annual Report of the Railway Commission of Texas for the Year 1955, covering Railroad Statistics for 1954, Table 12. For motor truck tonnage: derived from loadometer data in Tables 6 and 8.

statistics, since Class I motor carriers constitute only a small portion of the motor trucking universe.

The commodity classification used in the Texas loadometer program is based on the railroad classification.[5] Thus it is possible to make direct railroad-motor freight comparisons, if a few conditions are observed. First, it should be noted that the railroad commodity data refer to carload shipments. The relatively few less-than-carload shipments are grouped in the "LCL" class without commodity identification. On the other hand, most motor truck shipments approximate the LCL size, and the class of commodity being hauled is identified in the loadometer records regardless of the size of carried load —unless there are two or more commodity classes involved in the carried load of a trip. In this latter case, when there were two or more commodity classes involved, the trip was assigned a "Mixed Freight" classification. This mixed classification accounted for about 20 percent of the total ton-miles calculated from the loadometer sample.

Although there may well have been other studies along this line, we know of no similar highway freight commodity statistics with which the

[5]The principal use made of these commodity data to date is to identify the commodity class involved when trucks are found to be overloaded in some respect.

TABLE 6

CHARACTERISTICS OF HIGHWAY HAULS OF COMMODITIES, GROUPED BY COMMODITY AND VEHICLE TYPES, RECORDED AT 21 TEXAS LOADOMETER STATIONS DURING 1955

Commodity Group and Type of Vehicle	Number of Trips	Average Carried Load	Vehicle Miles	Percent of Vehicle Miles	Ton-Miles	Percent of Ton-Miles
		(Tons)				
PRODUCTS OF AGRICULTURE	1,047		543,228	15.090	6,584,577	20.991
Light Trucks, under 1½ Ton	32	1.06	2,841		3,063	
Other Single Unit Trucks	282	4.60	59,152		295,861	
Combination Vehicles	733	12.90	481,235		6,285,653	
ANIMALS AND PRODUCTS	1,237		328,077	9.114	2,913,163	9.287
Light Trucks, under 1½ Ton	50	0.68	2,532		1,654	
Other Single Unit Trucks	632	2.75	63,436		184,622	
Combination Vehicles	555	9.90	262,109		2,726,887	
PRODUCTS OF MINES	407		42,269	1.174	540,440	1.723
Light Trucks, under 1½ Ton	2	0.54	54		23	
Other Single Unit Trucks	172	5.85	5,272		27,365	
Combination Vehicles	233	13.94	36,943		513,052	
PRODUCTS OF FORESTS	393		93,505	2.597	1,130,554	3.604
Light Trucks, under 1½ Ton	11	0.95	737		708	
Other Single Unit Trucks	116	3.71	7,258		25,938	
Combination Vehicles	266	12.58	85,510		1,103,908	
MANUFACTURERS AND MISCELLANEOUS	8,923		2,592,899	72.025	20,199,318	64.395
Light Trucks, under 1½ Ton	513	0.63	54,175		32,053	
Other Single Unit Trucks	2,566	2.47	285,994		679,974	
Combination Vehicles	5,844	9.59	2,252,730		19,487,291	
All Commodity Groups						
All Vehicles	12,007		3,599,978	100.000	31,368,052	100.000
Light Trucks, under 1½ Ton	608	0.66	60,339	1.676	37,501	0.119
Other Single Unit Trucks	3,768	2.87	421,112	11.698	1,213,760	3.870
Combination Vehicles	7,631	10.17	3,118,527	86.626	30,116,791	96.011

material in Table 8 may be compared. For each commodity listed in this table a distinction is made as to general vehicle type—whether light truck, other single unit truck, or combination vehicle. Then, number of trips, trip length, average loads, etc., are indicated for each commodity or class. While the same trip-length bias operates here as in other unadjusted loadometer data, it is thought to be of little significance in making comparisons between commodities.

In Figure 8 the principal commodity groups are compared with respect to trips and ton-miles. This illustration pertains to unadjusted sample data; no attempt was made to estimate State or national parameters. It is evident that the major portion of truck transportation is devoted to finished products. Practically all of the Manufacturers and Miscellaneous commodities are finished goods, as also are most of the items involved in the Mixed Freight trips. All trips, whether by common carrier or otherwise, which involved more than one commodity were given the Mixed Freight designation.

Table 6 gives a summary of data relating to the major commodity groups. Information in a similar form is given in Table 8 for specific commodities and classes. Among other things these tables bring out the realtive importance of combination vehicles in Texas highway freight patterns.

For a better comparison, however, it is necessary to adjust the data, due to the fact that a higher percentage of combination vehicles which were counted in the traffic stream were stopped and weighed. When this adjustment is made, using the relationships given in Part III, the following estimates are obtained (relating to loaded vehicles only):

Vehicle Type	Percent of Vehicle Miles	Percent of Ton-Miles
Light Trucks, Under 1 ½ Ton	11.96	1.02
Other Single Unit Trucks	12.01	4.44
Combination Vehicles	76.03	94.54
Total	100.00	100.00

They apply only to the trips in the loadometer sample. If an adjustment is made because of the greater probability that vehicles on longer trips will pass a loadometer station the percentages shown for single unit trucks would be somewhat higher.

The distribution of railway and motor truck tonnage between groups of commodities is compared in Figure 9. Products of agriculture, mines, and forests are more important, tonnage-wise, in rail traffic than in motor trucking. Animals and products, manufacturers and miscellaneous, and mixed freight (or LCL) are relatively more important in the motor truck picture. The percentages shown in Figure 5 are as follows:

TABLE 7
COMMODITY DISTRIBUTION WITHIN TYPES OF TRANSPORT

Commodity Group	Percent of Rail Tonnage	Percent of Truck Tonnage
Products of Agriculture	15.9	12.1
Animals and Products	1.4	8.2
Products of Mines	27.6	4.8
Products of Forests	6.7	4.3
Manufacturers and Miscellaneous	46.9	52.1
Forwarder Traffic and LCL	1.5	
Mixed Freight		18.5
Total	100.0	100.0

Source: See Figure 9.

Comparisons of average loads and hauls are made in Figure 10. For none of the commodity groups does the average load of motor trucks approach that of railroads. The difference is less marked for the forwarder-mixed freight comparisons but these two groups are not comparable in a strict sense. With respect to products of agriculture the average haul (miles) of trucks exceeded that of railroads (based on unadjusted loadometer data). In all other commodity groupings the average rail haul far exceeded the average truck haul.

The data presented in Figures 9 and 10 give rise to the question of whether railway and motor trucks are in fact as competitive as is generally assumed. Both depend rather heavily on manufacturers and miscellaneous traffic, but the differences

RAILWAY AND MOTOR TRUCK LOADS AND HAULS

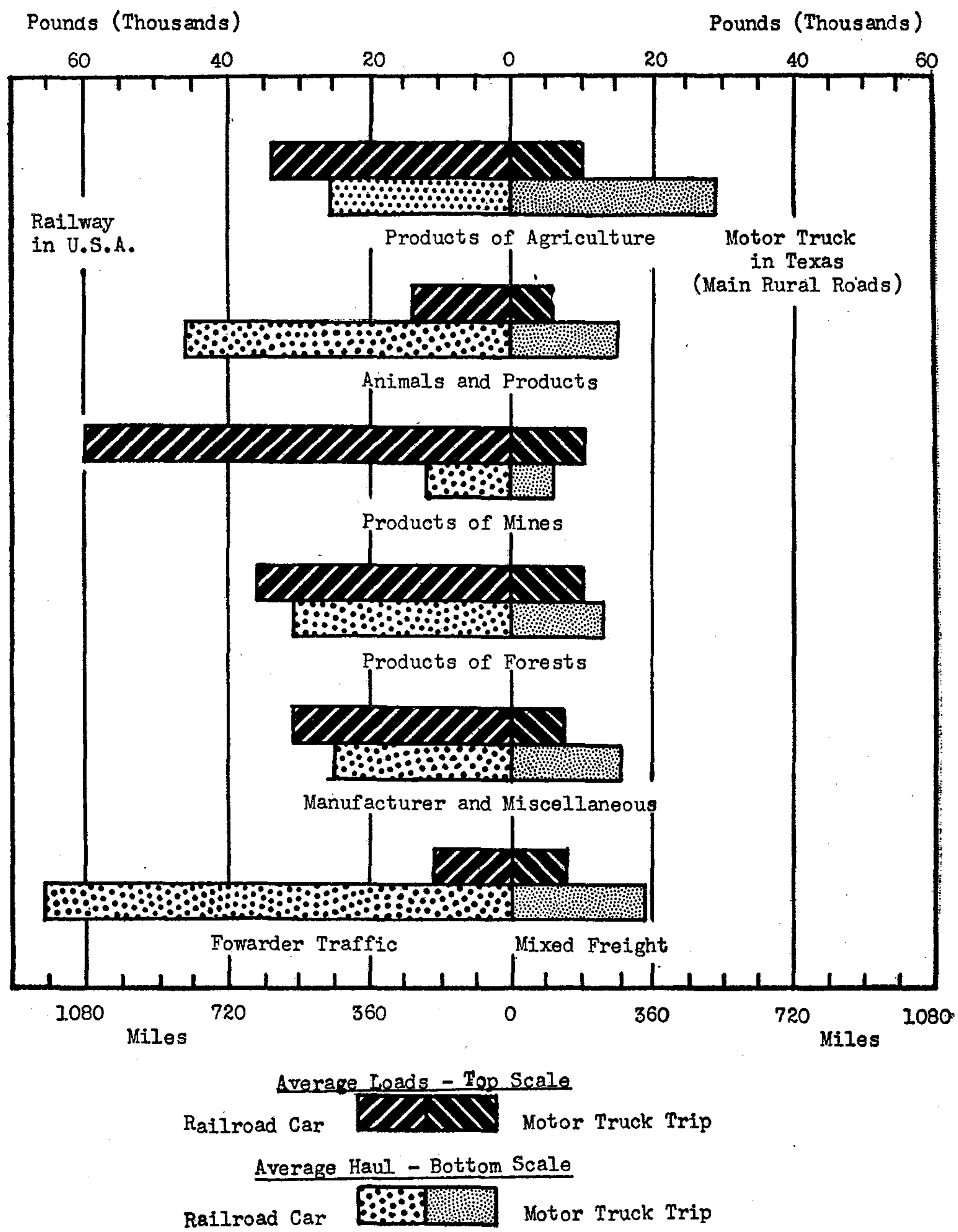


Figure 10 — Comparison average loads and hauls of rail and motor freight by commodity groups. Source: For railway: "Carload Waybill Statistics, 1954," Statement SS - 7, Interstate Commerce Commission, Bureau of Transport Economics and Statistics. For truck: loadometer data in Tables 6 and 8 (unadjusted).

in average loads and miles of haul are considerable, and would be even more striking—particularly with respect to length of haul—if data were available defining the actual trucking universe.

Perhaps the most unique commodity data resulting from the loadometer study may be found in Table 8. The length of this table is indicative of the great variety of products being hauled over main rural roads in Texas. Since this report is not concerned with an analysis of the transportation of any special commodity or commodities, few generalizations have been attempted. The relative importance of various commodities in highway freight traffic can be estimated from this reference table, and the trips, loads, distances, and types of vehicles pertaining to the hauls of specific products are outlined.

TABLE 8

TRIP CHARACTERISTICS OF LOADED VEHICLES BY COMMODITY HAULED AND VEHICLE GROUP RECORDED AT 21 TEXAS LOADOMETER STATIONS DURING 1955

COMMODITY AND VEHICLE TYPE	Number of Trips	Average Carried Load*	Trip Length (Avg.)	Total Ton Miles	Percent of Ton-Miles
		(Tons)	(Mi.)		
PRODUCTS OF AGRICULTURE					
Wheat					
All Vehicles	33	15.172	313	159,921	0.5099
Standard Trucks	1	4.395	37	163	
Combinations	32	15.509	322	159,758	
Corn					
All Vehicles	48	12.457	390	267,281	0.8522
Light Trucks	2	2.148	46	197	
Standard Trucks	9	6.036	61	3,302	
Combinations	37	14.576	489	263,782	
Oats					
All Vehicles	23	11.623	364	96,695	0.3083
Light Trucks	1	.080	7	1	
Standard Trucks	6	5.986	477	17,132	
Combinations	16	14.458	344	79,562	
Rice					
All Vehicles	8	6.098	328	24,832	0.0792
Standard Trucks	4	2.598	12	125	
Combinations	4	9.599	644	24,707	
Grain, n.o.s.**					
All Vehicles	110	14.106	395	658,994	2.1011
Light Trucks	2	1.168	27	63	
Standard Trucks	13	7.593	41	4,032	
Combinations	95	15.270	451	654,899	
Cereal Food Prep. edible, n.o.s.					
Combinations	4	13.029	1,021	53,223	0.1697
Mill Products, n.o.s.					
All Vehicles	125	7.047	207	233,632	0.7449
Light Trucks	6	0.777	38	177	
Standard Trucks	54	3.897	85	17,840	
Combinations	65	10.243	324	215,615	
Hay and Alfalfa					
All Vehicles	39	7.391	232	80,871	0.2579
Light Trucks	2	0.425	17	14	
Standard Trucks	12	3.680	95	4,173	
Combinations	25	9.729	315	76,684	
Cotton in Bales					
All Vehicles	42	8.593	235	95,950	0.3059
Standard Trucks	9	4.082	19	706	
Combinations	33	9.824	294	95,244	
Cotton Linters, Nails, and Regins					
All Vehicles	3	4.093	89	1,509	0.0048
Standard Trucks	1	0.245	17	4	
Combinations	2	6.018	125	1,505	

TABLE 8—Continued

COMMODITY AND VEHICLE TYPE	Number of Trips	Average Carried Load*	Trip Length (Avg.)	Total Ton Miles	Percent of Ton-Miles
		(Tons)	(Mi.)		
PRODUCTS OF AGRICULTURE (Continued)					
Cottonseed					
All Vehicles	77	12.830	207	204,459	0.6519
Standard Trucks	10	4.667	209	9,768	
Combinations	67	14.049	207	194,691	
Cottonseed, meal, cake, and hulls					
All Vehicles	35	10.298	185	72,679	0.2317
Standard Trucks	13	5.742	121	9,015	
Combinations	22	12.990	223	63,664	
Oranges and Grapefruit					
All Vehicles	7	11.438	951	77,024	0.2456
Standard Trucks	3	7.265	912	19,884	
Combinations	4	14.569	980	57,140	
Lemons, Limes, Citrus Fruits, n.o.s.					
Combinations	3	12.670	1,686	64,085	0.2043
Apples, fresh					
All Vehicles	10	8.436	791	84,657	0.2699
Standard Trucks	4	3.836	206	3,168	
Combinations	6	11.503	1,181	81,489	
Bananas					
All Vehicles	15	7.864	514	67,510	0.2252
Standard Trucks	2	1.042	75	156	
Combinations	13	8.914	581	67,354	
Cantaloupes and Melons, n.o.s.					
All Vehicles	21	8.967	615	133,296	0.4250
Standard Trucks	13	6.512	406	34,364	
Combinations	8	12.956	955	98,932	
Grapes, fresh					
Combinations	11	11.742	1,686	217,267	0.6943
Peaches, fresh					
All Vehicles	3	11.745	1,349	53,553	0.1707
Standard Trucks	1	5.795	676	3,917	
Combinations	2	14.720	1,686	49,636	
Watermelons					
All Vehicles	60	6.294	395	190,408	0.6071
Light Trucks	7	1.130	40	313	
Standard Trucks	33	4.259	328	46,125	
Combinations	20	11.458	628	143,970	
Fruits, fresh, domestic and Mixed, n.o.s.					
All Vehicles	22	13.058	1,328	391,794	1.2492
Standard Trucks	3	8.547	676	17,333	
Combinations	19	13.771	1,431	374,461	
Fruits, fresh, tropical, n.o.s.					
Standard Trucks	1	5.110	676	3,454	0.0110
Potatoes, other than sweet					
All Vehicles	41	12.490	808	469,825	1.4980
Light Trucks	1	0.430	75	32	
Standard Trucks	6	2.691	169	2,723	
Combinations	34	14.570	943	467,070	
Cabbage					
All Vehicles	8	11.926	875	84,922	0.2708
Standard Trucks	3	7.813	800	18,743	
Combinations	5	14.393	920	66,179	

TABLE 8—Continued

COMMODITY AND VEHICLE TYPE	Number of Trips	Average Carried Load*	Trip Length (Avg.)	Total Ton Miles	Percent of Ton-Miles
		(Tons)	(Mi.)		
PRODUCTS OF AGRICULTURE (Continued)					
Onions					
All Vehicles	51	12.290	921	641,130	2.0442
Standard Trucks	12	6.773	184	14,982	
Combinations	39	13.989	1,148	626,148	
Tomatoes					
All Vehicles	58	10.279	951	710,122	2.2642
Light Trucks	4	0.958	366	1,402	
Standard Trucks	18	4.131	345	25,678	
Combinations	36	14.388	1,319	638,042	
Vegetables, fresh, n.o.s., and mixed					
All Vehicles	58	11.109	804	564,290	1.7992
Light Trucks	1	0.250	37	9	
Standard Trucks	7	4.545	121	3,859	
Combinations	50	12.251	915	560,422	
Beans and Peas, dried					
All Vehicles	9	11.132	909	112,623	0.3591
Standard Trucks	3	3.960	242	2,871	
Combinations	6	14.718	1,243	109,752	
Fruits, dried or evaporated					
Combinations	19	12.541	1,633	389,072	1.2405
Vegetables, dry, n.o.s.					
All Vehicles	18	5.199	419	62,032	0.1978
Light Trucks	2	1.250	106	265	
Standard Trucks	13	4.285	252	14,033	
Combinations	3	11.792	1,349	47,734	
Peanuts					
All Vehicles	10	8.042	350	34,066	0.1087
Standard Trucks	2	0.302	46	28	
Combinations	8	9.976	427	34,038	
Products of Agriculture, n.o.s.					
All Vehicles	49	6.624	578	239,407	0.7633
Light Trucks	2	1.192	106	253	
Standard Trucks	21	3.277	257	17,689	
Combinations	26	9.745	874	221,465	
ANIMALS AND PRODUCTS					
Horses, Mules, Ponies, and Asses					
All Vehicles	11	3.424	382	15,509	0.0494
Light Trucks	1	0.325	7	2	
Standard Trucks	7	2.278	424	6,763	
Combinations	3	7.132	409	8,744	
Cattle and Calves, single deck					
All Vehicles	243	6.266	177	323,197	1.0305
Light Trucks	12	1.021	55	670	
Standard Trucks	81	3.030	80	19,550	
Combinations	150	8.435	239	302,977	
Sheep and Goats, single deck					
All Vehicles	9	4.530	237	10,289	0.0328
Standard Trucks	5	2.728	207	2,829	
Combinations	4	6.782	275	7,460	
Hogs, single-deck					
All Vehicles	23	5.109	219	42,429	0.1353
Light Trucks	7	0.390	27	73	
Standard Trucks	6	2.831	119	2,027	
Combinations	10	9.779	412	40,329	

TABLE 8—Continued

COMMODITY AND VEHICLE TYPE	Number of Trips	Average Carried Load*	Trip Length (Avg.)	Total Ton Miles	Percent of Ton-Miles
		(Tons)	(Mi.)		
ANIMALS AND PRODUCTS (Continued)					
Hogs, double-deck					
Standard Trucks	1	0.520	37	19	0.0001
Fresh Meats, n.o.s.					
All Vehicles	195	6.095	354	595,417	1.8984
Light Trucks	5	0.590	21	62	
Standard Trucks	88	2.194	112	21,703	
Combinations	102	9.730	578	573,652	
Meats, cured, dried, or smoked and Packing House Meats					
All Vehicles	44	3.618	221	63,162	0.2014
Standard Trucks	36	2.333	111	9,360	
Combinations	8	9.401	715	53,802	
Butterine and Margerine					
All Vehicles	13	8.887	491	57,516	0.1834
Standard Trucks	3	6.405	409	7,853	
Combinations	10	9.632	516	49,663	
Packing-house Products, edible, n.o.s. (not canned meats)					
All Vehicles	7	10.259	375	28,393	0.0905
Standard Trucks	1	4.085	175	715	
Combinations	6	11.288	409	27,678	
Poultry, live					
All Vehicles	39	5.135	209	42,585	0.1358
Standard Trucks	28	4.559	196	24,970	
Combinations	11	6.600	243	17,615	
Poultry, dressed					
All Vehicles	69	7.279	597	421,125	1.3427
Light Trucks	1	0.250	175	44	
Standard Trucks	28	1.910	150	8,041	
Combinations	40	11.223	920	413,040	
Eggs					
All Vehicles	51	6.591	675	341,432	1.0886
Light Trucks	6	0.652	60	233	
Standard Trucks	18	2.386	160	6,869	
Combinations	27	10.714	1,156	334,330	
Butter					
All Vehicles	11	7.373	962	91,459	0.2916
Standard Trucks	3	2.398	308	2,218	
Combinations	8	9.242	1,207	89,241	
Cheese					
All Vehicles	15	6.287	290	33,462	0.1067
Standard Trucks	4	1.469	56	329	
Combinations	11	8.040	375	33,133	
Wool, Mohair					
All Vehicles	5	11.085	590	38,240	0.1219
Light Trucks	1	.380	175	67	
Combinations	4	13.761	694	38,173	
Hides, green					
All Vehicles	8	11.994	325	31,061	0.0990
Standard Trucks	2	11.075	375	8,306	
Combinations	6	12.300	308	22,755	
Leather					
Combinations	1	2.420	175	424	0.0014
Fish or Sea-animal Oil					
Combinations	1	14.260	375	5,347	0.0170

TABLE 8—Continued

COMMODITY AND VEHICLE TYPE	Number of Trips	Average Carried Load*	Trip Length (Avg.)	Total Ton Miles	Percent of Ton-Miles
		(Tons)	(Mi.)		
ANIMALS AND PRODUCTS (Continued)					
Animals, live, n.o.s.					
All Vehicles	3	1.187	712	3,495	0.0111
Light Trucks	1	0.250	75	19	
Standard Trucks	1	1.490	1,686	2,512	
Combinations	1	2.570	375	964	
Animal Products, n.o.s.					
All Vehicles	81	7.694	505	476,764	1.5201
Light Trucks	5	0.515	101	261	
Standard Trucks	40	3.476	162	22,507	
Combinations	36	13.378	943	453,996	
Milk					
All Vehicles	407	4.926	94	291,838	0.9305
Light Trucks	11	0.776	26	223	
Standard Trucks	280	2.662	51	38,051	
Combinations	116	10.784	203	253,564	
PRODUCTS OF MINES					
Bituminous Coal					
Combinations	1	16.715	1,686	28,181	0.0898
Gravel and Sand					
All Vehicles	229	8.590	24	54,898	0.1750
Light Trucks	1	0.250	37	9	
Standard Trucks	145	6.043	17	14,883	
Combinations	83	13.147	37	40,006	
Stone, broken, ground, or crushed					
All Vehicles	10	7.086	103	5,985	0.0191
Standard Trucks	4	3.541	157	2,224	
Combinations	6	9.450	66	3,761	
Stone, rough, n.o.s.					
All Vehicles	6	6.858	242	11,352	0.3362
Standard Trucks	2	3.502	106	742	
Combinations	4	8.536	311	10,610	
Stone, finished, n.o.s.					
All Vehicles	8	4.464	375	17,124	0.0546
Light Trucks	1	0.820	17	14	
Standard Trucks	4	4.216	110	1,863	
Combinations	3	6.010	846	15,247	
Petroleum, crude					
Combinations	21	15.256	53	16,980	0.0541
Asphalt (natural by-product, or petroleum)					
All Vehicles	95	14.399	187	263,865	0.8413
Standard Trucks	7	6.644	45	2,106	
Combinations	88	15.016	198	261,759	
Salt					
All Vehicles	28	13.139	315	120,867	0.3854
Standard Trucks	4	4.742	190	3,613	
Combinations	24	14.538	336	117,249	
Sulphur (Brimstone)					
Combinations	2	14.518	525	15,258	0.0486
Products of Mines, n.o.s.					
All Vehicles	7	5.225	118	5,935	0.0189
Standard Trucks	6	4.318	75	1,934	
Combinations	1	10.670	375	4,001	

TABLE 8—Continued

COMMODITY AND VEHICLE TYPE	Number of Trips	Average Carried Load*	Trip Length (Avg.)	Total Ton Miles	Percent of Ton-Miles
		(Tons)	(Mi.)		
PRODUCTS OF FORESTS					
Logs					
All Vehicles	25	10.962	68	18,529	0.0591
Light Trucks	1	1.120	75	84	
Combinations	24	11.372	68	18,445	
Post, Poles, and Piling					
All Vehicles	36	6.926	129	37,258	0.1188
Standard Trucks	11	2.862	51	1,600	
Combinations	25	8.714	164	35,658	
Wood, Fuel					
All Vehicles	3	6.515	262	7,002	0.0223
Light Trucks	1	0.970	37	36	
Standard Trucks	1	6.090	375	2,284	
Combinations	1	12.485	375	4,682	
Ties, railroad					
All Vehicles	2	9.710	37	720	0.0023
Standard Trucks	1	2.000	37	74	
Combinations	1	17.420	37	646	
Pulp Wood					
All Vehicles	36	6.952	57	17,922	0.0571
Standard Trucks	30	5.862	39	6,776	
Combinations	6	12.398	150	11,146	
Lumber, Shingles, and Lath, Rig Timber					
All Vehicles	242	10.108	217	641,582	2.0456
Light Trucks	7	0.954	79	526	
Standard Trucks	65	2.976	70	13,460	
Combinations	170	13.212	279	627,596	
Box, Crate, and Cooperage Materials					
Light Trucks	1	1.450	37	54	0.0002
Veneer and Built-up Wood, Plywood					
All Vehicles	2	0.778	20	12	0.0000
Light Trucks	1	0.220	37	8	
Standard Trucks	1	1.335	3	4	
Rosin					
Combinations	1	15.980	175	2,796	0.0089
Crude Rubber (Not Reclaimed)					
Combinations	36	13.168	840	398,437	1.2704
Products of Forests, n. o. s.					
All Vehicles	9	4.056	128	6,242	0.0199
Standard Trucks	7	2.876	86	1,740	
Combinations	2	8.185	275	4,502	
MANUFACTURERS AND MISCELLANEOUS					
Gasolines and Refined Petroleum Oils, Including Butane (gas)					
All Vehicles	808	10.742	119	1,234,198	3.9351
Light Trucks	6	0.330	48	96	
Standard Trucks	199	2.417	32	15,375	
Combinations	603	13.592	149	1,218,727	
Fuel, Road, and Petroleum Residual Oils, n. o. s.					
All Vehicles	11	6.990	179	15,362	0.0490
Standard Trucks	7	3.911	152	4,153	
Combinations	4	12.386	226	11,209	

TABLE 8—Continued

COMMODITY AND VEHICLE TYPE	Number of Trips	Average Carried Load*	Trip Length (Avg.)	Total Ton Miles	Percent of Ton-Miles
		(Tons)	(Mi.)		
MANUFACTURERS AND MISCELLANEOUS (Continued)					
Lubricating Oils and Greases					
All Vehicles	89	9.549	217	225,759	0.7198
Light Trucks	5	0.708	35	123	
Standard Trucks	21	2.212	81	3,754	
Combinations	63	12.700	277	221,882	
Petroleum Products, n. o. s.					
All Vehicles	25	11.855	573	176,184	0.5617
Standard Trucks	1	0.695	17	12	
Combinations	24	12.318	596	176,172	
Cottonseed Oil					
Combinations	11	16.543	320	58,314	0.1859
Linseed Oil					
Standard Trucks	1	4.390	175	768	0.0024
Vegetables Oils, n. o. s.					
Combinations	1	16.210	175	2,837	0.0090
Sugar (beet or cane)					
All Vehicles	16	11.176	432	83,070	0.2649
Standard Trucks	2	3.960	75	594	
Combinations	14	12.206	483	82,476	
Table Sirup and Edible Molasses					
All Vehicles	40	12.468	451	229,721	0.7324
Light Trucks	1	1.850	37	68	
Standard Trucks	2	7.938	426	6,755	
Combinations	37	13.000	463	222,898	
Molasses, Blackstrap, and Beet Residual					
Combinations	13	14.533	377	71,241	0.2271
Iron, pig					
All Vehicles	3	10.180	1,349	39,734	0.1267
Standard Trucks	1	7.260	1,686	12,240	
Combinations	2	11.640	1,181	27,494	
Iron and Steel, Rated 6th Class, n. o. s.					
All Vehicles	2	5.787	81	1,986	0.0063
Standard Trucks	1	0.250	17	4	
Combinations	1	11.325	175	1,982	
Rails, Fastenings, Frogs and Switches					
All Vehicles	3	2.628	50	400	0.0013
Light Trucks	1	2.175	37	80	
Standard Trucks	2	2.855	56	320	
Iron and Steel Pipe Fittings, Pipe, and Tubing					
All Vehicles	152	9.177	262	399,765	1.2746
Light Trucks	2	0.330	56	37	
Standard Trucks	19	2.263	68	2,931	
Combinations	131	10.315	294	396,797	
Iron and Steel; Nails and Wire, not woven					
All Vehicles	43	6.749	209	80,708	0.2573
Light Trucks	4	0.922	75	277	
Standard Trucks	15	2.414	86	3,121	
Combinations	24	10.429	309	77,310	
Iron and Steel, rated 5th class, n.o.s.					
All Vehicles	242	10.847	274	778,207	2.4813
Light Trucks	3	0.722	20	44	
Standard Trucks	27	2.462	84	5,591	
Combinations	212	12.059	302	772,572	

TABLE 8—Continued

COMMODITY AND VEHICLE TYPE	Number of Trips	Average Carried Load*	Trip Length (Avg.)	Total Ton Miles	Percent of Ton-Miles
		(Tons)	(Mi.)		
MANUFACTURERS AND MISCELLANEOUS (Continued)					
Copper, Brass, Bronze Bar, Sheet and Pipe					
Combinations	1	12.765	1,686	21,522	0.0686
Lead and Zinc: ingot, pig, or bar					
All Vehicles	3	6.972	208	4,618	0.0147
Standard Trucks	1	1.765	175	309	
Combinations	2	9.575	225	4,309	
Aluminum: ingot, pig, or slab					
All Vehicles	8	9.898	539	44,190	0.1409
Standard Trucks	1	1.775	375	666	
Combinations	7	11.058	562	43,524	
Machinery and Boilers					
All Vehicles	175	4.308	250	275,406	0.8781
Light Trucks	29	0.962	79	2,039	
Standard Trucks	81	3.182	77	19,910	
Combinations	65	7.205	541	253,457	
Cement, natural or Portland, building					
All Vehicles	175	11.458	114	277,145	0.8837
Light Trucks	1	1.320	75	99	
Standard Trucks	65	4.958	42	13,491	
Combinations	109	15.427	157	263,555	
Brick, common					
All Vehicles	80	10.059	181	152,972	0.5103
Light Trucks	1	0.980	37	36	
Standard Trucks	26	5.860	144	21,957	
Combinations	53	12.297	201	130,979	
Brick, n.o.s., and Building Tile					
All Vehicles	14	8.644	201	27,338	0.0872
Standard Trucks	5	5.893	58	1,715	
Combinations	9	10.172	280	25,623	
Artificial Stone, n.o.s.					
All Vehicles	22	12.720	110	32,952	0.1051
Standard Trucks	3	5.670	24	403	
Combinations	19	13.833	124	32,549	
Lime, common (quick or slack)					
All Vehicles	7	8.243	222	16,510	0.0526
Light Trucks	1	0.480	7	3	
Standard Trucks	1	1.695	75	127	
Combinations	5	11.105	295	16,380	
Sewer Pipe and Drain Tile (not metal)					
All Vehicles	66	11.431	272	205,438	0.7358
Light Trucks	3	0.463	119	165	
Standard Trucks	10	4.332	58	2,530	
Combinations	53	13.392	321	228,079	
Agricultural Implements and Parts, n.o.s.					
All Vehicles	32	3.145	353	43,038	0.1372
Light Trucks	1	0.380	7	3	
Standard Trucks	20	2.358	232	10,929	
Combinations	11	4.828	605	32,106	
Tractors and Parts					
All Vehicles	29	7.106	306	83,510	0.2663
Light Trucks	4	0.732	42	122	
Standard Trucks	7	2.852	99	1,982	
Combinations	18	10.177	444	81,406	

TABLE 8—Continued

COMMODITY AND VEHICLE TYPE	Number of Trips	Average Carried Load*	Trip Length (Avg.)	Total Ton Miles	Percent of Ton-Miles
		(Tons)	(Mi.)		
MANUFACTURERS AND MISCELLANEOUS (Continued)					
Railway Car Wheels, Axles, Trucks					
All Vehicles	3	4.443	242	4,183	0.0133
Standard Trucks	2	2.040	175	714	
Combinations	1	9.250	375	3,469	
Automobiles (passenger)					
All Vehicles	325	6.746	565	1,227,975	3.9153
Standard Trucks	3	1.603	1,249	6,006	
Combinations	322	6.794	559	1,221,969	
Auto Trucks, Fire Fighting Equipment, Wrecking Equipment					
All Vehicles	40	6.551	471	127,483	0.4065
Standard Trucks	3	1.822	208	1,139	
Combinations	37	6.934	492	126,344	
Automobiles and Auto Trucks, knocked down, and parts, n.o.s.					
All Vehicles	72	4.704	288	130,284	0.4154
Light Trucks	12	0.550	140	927	
Standard Trucks	29	2.651	168	12,940	
Combinations	31	8.232	456	116,417	
Automobile and Auto-truck tires					
All Vehicles	29	2.128	181	15,410	0.0491
Light Trucks	12	0.622	129	963	
Standard Trucks	11	2.076	140	3,187	
Combinations	6	5.235	358	11,260	
Furniture, metal					
All Vehicles	2	0.508	375	381	0.0012
Standard Trucks	1	0.845	375	317	
Combinations	1	0.170	375	64	
Furniture (other than metal) and Household Goods					
All Vehicles	505	3.362	797	1,502,867	4.7918
Light Trucks	27	0.359	517	5,011	
Standard Trucks	105	1.338	386	54,253	
Combinations	373	4.149	933	1,443,603	
Beverages, Soda Water, Water					
All Vehicles	420	5.403	108	481,243	1.5344
Light Trucks	7	1.662	31	364	
Standard Trucks	317	2.936	41	38,488	
Combinations	96	13.823	333	442,391	
Ice					
All Vehicles	29	3.538	44	6,747	0.0215
Light Trucks	3	0.448	6	8	
Standard Trucks	18	2.463	26	1,133	
Combinations	8	7.114	99	5,606	
Fertilizers, n. o. s., Bones, Potash					
All Vehicles	65	13.344	216	198,221	0.6320
Light Trucks	1	0.480	37	18	
Standard Trucks	8	5.711	94	4,272	
Combinations	56	14.664	236	193,931	
Alcohol, denatured or Wood					
Combinations	6	12.665	208	15,831	0.0505

TABLE 8—Continued

COMMODITY AND VEHICLE TYPE	Number of Trips	Average Carried Load*	Trip Length (Avg.)	Total Ton Miles	Percent of Ton-Miles
		(Tons)	(Mi.)		
MANUFACTURERS AND MISCELLANEOUS (Continued)					
Explosives, n. o. s., Dynamite					
All Vehicles	67	10.165	782	575,085	1.8336
Light Trucks	2	0.983	175	344	
Standard Trucks	5	1.395	175	1,221	
Combinations	60	11.202	853	573,520	
Cotton Cloth and Cotton Fabrics, n. o. s.					
Combinations	4	11.254	1,274	57,339	0.1828
Bagging and Bags, burlap,gunny,or jute					
All Vehicles	19	8.133	395	73,124	0.2332
Standard Trucks	5	2.676	66	886	
Combinations	14	10.082	512	72,238	
Canned Food Products, n. o. s.					
All Vehicles	99	9.316	442	441,144	1.4066
Light Trucks	1	2.070	17	35	
Standard Trucks	16	2.264	222	8,023	
Combinations	82	10.780	490	443,086	
Tobacco, manufactured products					
All Vehicles	9	4.162	389	47,242	0.1506
Standard Trucks	7	1.364	18	176	
Combinations	2	13.958	1,686	47,066	
Paints in Oil and Varnishes					
All Vehicles	19	8.260	257	42,288	0.1348
Light Trucks	1	0.250	175	44	
Standard Trucks	3	4.127	196	2,423	
Combinations	15	9.649	275	39,821	
Furnace Slag					
Light Trucks	1	1.910	37	17	0.0002
Scrap Iron and Scrap Steel					
All Vehicles	66	4.804	167	64,942	0.2071
Light Trucks	9	0.682	101	621	
Standard Trucks	35	2.784	139	13,544	
Combinations	22	9.705	238	50,777	
Paper Bags and Wrapping Paper					
All Vehicles	26	6.941	314	69,978	0.2231
Standard Trucks	7	1.337	67	630	
Combinations	19	9.005	405	69,348	
Paperboard, Pulpboard, and Wallboard					
All Vehicles	21	4.153	166	19,768	0.0630
Light Trucks	2	1.345	125	336	
Standard Trucks	11	2.860	48	1,519	
Combinations	8	6.632	338	17,913	
Building Paper and Prepared Roofing Materials					
All Vehicles	104	8.864	223	237,580	0.7575
Light Trucks	3	1.103	76	253	
Standard Trucks	20	2.011	65	2,598	
Combinations	81	10.844	267	234,729	
Building Woodwork (millwork), Building Material, n. o. s.					
All Vehicles	130	4.446	118	86,760	0.2766
Light Trucks	5	0.386	19	37	
Standard Trucks	63	2.165	68	9,268	
Combinations	62	7.091	176	77,455	

TABLE 8—Continued

COMMODITY AND VEHICLE TYPE	Number of Trips	Average Carried Load*	Trip Length (Avg.)	Total Ton Miles	Percent of Ton-Miles
		(Tons)	(Mi.)		
MANUFACTURERS AND MISCELLANEOUS (Continued)					
Soap and Washing Compounds					
Combinations	6	10.582	358	22,762	0.0726
Glass, flat (other than plate)					
All Vehicles	7	5.774	520	29,040	0.0926
Light Trucks	2	0.500	27	27	
Combinations	5	8.086	718	29,013	
Glass: bottles, jelly glasses, empty					
All Vehicles	84	6.604	255	165,507	0.5277
Light Trucks	1	0.680	75	51	
Standard Trucks	22	2.442	78	4,193	
Combinations	61	8.203	322	161,263	
Bakery, Cafe, and Confectionery Products					
All Vehicles	388	2.356	145	238,078	0.7591
Light Trucks	45	0.718	48	11,566	
Standard Trucks	239	1.068	76	19,413	
Combinations	104	6.026	346	217,099	
Chemicals, Drug and Gas, n. o. s.					
All Vehicles	165	8.958	231	407,052	1.2979
Light Trucks	3	0.645	70	135	
Standard Trucks	57	3.702	103	21,771	
Combinations	105	12.049	304	385,146	
Clothing, dry goods, shoes, notions					
All Vehicles	14	6.668	977	112,200	0.3577
Standard Trucks	3	0.912	24	65	
Combinations	11	8.238	1,237	112,135	
Crockery, Glassware, and Pottery					
Standard Trucks	2	2.270	376	1,705	0.0054
Empty Containers, n. o. s.					
All Vehicles	355	2.776	176	232,183	0.7403
Light Trucks	14	0.083	42	49	
Standard Trucks	181	1.343	100	24,257	
Combinations	160	4.634	280	207,877	
Equipment and Tools, n. o. s.					
All Vehicles	543	3.830	150	527,035	1.6804
Light Trucks	183	0.434	63	5,021	
Standard Trucks	222	2.360	123	64,567	
Combinations	138	10.696	310	457,447	
Hardware, n. o. s.					
All Vehicles	93	5.762	267	179,899	0.5736
Light Trucks	7	0.404	32	92	
Standard Trucks	25	1.724	113	4,862	
Combinations	61	8.032	357	174,945	
Laundry					
All Vehicles	30	1.006	97	3,016	0.0096
Light Trucks	2	0.488	12	12	
Standard Trucks	28	1.043	103	3,004	
Living Quarters					
Combinations	2	5.922	125	1,480	0.0047
Luggage (Baggage)					
All Vehicles	4	0.208	513	843	0.0026
Light Trucks	3	0.412	678	839	
Standard Trucks	1	0.250	17	4	

TABLE 8—Continued

COMMODITY AND VEHICLE TYPE	Number of Trips	Average Carried Load*	Trip Length (Avg.)	Total Ton Miles	Percent of Ton-Miles
		(Tons)	(Mi.)		
MANUFACTURERS AND MISCELLANEOUS (Continued)					
Oil Well Outfits and Oil Well Supplies					
All Vehicles	554	10.364	273	1,734,523	5.5304
Light Trucks	17	0.960	57	930	
Standard Trucks	102	5.460	78	43,390	
Combinations	435	11.881	327	1,690,230	
Trailers					
All Vehicles	13	5.324	515	34,946	0.1114
Standard Trucks	2	6.222	175	2,178	
Combinations	11	5.162	577	32,768	
Airplane engines, parts, etc.					
All Vehicles	21	7.137	743	116,728	0.3722
Light Trucks	1	0.830	37	31	
Standard Trucks	1	0.225	676	152	
Combinations	19	7.826	784	116,545	
Manufacturers and Miscellaneous, n. o. s.					
All Vehicles	280	3.531	221	289,438	0.9228
Light Trucks	43	0.780	104	3,487	
Standard Trucks	135	2.131	149	42,876	
Combinations	102	6.542	364	243,075	
Mixed classes: Freight, Merchandise, Groceries, Produce					
All Vehicles	2,229	7.373	340	6,068,708	19.3496
Light Trucks	44	0.920	187	7,589	
Standard Trucks	359	2.220	165	155,163	
Combinations	1,826	8.542	379	5,905,956	

Summary — All Commodities

Vehicle Type	Vehicle Miles	Ton-Miles
Light Trucks—under 1½ Ton	60,339	37,501
Other (Standard) Single Unit Trucks	421,112	1,213,760
Combination Vehicles	3,118,527	30,116,791
All Vehicles	3,599,978	31,368,052

***Note:** Carried load values in this column pertaining to "All Vehicles" are weighted averages, per trip and are derived from sub-totals in the column. The ton-miles listed for the three types of vehicles are the products of average carried load times total vehicle miles. However, the ton-miles value pertaining to all vehicles carrying a given commodity is the sum of ton-miles for the vehicle types, instead of the product of average carried load times vehicle miles.

****n.o.s.:** Not otherwise specified.

PART III

WEIGHT, LOAD AND DISTANCE CHARACTERISTICS

With regard to loadometer data the key to determining usable estimates of the weight of carried loads, or payloads, is to estimate the probable empty weight of loaded vehicles. The probable empty weight subtracted from the observed gross loaded weight gives as the remainder an estimated carried load.

A practical procedure for obtaining empty weight estimates is to classify and weigh a sample of empty vehicles according to type. For these purposes, motor freight vehicles are usually classified as follows:

TRUCKS—SINGLE UNIT	(CODE)
Panel and Pick-up	(2)
Other 2-Axle	(2)
—Single rear tire	(2)
—Dual rear tire	(2)
3-Axle Trucks	(3)
COMBINATION VEHICLES	
Tractor-Truck Semitrailers	
—3-axle	(2-S1)
—4-axle	(2-S2 or 3-S1)
—5-axle or more	(3-S2 or 2-S3, etc.)
Truck-Trailers	
—3-axle	(2-1)
—4-axle	(2-2 or 3-1)
—5-axle or more	(3-2 or 2-3, etc.)

As such, the most frequently observed load-carrying vehicles in Texas are single unit trucks with dual rear tires, and tractor-truck semitrailers of three and four axles. These are visual classifications, which make possible the manual classified counts of moving vehicles.

With respect to a specific type of vehicle—for example, 4-axle tractor-semitrailers — an estimated average carried load is derived by subtracting the average weight of a large number of empty vehicles from the average weight of a large number of loaded vehicles.[1] The estimated total of ton-miles pertaining to this type of vehicle is then determined by multiplying this average carried load, expressed in tons, by the estimated total annual vehicle miles attributed to loaded combinations of this type. The miles traveled by loaded vehicles are calculated by multiplying estimated total mileage of the vehicle type times an estimated percent of loaded mileage.

The above procedures, of course, are subject to a number of errors of estimate. In computing ton-miles, for instance, an average is subtracted from an average and the remainder is multiplied by the product of an estimated total times an estimated percent. By comparison, measures of tonnage and ton-miles for the other modes of freight transport are considerably more precise. For example, estimates of railroad ton-miles for a given year can be based on the Interstate Commerce Commission's comprehensive and systematic one percent waybill sample. Each waybill identifies the commodity being hauled, gives its shipping weight, origin, destination, etc. Actual short-line miles and ton-miles can be computed for every trip represented in a sample, and sample statistics can readily be expanded to represent the universe of rail freight shipments.[2]

Due to the multiform nature of motor trucking it appears unlikely that simple and inexpensive procedures can be devised that would produce truly comparable data. A sig-

---

[1]For estimates of carried loads on a regional and national basis the Bureau of Public Roads modifies this procedure. Carried load is computed separately for loaded vehicles for which empty weights are known, which occurs principally when empty weight is stenciled on the vehicles for easy reference or when the exact empty weight is known by the drivers. These "known" carried load values, when combined with data for the "unknown" group, result generally in smaller over-all averages for a vehicle type which are believed to be more accurate. See **Public Roads**, volume 23, number 9, page 240.

[2]For a complete description see "Waybill Statistics, Their History and Uses," Statement No. 543, Bureau of Transport Economics and Statistics, Interstate Commerce Commission.

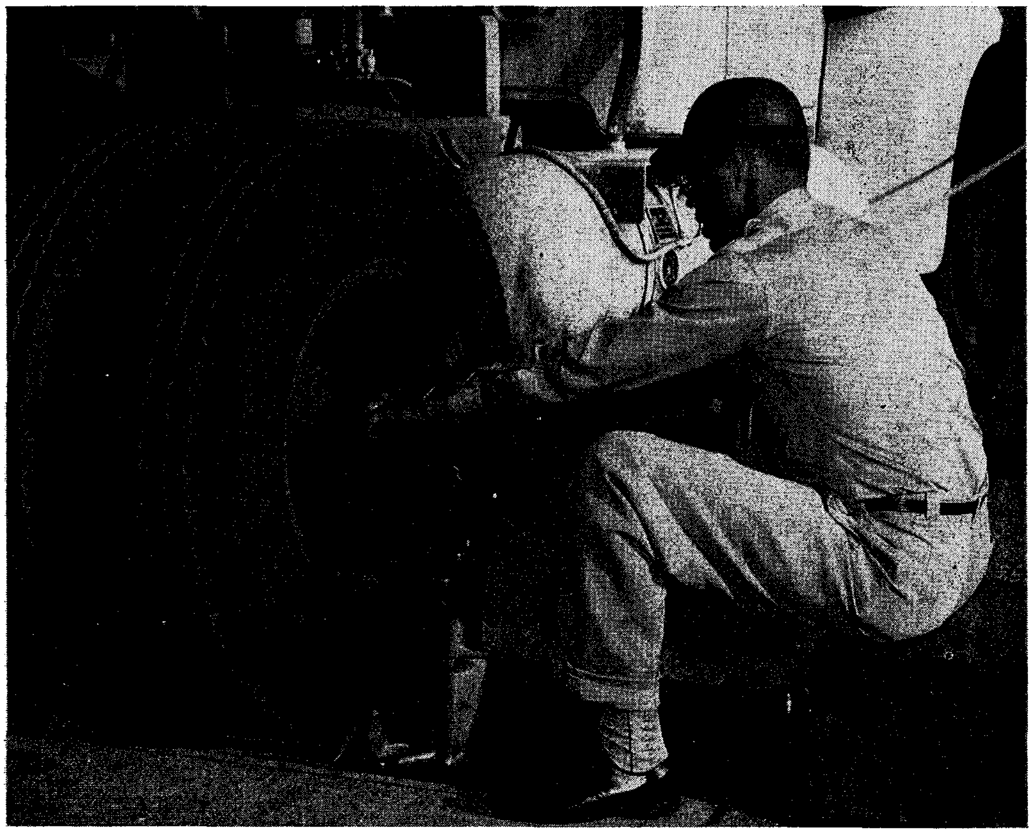


Figure 11 — Close-up of weighing operation. Wheel load is doubled to obtain axle load.

nificant detriment to comparability is the fact that most motor freight tonnage and mileage statistics are collected on the basis of the frequency of occurence of various vehicle classes in the traffic stream rather than on a trip or waybill basis. With loadometer data, however, it is possible to study motor trucking on a trip basis and to investigate more detailed classifications of vehicles. Those possibilities have formed the elements of our approach in this study.

A. VEHICLE EMPTY WEIGHT CLASSIFICATIONS

When the empty weights of a number of vehicles belonging to a given axle grouping are compared it is evident that a wide range of weights is represented, as indicated in the following table.

Since these low and high ranges within axle types are separated by as much as 20,000 pounds it is obvious that only the most general classifi-

TABLE 9

WEIGHT RANGES OF EMPTY VEHICLES

Type of Vehicle	Number	Average of Ten Lowest	Average of Ten Highest	Average of All
		(Lbs.)	(Lbs.)	(Lbs.)
2-Axle Trucks, 1 1/2 Ton and Over	1,081	4,370	17,090	8,210
3-Axle Tractor-Semitrailers	420	9,280	29,890	16,730
4-Axle Tractor-Semitrailers	675	14,800	34,220	22,300

Source: Based on a 4-months loadometer sample of private-use, gasoline-fuel vehicles operating over main rural roads in Texas.

cation of carried loads is appropriate if the "Average of All" empty weights are used. However, a general classification — such as, "average carried load of 4-axle tractor-semitrailers"— is of little use in a study of the tons and ton-miles of specific commodities hauled by motor trucks. It is not unusual for a "loaded" freight vehicle to have a gross weight that is less than the "average empty weight" of its vehicle axle-type.

It seems appropriate therefore to attempt a detailed breakdown of these broad vehicle axle-type into smaller and more homogeneous groups, with the hope that the probable empty weight of a loaded vehicle can eventually be estimated within reasonable limits of accuracy. This "probable empty weight" is not itself the main objective, but it is a prerequisite to practical estimates of carried loads. The gross weight and length of haul pertaining to loaded vehicles may be **measured** for every item in a sample; but the probable empty weight of a loaded vehicle must usually be **estimated.** We are concerned therefore with methods of obtaining better estimates of empty weight.

Vehicle Body Types

A primary classification made possible by our loadometer data is vehicle body type. The eight body types identified in this study are listed in Figure 12 and the average empty weight of each type is shown for each of four axle groupings.

These body types as given need little additional explanation. "Covered" units are of permanent, box-like, construction. A tarpaulin protecting the payload of an "open-top" vehicle would not change the body classification. The "auto carrier" body type is confined almost entirely to 3-axle tractor-semitrailers. The "special" body classification is a catch-all made necessary by the considerable variety of occasional body constructions observed. It is, accordingly, the least homogeneous of the various types with respect to empty weights and carried loads.

From Figure 12 it is evident that the body types bear a generally consistent interrelation. Types (1) to (7) have the same position with respect to empty weight in both the 3- and 4-axle combinations, and types (4) to (7) have the same position in all groupings shown. According to the observed averages, the body types appear to be discrete variables. A tentative conclusion, therefore, is that they can be of use in dividing an axle group into six to eight sub-classes.

Manufacturers' Rated Capacity

Another simple classification obtained from loadometer records is the manufacturers' rated capacity of vehicles. This rating is given in ton and half-ton units and is supposed to define load-carrying or load-pulling potential. It is sometimes referred to as an "unrealistic" vehicle classification because of the fact that actual load capacities of vehicles usually exceed the rated capacities.[3]

Rated capacities are far from unrealistic, however, as bench marks of central tendencies in vehicle weights. Figure 13 illustrates the consistent influence of rated capacity of prime mover on the average empty weight of vehicles grouped according to axle type. From Table 18 it is seen that this relationship holds true also for average gross weights and, of course, for average carried loads, provided samples are of sufficient size.

The rated load capacties of the trailers of combination vehicles were not used in deriving average empty weights for two reasons. First, it was determined by inspection of the data that the relationship of trailer capacity and empty weight of truck combinations do not appear to be significant. Secondly there appeared to be greater probability of errors of observation regarding trailer capacities than for truck and tractor capacities. The method of obtaining rated capacity of prime movers involved little guesswork. The loadometer party chief, having a ready reference of the

[3]See Table 18.

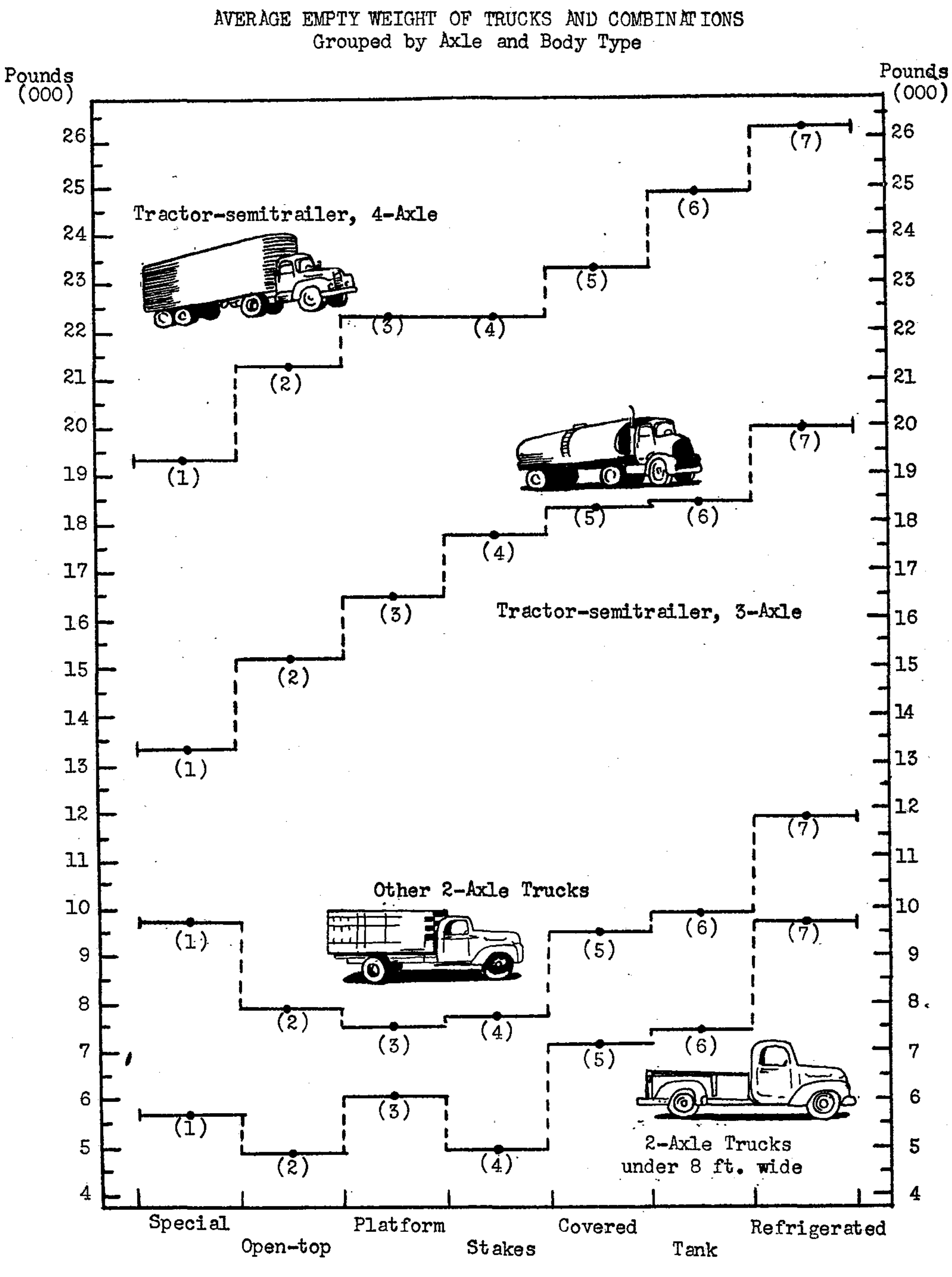


Figure 12 — Relation of body type and average empty weight. Source: Derived from Table 19.

rated capacities of various makes and models of trucks, had merely to observe the model insignia on the front and side of the vehicle being weighed to determine manufacturers' rated capacity. The determination of load capacities of trailers, however, was necessarily less precise.

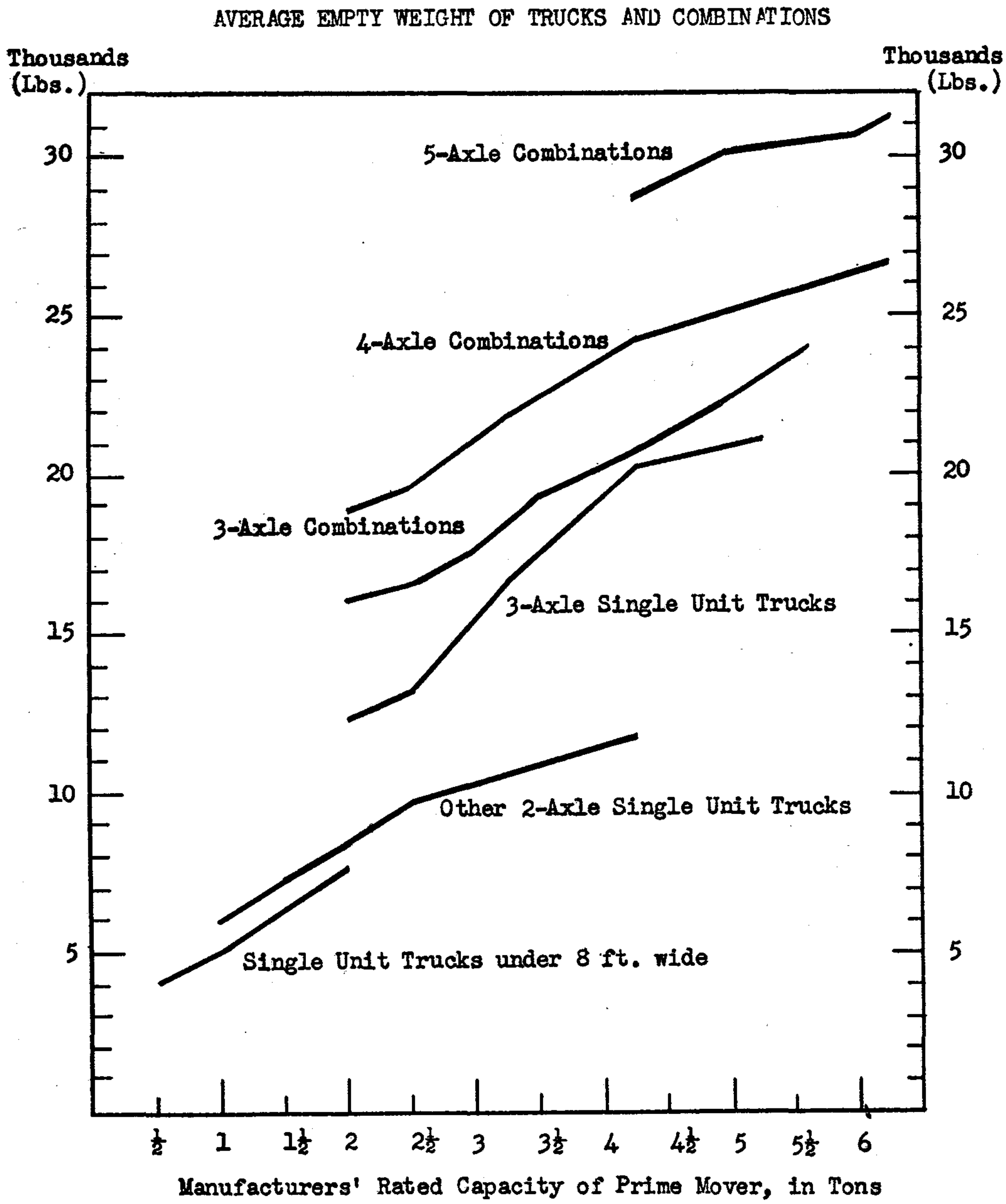


Figure 13 — Relation of manufacturers' rated capacity to average empty weight of vehicles grouped by axle type. Source: Table 18.

Types of Fuel

Another principle of classification experimented with in deriving empty weight averages was the type of fuel being used. It was determined that diesel-powered units of a given axle type definitely weigh more than gasoline units. However, when vehicles are segregated according to manufacturers' rated capacity the diesel units which have special weight significance are automatically grouped into the higher capacity classes. Gasoline-powered vehicles rarely exceeded 5 tons rated capacity while diesel units were rarely under that class. At the common meeting ground—5 ton rated capacity—there was but little distinction between the empty weights of gasoline and diesel vehicles.

Vehicles using butane fuel were found to be entirely comparable with equally rated gasoline powered units in regard to empty weight, except for trucks and combinations having tank bodies. Tank vehicles using butane fuel consistently averaged from four to five thousand pounds more when empty than did similar gasoline powered units. It is assumed that most tank vehicles using butane fuel were also equipped to haul butane gas under pressure, which would account for their heavier empty weight. The empty weight distinctions based on diesel or butane fuel which were judged of importance are included with the axle, body, and capacity listings in Table 19.

Private and Hired Status

Data regarding empty vehicles collected during a five months period were first sorted according to the three fuel types, and gasoline-fuel vehicles were then sub-divided into classes according to private or hired use. The four groups of empty vehicles — diesel, butane, gasoline hired, gasoline private—were each then arranged into sub-groups by axle and body types and rated capacity.

Thus organized, the data did not reflect the significant differences in empty weights between private and hired vehicles that can be observed when fuel, body, and capacity classifications are omitted. Private and hired empty weight averages differed some, but when there were 20 or more items in two comparable means the difference was usually a matter of 1 to 3 percent of the larger value. The for-hire vehicle averages were generally larger, but there were numerous exceptions. Since the most frequent result of separating the data according to private or hired status was to reduce an axle-body-capacity sample to an undesirable size, these distinctions were usually omitted in determining average empty weights. Some of the weight and load data of Table 19, however, do reflect this classification.

Influence of Vehicle Size

A preliminary investigation was also made of the effect that wheelbase, height, and width might have on the variations in empty weight within an axle-body-capacity group. The immediate difficulty here was obtaining sub-samples of sufficient size. When the 6900 empty vehicles were grouped by axle-body-capacity types, relatively few of the classes were of a size which would justify further analysis with respect to weight.

A few classes were selected for study, however, and scatter diagrams were constructed plotting wheelbase or height in feet against empty weight in pounds. It was soon apparent that such relationships were complex and that the system of cross classification and averages, which defined consistent relationships according to body and capacity classes, would be unsatisfactory in generalizing the influence of wheelbase and height on vehicle empty weight. Low wheelbase values were associated almost indiscriminately with high and low empty weights and the same was true of vehicle height. Only slight improvement was noted when combinations of wheelbase and height were charted in relation to empty weight.

Some of the factors involved in these difficulties can be identified on a rational basis. The cab-over-engine vehicles, which were not identified in the loadometer data, might be expected to have shorter wheelbase lengths and greater height in relation to empty weight than the more conventional vehicles. The proportion of light and heavy metals and lumber used in the construction of trucks and trailers could be of greater significance than differences in vehicle size. Wheelbase length in any case is only generally indicative of over-all vehicle length, which was not measured; and the height of a given vehicle when loaded might well differ from the height when empty if the vehicle body were of the platform, stake, or open-top type.

The only significant differences in vehicle width were those related to single unit trucks. Practically all heavy vehicles are standardized at the eight-foot width, but many of the lighter trucks were coded on the loadometer cards at widths of six and seven feet. This proved a useful subclassification of single unit trucks inasmuch as the panel and pick-up classification and the single-rear-tire and dual-rear-tire distinctions were not made on the punched cards. Various tables and charts in this report make use of the classification of single unit trucks by vehicle width. (A workable approximation of the dual-rear-tire truck classification is obtained by grouping 2-axle trucks into the rated capacity class of "1½ ton and over.")

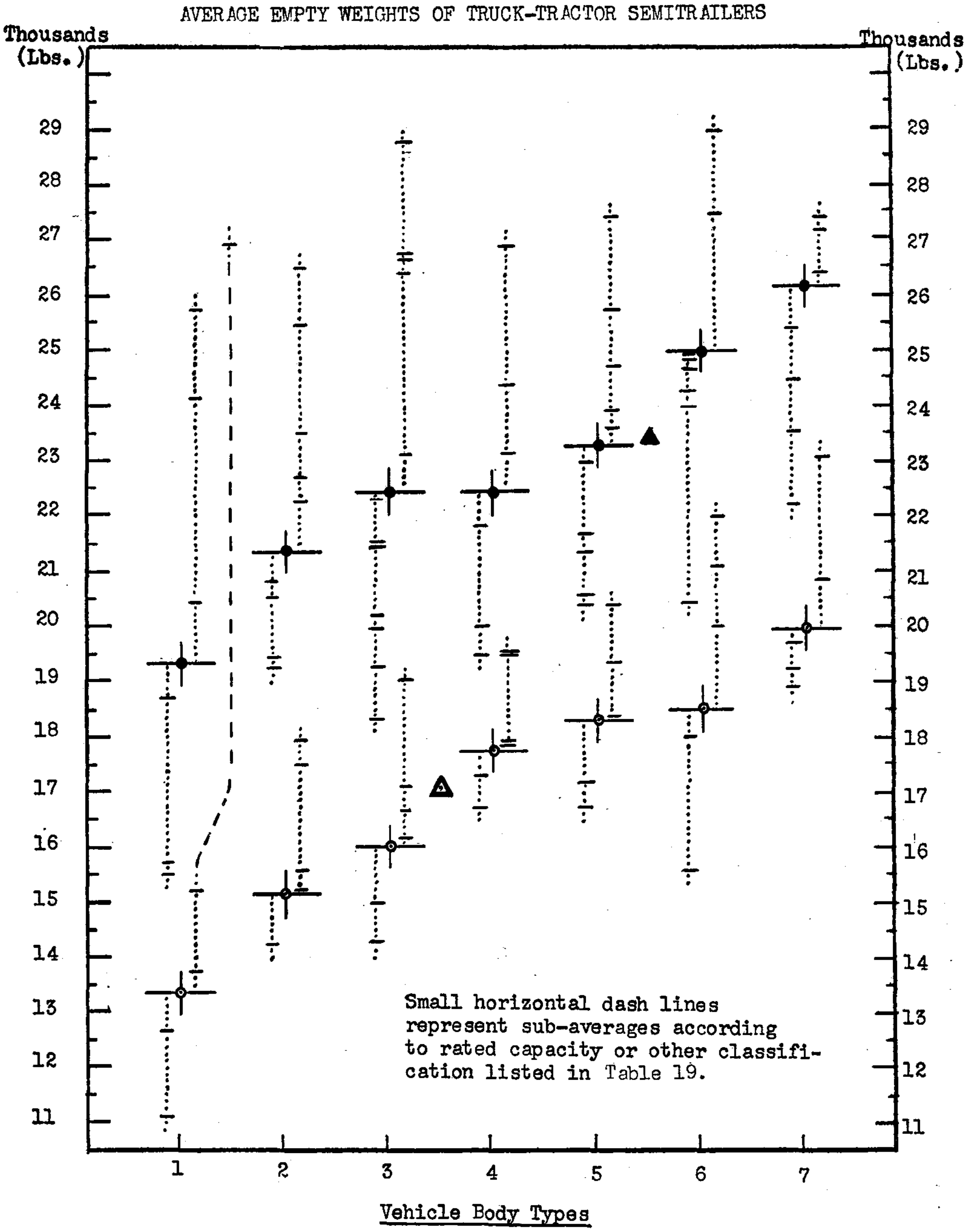
Empty Weights Used In This Study

The empty weights we have elected to use are in most cases those derived by grouping vehicles according to rated capacity within body type, and body type within axle type. These averages, along with occasional variations based on fuel type or operating classification, are given in Table 19. In every case the number of items included in a mean is given. When there were no comparable empty weight observations, or when the number of observations was deemed insufficient, an estimate of probable empty weight was made. These empty weight and carried load estimates, found in the last two columns of the table, were based on the central tendencies shown for similar and related classifications.

More than one hundred empty weight averages associated with 3- and 4-axle tractor-semitrailers are

Figure 14 — Measuring wheel base between axles 2 and 3.

AVERAGE EMPTY WEIGHTS OF TRUCK-TRACTOR SEMITRAILERS



1- Special
2- Open-top
3- Platform
4- Stakes
5- Covered
6- Tank
7- Refrigerated

4-Axle Tractor-Semitrailers:
◆ - Avg. Empty Weight of Body Type
▲ - Avg. Empty Weight, all Vehicles

3-Axle Tractor Semitrailers:
◇ - Avg. Empty Weight of Body Type
△ - Avg. Empty Weight, all Vehicles

Figure 15 — Relation of body type to average empty weight of truck-tractor semi-trailer vehicles.

summarized in graphic form in Figure 15. A stair-step arrangement similar to that of Figure 12 is again used for body type means. In addition, a number of sub-averages associated with each body type group are shown, using short horizontal dash marks which are connected by vertical dot-lines to the parent mean. In this way the approximate ranges and numerous overlappings may be visualized. The two values represented by triangle symbols are the axle type averages involved. These two means, under usual procedures, would be used to approximate the average empty weight of all the 3750 combination vehicles represented on the chart. The quite realistic rated capacity and body type bench marks have thus afforded a basic approach to the problem of breaking down a broad axle type generalization into a number of consistent and useful components.

Conclusion Regarding Average Empty Weights

It was concluded that for the data now on hand average empty weights of more precision than the axle-body-capacity values listed in Table 19 must await a comprehensive multiple correlation analysis which would indicate the degree of interaction between various factors. With empty weight as the dependent variable and a selection of appropriate independent variables, such as wheelbase, height, width, axle spacing A-B, fuel type, operating classification, and trailer capacity, the axle-body-capacity groups could be explored further with the object of obtaining better estimates of the probable empty weights of loaded vehicles. To carry our cross classification and averages much further a larger sample should be obtained, and in any case the procedure would soon become quite cumbersome. Empirical formulas might be developed from multiple correlation analysis which could be applied to the loaded vehicles in an axle-body-capacity group. Based on such independent factors as have been mentioned a probable empty weight could thus be obtained for each and every loaded vehicle. Using punched cards and an electronic computer the complexity of the relationships involved would perhaps not prove insurmountable.

On the other hand, the desired greater precision might be obtained in other ways. Loadometer field procedures might be revised in some respects. For instance, the actual make

TABLE 10

Test of Independence

COMPARISON OF OBSERVED AND THEORETICAL FREQUENCIES OF LOADED AND EMPTY 3-AXLE TRACTOR-SEMITRAILERS CLASSIFIED ACCORDING TO EMPTY WEIGHT AVERAGE

(1) Class Limits, Empty Weight Averages	(2) Vehicles in Empty Sample: Observed	(3) Vehicles in Empty Sample: Theoretical	(4) $\frac{(f_o - f)^2}{f}$	(5) Vehicles in Loaded Sample: Observed	(6) Vehicles in Loaded Sample: Theoretical	(7) $\frac{(f_o' - f')^2}{f'}$	(8) Total Both Samples
(Thousands Lbs.)	f_o	f		f_o'	f'		
Under 14.0	40	41	0.02	70	69	0.01	110
14.0 — 14.9	168	156	0.92	249	261	0.55	417
15.0 — 15.4	26	24	0.17	38	40	0.10	64
15.5 — 15.9	62	53	1.53	79	88	0.92	141
16.0 — 16.4	39	28	4.32	35	46	2.63	74
16.5 — 16.9	175	172	0.05	287	290	0.03	462
17.0 — 17.4	355	314	5.35	488	529	3.18	843
17.5 — 17.9	77	65	2.22	97	109	1.32	174
18.0 — 18.9	139	140	0.01	237	236	0.00	376
19.0 — 19.9	101	135	8.56	261	227	5.09	362
20.0 — 20.9	80	132	20.48	273	221	12.24	353
21.0 — 21.9	20	20	0.00	33	33	0.00	53
22.0 — Over	13	15	0.27	28	26	0.15	41
Total	1295	1295	43.90	2175	2175	26.22	3470

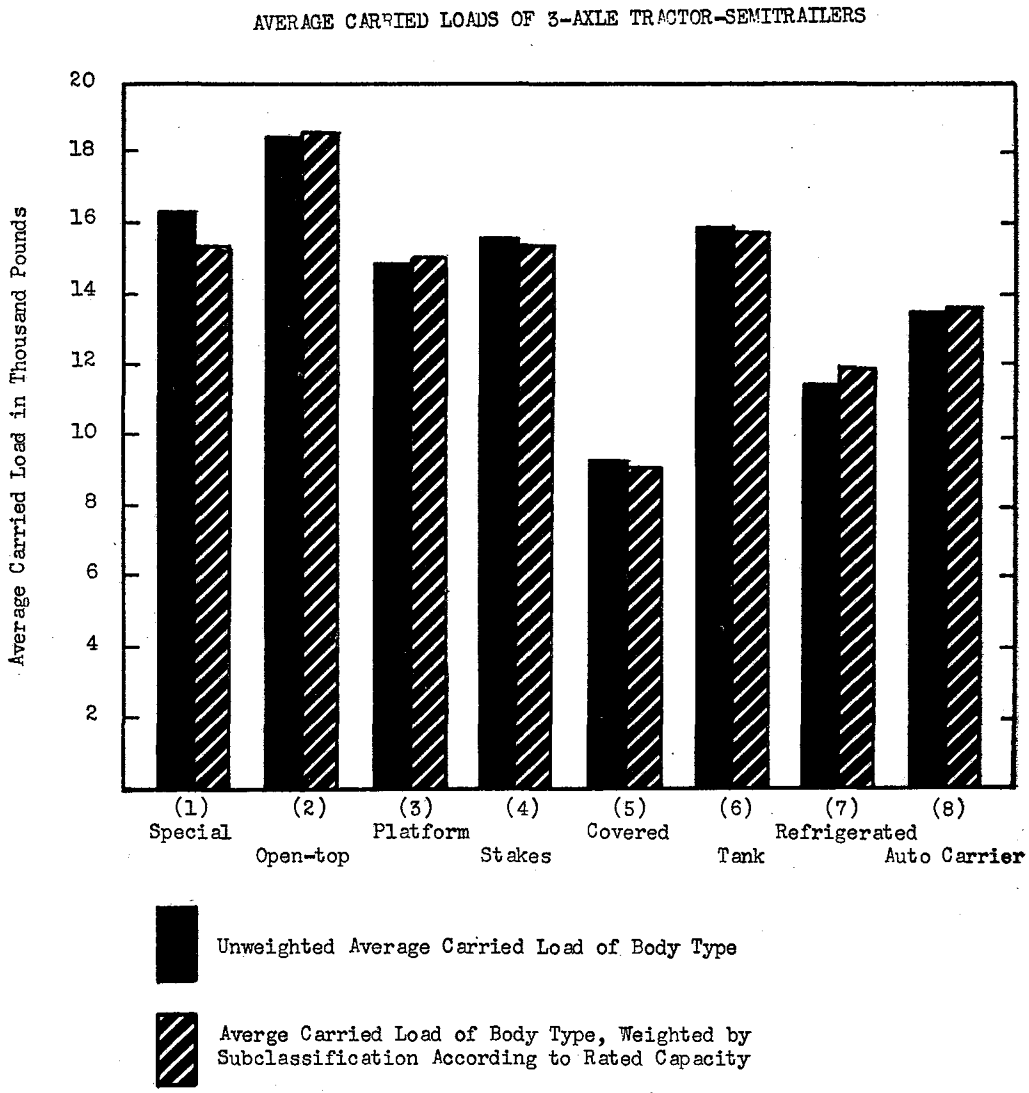


Figure 16 — Relation of body type and average carried load of three-axle tractor-semitrailers, weighted by rated capacities and unweighted.

and model of prime mover and trailer might be noted, and body descriptions somewhat expanded in order to allow more homogeneous groupings. The GVW (gross vehicle weight) rating of vehicles could be added as a loadometer item. Also, in at least one state it has been required that the empty weight of a truck or combination be printed on door or hood, and thus the "usual" empty weight is known to a roadside interviewer. We employ the word "usual" here because the observed empty weight of a vehicle will vary at different times due to the amount of fuel in the tank, weight of spare tires and other miscellaneous equipment, number of passengers if any, and errors of observation. These and other considerations set rational limits to the accuracy of estimates of probable empty weight.

B. THE DETERMINATION OF CARRIED LOADS

Estimates of the probable empty weight of a classification of loaded vehicles are necessarily based on an assumption. It is assumed that the average weight of a sample of empty vehicles is representative of the average empty weight of a sample of loaded vehicles of the same type.

Having determined for every vehicle axle type a number of sub-classes which are homogenous with respect to empty weight, it is now possible to test the validity of this assumption when it is made (as is customary) in reference to a broad axle group. The data in Tables 18 and 19 show a linear progression of these sub-classes according to average empty weight. By comparing the frequency of occurence of the sub-classes in the empty sample with their occurence in the loaded sample we gain some knowledge of the representativeness of the empty sample.

This comparison can be made in a general way by referring to the two percentage columns of Table 18. These columns, relating to 3-axle tractor-semitrailers, are reproduced below:

3-AXLE TRACTOR-SEMITRAILERS

Rated Capacity	Percent of Empty Sample	Percent of Loaded Sample
1-1½ ton	0.7	0.5
2 ton	51.4	43.9
2½ ton	9.6	8.8
3 ton	20.5	20.1
3½ ton	5.3	7.1
4-4½ ton	12.0	18.0
5 ton	0.5	1.1
6 ton	0.1	0.2

It is apparent that the four lighter weight classifications are relatively more numerous, and the four heavier classes less numerous in the empty sample than in the loaded sample. Vehicles of 3-ton or less capacity comprise 82.2 percent of the empty sample but only 73.3 percent of the loaded group. Based on this comparison alone, it appears that the empty sample is not representative of the loaded sample. Thus, when used in regard to a vehicle axle-type, the basic assumption upon which carried load estimates are based appears to be questionable.

This comparison is not entirely satisfactory, however. Body type variations have not been taken into account, and even if they were listed in a similar way there is no indication of the significance of the differences observed. The difference between the 82.2 and 73.3 relative frequencies may be due merely to the play of chance.

A Chi-Square Test

A better comparison can be made by employing a statistical instrument known as the chi-square test. This is a measure of discrepancies between observed and theoretical frequencies, represented by the symbol X^2. The chi-square test is appropriate here since in this study we are interested primarily in determining the significant relationships that exist, rather than the degree of correlation.

Our problem is to determine whether the two principles of classification are independent of one another. Was the empty or loaded status of random 3-axle tractor-semitrailers related to their average empty weight? Expressed in other words, should the fact of the relatively more frequent empty status of the lighter vehicles be regarded as a normal random expectation? If so, it is not considered to be of statistical significance. On the other hand, if the more frequent empty status of certain vehicles should appear to be in part a function of relative vehicle weight, then the two variables are probably not independent. In dealing with this problem it is convenient to set up the hypothesis that the two principles of classification are not related, and then to test this assumed independence.

One of the conditions of the chi-square test is that none of the theoretical cell frequencies be less than 5. We cannot, therefore, use the exact body-capacity values of Table 19. Test conditions are met and an excessive number of classes avoided by grouping the empty weight means from that table into convenient size classes, as in column (1) of Table 10.

The combined total of columns (4) and (7) gives a chi-square value of 70.1 for the data relating to 3-axle tractor-semitrailers. The contingency table as organized above allows 12 degrees of freedom. Choosing an .01 level of significance and referring to a table of Selected Percentile Values of the Chi-Square Distribution[4], we find the relevent X^2 entry to be only 26.2. This means that only 1 time in 100 would chance bring about a chi-square value greater than 26.2 if empty-loaded status were in fact unrelated to empty weight. Since our X^2 of 70.1 is much greater than 26.2 we choose to reject the hypothesis that the two principles of classification are unrelated, rather than accept the idea that a very rare event has occurred. With regard to 3-axle tractor-semitrailers traveling over main rural roads in Texas during 1955, the data at hand indicate a significant relation between the probable or actual empty weight of such vehicles and their empty-loaded status. Similar investigations were made of other axle types, with the results summarized below.

For the three principal axle types considered these tests indicate that the empty weight of vehicles is likely to affect the incidence of empty trips. The assumed representativeness of empty samples would probably result in biased estimates of the loads carried by trucks and combinations operating in Texas. In most cases the bias would be in the direction of over-estimation of loads, since the predominance of lightweight units in empty samples results in under-estimation of the subtractive factor (probable empty weight) which is to be applied to loaded samples.

Differences in Carried Loads

The differences in average carried loads attributed to this bias appear of little significance for combination vehicles, if they are grouped by axle type alone. This is perhaps because the errors are compensating. The difference is more noticeable, however, for single unit trucks. These relationships are summarized in Table 12 which gives comparative loads for the principal axle types, obtained by four methods of estimation. In this table, unweighted averages derived from raw samples which were grouped by axle type alone are compared with weighted averages computed by using the body and capacity subclassifications.

While the differences resulting from the more detailed construction are not great, this method (Basis IV) is quite practical if loadometer samples are large. It provides a staightforward system of obtaining greater precision in carried loads. Moreover, the differences in loads shown in Table 12 gain increased significance when ton-miles are being calculated. If the differences represent errors, and the errors are multiplied by the estimated total miles traveled by their respective vehicle types, they become multiplied errors in ton-miles.

TABLE 11

SUMMARY OF RESULTS OF CHI-SQUARE TESTS

Vechicle Type	Total Number of Vehicles	Degrees of Freedom	Computed Chi-Square (X^2)	Value at 99th Percentile
2-Axle Trucks, 1½ Ton-up				
(300 lbs. interval)	4,820	16	238.3	32.0
3-Axle Tractor-Semitrailers				
(500 lbs. interval)	3,470	12	70.7*	26.2
4-Axle Tractor-Semitrailers				
(500 lbs. interval)	7,262	21	293.0	38.9
(1000 lbs. interval)	7,262	12	232.0	26.2

*More decimal places were used in these computations than in Table 10.

[4]Found in Frederick C. Mills, "Statistical Methods, Third Edition," Henry Holt and Company, New York, page 773, and in other standard references.

The real advantage in following a system of subclassification of axle types, however, is not the somewhat greater precision in aggregate estimates like those in Table 12, but rather the greater accuracy that can be expected of estimates pertaining to a single vehicle. Grouping vehicles by axle type alone may be sufficient when a carried load value is desired which would apply to all highway movement of all goods. If data regarding specific commodities or classes of commodities are needed, however, a system of subclassification appears quite necessary.

Figure 16 illustrates the benefit to be derived by applying additional principals of classification to a sample of 3-axle tractor-semitrailers. Separating the vehicles by body type before averaging them results in eight distinct carried load values. The weighted averages shown, based on rated capacity, differ only slightly from unweighted values. Here again, however, the real advantage lies in the distinct sub-classes of each body type that are created by using rated capacity, as shown in Table 19. The data presented in Figure 16 is based on Table 17, which lists similar information for 2-axle trucks and 4-axle combinations.

This illustration also affords an opportunity to compare the ranking of body types in empty weight with their ranking in carried loads. In Figures 12 and 15 the first seven body types were arranged according to their rank in average empty weight, from lowest to highest. They are listed in the same order in Figure 16. However, it is readily apparent that the stair-step simile no longer applies. The open-top body, which was next to lowest in empty weight, has the highest rank in average carried load, while the covered body type which ranks lowest in average carried load was among the three highest in average empty weight.

The low rank of the covered body type is of special significance since this is the most numerous of the types, accounting for 40.6 percent of the 3-axle tractor-semitrailer total. The weighted average carried load for this axle type is 12,690 pounds. If covered body vehicles are excluded, the average rises to 15,167 pounds, an increase of 19.5 percent.

TABLE 12

AVERAGE CARRIED LOADS OF TRUCKS AND COMBINATIONS COMPARED BY METHOD OF CALCULATION

Comparison	Trucks 2-Axle 1½ Ton-up	Tractor-Semitrailers 3-Axle (2-S1)	4-Axle (2-S2)
	(Lbs.)	(Lbs.)	(Lbs.)
Basis I			
Unweighted	5,697	13,084	23,638
Basis II			
Weighted only by Body Type	5,126	12,846	23,670
Basis III			
Weighted only by Rated Capacity	5,611	12,745	23,299
Basis IV			
Weighted by Rated Capacity within Body Type	5,227	12,690	23,498
Difference (I - IV)	470	394	140
Difference as percent of I	8.2	3.0	0.6

Basis I: Vehicles are grouped by axle type (as specified in the three column headings); average weight of empty vehicles is subtracted from average weight of loaded vehicles. The remainder is average carried load.

Basis II: Vehicles are grouped by body type within axle type and an average carried load is derived, as above, for each body type. A weighted average for the entire axle type is then constructed, using as weights the number of loaded trips and the average loads observed for each body group.

Basis III: Same as II, substituting rated capacity for body type.

Basis IV: Vehicles are grouped by rated capacity within body type, and each sub-group is used in constructing an over-all weighted average.

Source: Derived from Tables 18 and 19.

C. DISTANCE RELATIONSHIPS

The distance characteristics of the trips in the loadometer sample were not investigated in great detail. As has been mentioned, it is possible to measure the intercity miles of haul of every trip, since origin and destination are known. In the present case, however, mileage data punched into the loadometer cards by the Texas Highway Department were in the form of mileage block identifications. That is, the trips were grouped into classes according to distance, and each loadometer card was then given a code representing the appropriate mileage block.

When it was desired to estimate trip mileage in this study, an arbitrary mid-point for each mileage block was used as a multiplication factor. The mileage classes and mid-point values are as follows:

Code	Mileage Block	Mid-point
1.	1-4 Miles	3
2.	5-9 Miles	7
3.	10-24 Miles	17
4.	25-49 Miles	37
5.	59-99 Miles	75
6.	100-249 Miles	175
7.	250-499 Miles	375

The 500 to 999 mileage block and the open-end class reserved for trips over 1000 miles were not represented by arbitrary values. Instead, the cards pertaining to trips over 500 miles were separated and approximate mileages determined for each trip. These values were then averaged for the two mileage classes, with empty and loaded trips computed separately. The result of this investigation is given below:

Code	Mileage Block	Average Miles per Trip	
		Empty	Loaded
8.	500-999 Miles	646	676
9.	Over 1000 Miles	1477	1686

As has been mentioned, the use of mileage information derived from loadometer data requires special considerations. It is necessary to either consider all distance generalizations as applying only to the trips included in the sample while recognizing that a bias exists, or else to make some adjustment for the bias that arises when trip lengths are observed at widely separated stations throughout the State. An "average carried load over main rural roads" for a vehicle classification, derived from loadometer data, can be considered fairly representative of the vehicles of that class which were not sampled. This cannot be said, however, of an "average length of haul" derived from loadometer data.

We are indebted to the Highway Transport Research Branch, Bureau of Public Roads, for the following explanation of this bias and a suggested adjustment of it.[5]

"The sampling of trips is not generally a part of our plan.

Some of the data collected in the original loadometer survey gave the lengths of trips as these were collected at the various stations. When these data were summarized they appeared to indicate that the average truck trip amounted to somewhere between 100 and 120 miles. At the same time the road-use surveys, which included all long and short trips, reported in a year by a selected sample of drivers, indicated that when all short trips were included (which were generally missed in the loadometer surveys) the actual trip length was much smaller than was indicated by the loadometer data or possibly between 15 and 20 miles. A study of this problem indicated that the probability of a trip being sampled varies in direct proportion to its length and that in order to get the true length of such trips, when only sampled at stations spaced along the highway, adjustments must be made to remove this bias.

A simple illustration will demonstrate the necessity of an adjustment such as described above. Consider a 10-mile stretch of road on which a

[5]Contained in a letter dated June 14, 1956, received in response to our inquiry, from S. T. Hitchcock, Acting Chief, Highway Transport Research Branch, Bureau of Public Roads.

traffic recording station shows two trips as follows:

Number of trips	Length of trips
1	10 miles
1	2 miles

The field sheet would show two trips and the average at the station would be six miles. But this probably is not the correct answer. Assuming uniformity over the 10-mile section, where one two-mile trip left off another would begin. Therefore the average trip length would be as follows:

Number of trips	Miles per trip	Total miles
1	10	10
5*	2	10
—		—
Total 6		20

Average=3.33 miles

*Only one of which could be counted at the station.

To accomplish this result a generalized procedure can be developed consisting of the following steps: (1) divide the number of trips by their corresponding trip lengths within the State, (2) divide the number of trips by the total obtained in step (1). Using the above set of data an application of the method is as follows:

Step 1	1 divided by 10	=0.10
	1 divided by 2	=0.50
	—	——
Total	2	0.60

Step 2 2 divided by 0.60=3.33 miles average trip length.

It should be noted that in analyzing the data for a single State, the portion of a trip outside of the State, in which the survey was made, does not affect the chance of the trip being sampled, and should be ignored in the calculation."

Following the general procedure outlined above, average trip lengths (applying only to trips in the loadometer sample) have been computed on an adjusted basis for comparison with unadjusted averages. Since it was not feasible to separate and discard the out-of-state portion of trips, as is suggested above, the averages given below are somewhat higher than would otherwise be the case.

AVERAGE LENGTH OF INTERCITY HAUL
Loaded and Empty Trucks and Combinations

Description	Single Unit Trucks Under 1½ Ton	Single Unit Trucks 1½ Ton-Over	Combination Vehicle
	(Miles)	(Miles)	(Miles)
Loaded Vehicles			
Unadjusted	99	112	409
Adjusted	22	24	114
Empty Vehicles			
Unadjusted	71	98	251
Adjusted	15	19	67

Source: Based on observations of 18,882 vehicle trips made at 21 Texas loadometer stations during 1955. Trip distribution, from Tables 13 and 14; mileage block mid-points were used, as given above in this section.

The adjusted averages shown here would probably compare with the "between 15 and 20 miles" average observed in the study conducted by the Bureau of Public Roads if empty and loaded data were combined, if the out-of-state portion of trips were eliminated, and if the grand average were weighted by the number of vehicles of the three classes which are operated in Texas.[6] It might be expected on rational grounds, however, that the average length of haul observed in Texas would somewhat exceed the national average (more distance between typical origins and destinations). A marked difference in empty and loaded trip lengths is apparent regardless of the basis of estimate.

D. COMPUTING TRIP CHARACTERISTICS

The trip characteristics of loaded and empty vehicles at various mileage blocks are summarized in Tables 13 and 14. The carried load values given here were used in deriving the estimates presented in the industry and commodity sections. These values were computed on a different basis than that used in Tables 18 and 19 (see Basis IV of Table 12). In this case, empty weight values pertaining

[6]A more recent study by the Bureau gives an average trip length (one-way), for all freight-carrying vehicles, of 28 miles. See **Public Roads**, Volume 29, Number 5, page 103, December, 1956.

to the axle-body-capacity groups in Table 19 with some modification, were punched into the loadometer cards. Each card pertaining to a loaded vehicle thus contained a gross weight and an estimated empty weight. To get an average load for, say, combination vehicles making trips of 25 to 49 miles, the cards were sorted accordingly and grand totals obtained of gross load and estimated empty weight. Subtracting the latter from the former and dividing by the number of trips gave an average carried load of 9.4 tons for such vehicles. In Table 13 this is expressed as "Average Load per Mile" and given to three decimal places. Multiplying the given value of 9.363 tons times the total vehicle miles traveled by combinations making these 25 to 49 mile trips gives a ton-mile estimate of 125,400.

Using the above procedure it was possible to make use of the axle-body-capacity empty weight averages for every grouping of vehicles, whether by distance, commodity, or industry. The empty weight values punched into the cards were only estimated averages and when groups are small in number the carried load values are less dependable. Still the procedure is believed to be a practical first approach to the problem of using estimates of the probable empty weight of loaded vehicles.

The carried load average given in Table 13 for a vehicle class at all trip distances (such as the 10.387 tons shown for combination vehicles) is a weighted average of the mileage block values. The weights used, however, are the vehicle miles rather than the

TABLE 13

TRIP CHARACTERISTICS OF 12,008 LOADED VEHICLES BY VEHICLE TYPE AT STATED MILEAGE BLOCKS RECORDED AT 21 TEXAS LOADOMETER STATIONS DURING 1955

VEHICLE TYPE And TRIP LENGTH	Number of Trips	Total Vehicle Miles	Percent Vehicle Miles	Average Load per Mile (Tons)	Total Ton-Miles	Percent of Ton-Miles
SINGLE UNIT TRUCKS						
UNDER 1½ TON CAPACITY	608	60,339	100.00	0.753	45,444	100.00
Under 5 miles	11	33	0.05	0.544	18	0.04
5 to 9 miles	72	504	0.84	0.463	234	0.51
10 to 24 miles	123	2,091	3.47	0.519	1,085	2.39
25 to 49 miles	167	6,179	10.24	0.726	4,489	9.88
50 to 99 miles	120	9,000	14.92	0.725	6,520	14.35
100 to 249 miles	74	12,950	21.46	0.773	10,010	22.03
250 to 499 miles	24	9,000	14.92	0.722	6,497	14.29
500 to 999 miles	8	5,408	8.96	0.466	2,521	5.55
Over 999 miles	9	15,174	25.15	0.927	14,070	30.96
SINGLE UNIT TRUCKS						
OVER 1 TON CAPACITY	3,768	421,112	100.00	3.187	1,341,925	100.00
Under 5 miles	79	237	0.06	2.372	562	0.04
5 to 9 miles	349	2,443	0.58	3.298	8,058	0.60
10 to 24 miles	647	10,999	2.61	2.682	29,497	2.20
25 to 49 miles	977	36,149	8.59	2.560	92,530	6.90
50 to 99 miles	794	59,550	14.15	2.680	159,558	11.89
100 to 249 miles	579	101,325	24.07	3.238	328,048	24.45
250 to 499 miles	229	85,875	20.40	3.496	300,233	22.37
500 to 999 miles	67	45,292	10.76	4.231	191,640	14.28
Over 999 miles	47	79,242	18.83	2.925	231,799	17.27
COMBINATION						
VEHICLES	7,632	3,118,902	100.00	10.387	32,396,142	100.00
Under 5 miles	22	66	0.00	14.256	941	0.00
5 to 9 miles	41	287	0.01	9.478	2,720	0.01
10 to 24 miles	163	2,771	0.09	8.973	24,864	0.08
25 to 49 miles	362	13,394	0.43	9.363	125,405	0.39
50 to 99 miles	977	73,275	2.36	10.411	762,855	2.35
100 to 249 miles	2,543	445,025	14.31	9.965	4,434,728	13.69
250 to 499 miles	1,950	731,250	23.52	10.135	7,411,321	22.88
500 to 999 miles	793	536,068	17.24	10.761	5,768,815	17.80
Over 999 miles	781	1,316,766	42.22	10.529	13,864,493	42.80

TABLE 14

TRIP CHARACTERISTICS OF 6874 EMPTY VEHICLES BY VEHICLE TYPE AT STATED MILEAGE BLOCKS RECORDED AT 21 TEXAS LOADOMETER STATIONS DURING 1955

VEHICLE TYPE And TRIP LENGTH	Number of Trips	Total Vehicle Miles	Percent Vehicle Miles	Average Empty Weight	Trip Ratio Empty to Loaded
				(lbs.)	
SINGLE UNIT TRUCKS					
UNDER 1½ TON CAPACITY	879	62,801	100.00	4,317	1.45
Under 5 miles	48	144	0.23	4,162	4.36
5 to 9 miles	155	1,085	1.73	4,091	2.15
10 to 24 miles	226	3,842	6.12	4,225	1.84
25 to 49 miles	217	8,029	12.78	4,335	1.30
50 to 99 miles	118	8,850	14.09	4,513	0.98
100 to 249 miles	69	12,075	19.23	4,633	0.93
250 to 499 miles	28	10,500	16.72	4,532	1.17
500 to 999 miles	10	6,460	10.29	4,610	1.25
Over 999 miles	8	11,816	18.82	4,988	0.89
SINGLE UNIT TRUCKS					
OVER 1 TON CAPACITY	2,007	196,895	100.00	8,502	0.53
Under 5 miles	56	168	0.09	7,527	0.71
5 to 9 miles	326	2,282	1.16	8,089	0.93
10 to 24 miles	366	6,222	3.16	8,348	0.57
25 to 49 miles	480	17,760	9.02	8,675	0.49
50 to 99 miles	308	23,100	11.73	8,631	0.39
100 to 249 miles	308	53,900	27.37	8,647	0.53
250 to 499 miles	105	39,375	20.00	9,166	0.46
500 to 999 miles	38	24,548	12.47	8,071	0.57
Over 999 miles	20	29,540	15.00	9,705	0.43
COMBINATION					
VEHICLES	3,988	999,274	100.00	21,431	0.52
Under 5 miles	29	87	0.01	18,693	1.32
5 to 9 miles	74	518	0.05	19,197	1.80
10 to 24 miles	169	2,873	0.29	20,067	1.04
25 to 49 miles	336	12,432	1.24	20,476	0.93
50 to 99 miles	719	53,925	5.40	22,475	0.74
100 to 249 miles	1,419	248,325	24.85	21,470	0.56
250 to 499 miles	849	318,375	31.86	21,430	0.44
500 to 999 miles	262	169,252	16.94	20,892	0.33
Over 999 miles	131	193,487	19.36	22,448	0.17

number of trips in each category. Every entry in the Average Load per Mile column is therefore a value which may be multiplied by vehicle miles to obtain ton-miles. The 32-million ton-miles total for all trips by combination vehicles, obtained thus by multiplication, is the same value resulting from summation of the nine mileage block sub-totals, if sufficient decimal places are used in the carried load figure.

The last column in Table 13 shows the influence of distance in the ton-mile concept. The 781 combinations

TABLE 15

TRIP CHARACTERISTICS OF 4-AXLE TRACTOR-SEMITRAILERS OF COVERED BODY AND 4 TON RATED CAPACITY

Mileage Block		Trips	Vehicle Miles	Average Loads	Ton-Miles
				(Tons)	
10 - 24 Miles		7	119	7.536	897
25 - 49 Miles		25	925	8.020	7,418
50 - 99 Miles		70	5,250	9.272	48,678
100 - 249 Miles		431	75,425	9.308	702,056
250 - 499 Miles		393	147,375	9.926	1,462,844
500 - 999 Miles		99	66,924	11.656	780,066
Over 1000 Miles		56	94,416	12.968	1,224,387
	Totals	1,081	390,434	9.894	4,226,346

Source: Based on trips observed at 21 Texas loadometer stations in 1955.

TABLE 16
TRIP CHARACTERISTICS OF SELECTED BODY TYPES OF 4-AXLE, 4 TON TRACTOR-SEMITRAILERS

	(1)		(2)		(3)		(4)	
Mileage	Tank Body		Covered Body		All Others		Total	
Block	Trips	Loads	Trips	Loads	Trips	Loads	Trips	Loads
(Miles)		(Lbs.)		(Lbs.)		(Lbs.)		(Lbs.)
Under 25	27	24,362			18	19,644	45	22,475
25 - 49	39	29,170			65	21,023	104	24,078
50 - 99	212	29,072			177	20,644	389	25,237
100 - 249	272	28,819	431	18,617	323	22,703	1,026	22,608
250 - 499			393	19,851	332	25,548	725	22,460
500 - 999			99	23,312	150	25,721	249	24,763
Over 1000							146	24,511

Source: Based on trips recorded at 21 Texas loadometer stations in 1955.

making trips over 999 miles represented only 10.2 percent of the total trips, but accounted for 42.8 percent of the ton-miles. This also illustrates the need of adjusting loadometer trip mileages to correct the trip-length bias discussed above.

Data for trips by empty vehicles are assembled in a similar way in

TABLE 17
AVERAGE CARRIED LOADS OF TRUCK AND COMBINATION BODY TYPES COMPARED BY METHODS OF CALCULATION

Body Type and Comparison	2-Axle Trucks 1½ Ton and Over*		3-Axle Tractor-Semitrailers		4-Axle Tractor-Semitrailers	
	Number Loaded	Average Load	Number Loaded	Average Load	Number Loaded	Average Load
		(Lbs.)		(Lbs.)		(Lbs.)
Special	221		77		299	
I. Unweighted		4,073		16,377		25,860
II. Weighted by Capacities		5,182		15,232		25,715
Difference (I - II)		—1,109		1,145		145
Open-Top	701		248		630	
I. Unweighted		6,916		18,527		27,545
II. Weighted by Capacities		6,908		18,557		27,553
Difference (I - II)		8		—30		—8
Platform	420		299		712	
I. Unweighted		6,154		14,825		23,460
II. Weighted by Capacities		5,970		14,843		23,131
Difference (I - II)		184		—18		329
Stakes	548		191		103	
I. Unweighted		5,712		15,497		23,643
II. Weighted by Capacities		5,576		15,333		23,728
Difference (I - II)		136		164		—85
Covered	1,093		883		1,703	
I. Unweighted		3,930		9,361		20,032
II. Weighted by Capacities		4,150		9,064		19,781
Difference (I - II)		—220		297		251
Tank	227		65		838	
I. Unweighted		5,206		15,828		28,723
II. Weighted by Capacities		4,925		15,678		28,728
Difference (I - II)		281		50		—5
Refrigerated	298		93		583	
I. Unweighted		3,492		11,474		22,416
II. Weighted by Capacities		3,799		11,867		22,108
Difference (I - II)		—307		—393		308
Auto Carrier			319		7	
I. Unweighted				13,571		9,778
II. Weighted by Capacities				13,580		13,828
Difference (I - II)				—9		—4,050

*Does not include 2-axle trucks pulling 1-axle trailers (Type 2-1).

Table 14. The last column in this table gives a trip ratio obtained by dividing the number of loaded trips into the number of empty trips. A ratio of 1.00, therefore, would mean an even number of trips in each category; a ratio less than 1.00 shows the dominance of loaded vehicles and a ratio more than 1.00 shows the extent to which empty trips dominate.

Miles, Tons, and Ton-Miles

Certain difficulties seem inherent to the ton-mile concept when it is used in relation to motor trucking. As a product of two variables, weight and distance, ton-miles should ideally be computed for the smallest possible unit, i.e., a trip, and the ton-mile products for all loaded trips attributed to a vehicle (or other) group could then be combined into a total by addition. This general procedure is practical for rail carload movements, using the continuous one percent sample of waybill terminations. But even if a similar freight bill sample were available from all motor carriers licensed by the Interstate Commerce Commission it could not be as representative of the motor trucking universe as is the railway sample of its universe. Private haulers of goods make up a major portion of the motor trucking universe, as is shown in Part I of this report, and records covering their operation are not as readily available.

Since motor truck ton-miles can not ordinarily be calculated by summation of individual trip data, it is necessary to derive group totals by multiplying an estimated total miles (based on frequency of occurrence of visual vehicle classes in the traffic stream) times an estimated average load (in tons). Using this system a great deal of importance is attached to average carried loads and to the methods by which they are derived.

This may be illustrated by referring to Table 13. Single unit trucks of over 1 ton capacity are here ascribed an "Average Load per Mile" of 3.187 tons (a weighted average of mileage-block sub-totals, using vehicle miles as weights). But the observed average carried load for such vehicles, obtained by subtracting the grand total of estimated empty weights from the grand total of observed gross weights and dividing by the number of trips, is 5731.4 lbs., or 2.866 tons. Multiplying 2.866 times the 421,112 vehicle miles gives 1,206,907 ton-miles. This amount is 135,000 less than the ton-mile grand total of 1,341,925 obtained by adding the sub-totals of the nine mileage blocks. In both cases the same 3768 trips and the same 421,112 vehicle miles were used but the shorter "raw" method yields a ton-mile total which is 10 percent under the sum of the mileage block sub-totals.

Another illustration of ton-mile discrepancies can be made from the data appearing in Table 15 relating to the largest axle-body-capacity group included in the loadometer sample.

The total of 4,226,346 ton-miles shown here is the sum of the mileage block values. The carried load value of 9.894 tons in the bottom row of the table is the usual mean obtained by subtracting the average weight of empty vehicles of this axle-body-capacity class from the average gross loaded weight. However,

$$9.894 \text{ tons} \times 390{,}434 \text{ mlies} = 3{,}862{,}954 \text{ ton-miles,}$$

which is 363,392 less than the summed total in the table, a difference amounting to 8.6 percent of the larger value.

It is evident from the table that the difficulty here arises from the fact that, for vehicles of this type, loads increase directly as distance increases, with the result that shorter trips are associated with lighter loads and longer trips with heavier loads. Thus the usual average carried load when multiplied by total miles gives a distorted estimate of ton-miles. This imbalance of moments about the mean is most noticeable for the covered body type. That it applies in a general way to most of the 4-axle, 4-ton classes is evident from Table

TABLE 18

TRIP DISTRIBUTION AND AVERAGE WEIGHTS AND LOADS OF 18,877 VEHICLES IN TEXAS LOADOMETER SAMPLE, APRIL 18 TO DECEMBER 31, 1955 BY AXLE TYPE AND MANUFACTURERS' RATED CAPACITY

VEHICLE TYPE And Rated Capacity*	Vehicle Trips* Empty Sample Number	Percent	Loaded Sample Number	Percent	Average Weights and Loads Empty Weight (lbs.)	Loaded Weight (lbs.)	Carried Load (lbs.)
Single Unit—2 Axle							
Under 8 Feet Wide	1,122	100.0	893	100.0	5,069	8,579	3,510
½ ton	691	61.6	326	36.5	4,051	4,874	823
1 ton	132	11.8	183	20.5	5,074	7,100	2,026
1½ ton	63	5.6	147	16.5	6,305	9,994	3,635
2 ton	221	19.7	216	24.2	7,694	13,956	6,262
2½ ton	12	1.1	18	2.0	7,934	13,956	6,022
3 ton	3	0.3	3	0.3	8,700	12,567	3,867
Single Unit—2 Axle							
8 Feet Wide	1,759	100.0	3,266	100.0	8,571	14,044	5,473
½ ton	4	0.2	7	0.2	5,500	6,343	843
1 ton	51	2.9	93	2.9	5,880	8,061	2,181
1½ ton	270	15.4	504	15.4	7,312	11,216	3,904
2 ton	1,132	64.4	2,113	64.7	8,451	14,191	5,740
2½ ton	149	8.5	313	9.6	9,780	15,830	6,050
3-3½ ton	75	4.3	160	4.9	10,651	18,453	7,802
4-4½ ton	69	3.9	72	2.2	11,725	20,039	8,314
5 ton	2	0.1	1	0.0	12,100	13,700	1,600
6-up ton	7	0.4	3	0.1	17,657	23,467	5,810
Single Unit—2 Axle							
1½ Ton and Over	2,003	100.0	3,550	100.0	8,473	14,041	5,568
1½ ton	333	16.6	651	18.3	7,122	10,940	3,818
2 ton	1,353	67.5	2,329	65.6	8,327	14,169	5,842
2½ ton	161	8.0	331	9.3	9,642	15,727	6,085
3-3½ ton	78	3.9	163	4.6	10,575	18,344	7,769
4-4½ ton	69	3.4	72	2.0	11,725	20,039	8,314
5 ton	2	0.1	1	0.0	12,100	13,700	1,600
6-up ton	7	0.3	3	0.1	17,657	23,467	5,810
All Single Unit							
2 Axle Trucks	2,881	100.0	4,159	100.0	7,207	12,870	5,663
½ ton	695	24.1	333	8.0	4,059	4,905	846
1 ton	183	6.4	276	6.6	5,298	7,424	2,126
1½ ton	333	11.6	651	15.7	7,122	10,940	3,818
2 ton	1,353	47.0	2,329	56.0	8,327	14,169	5,842
2½ ton	161	5.6	331	8.0	9,642	15,727	6,085
3-3½ ton	78	2.7	163	3.9	10,575	18,344	7,769
4-4½ ton	69	2.4	72	1.7	11,725	20,039	8,314
5 ton	2	0.1	1	0.0	12,100	13,700	1,600
6-up ton	7	0.2	3	0.1	17,657	23,457	5,810
Single Unit—3 Axle							
Trucks	93	100.0	219	100.0	18,381	30,280	11,899
1 ton	1	1.1			10,700		
1½ ton	1	1.1	1	0.5	17,400	30,200	12,800
2 ton	25	26.9	50	22.8	12,452	26,770	14,318
2½ ton	10	10.8	35	16.0	13,210	26,946	13,736
3-3½ ton	9	9.7	30	13.7	16,700	30,450	13,750
4 ton	35	37.6	83	37.9	20,143	32,038	11,895
5 ton	2	2.2	7	3.2	21,950	29,886	7,936
6 ton	2	2.1	13	5.9	20,600	41,362	20,762
8½ ton	5	5.4			30,300		
12½ ton	2	2.2			45,250		
20 ton	1	1.1			55,500		
All Single Unit							
Vehicles	2,974	100.0	4,378	100.0	7,557	13,741	6,184
½ ton	695	23.4	333	7.6	4,059	4,905	846
1 ton	184	6.2	276	6.3	5,327	7,424	2,097
1½ ton	334	11.2	652	14.9	7,153	10,970	3,817
2 ton	1,378	46.3	2,379	54.3	8,402	14,434	6,032
2½ ton	171	5.8	366	8.4	9,851	16,800	6,949
3-3½ ton	87	2.9	193	4.4	11,209	20,226	9,017
4-4½ ton	104	3.5	155	3.5	14,558	26,464	11,906

*See note at end of table.

TABLE 18—Continued

VEHICLE TYPE And Rated Capacity*	Vehicle Trips* Empty Sample Number	Percent	Loaded Sample Number	Percent	Average Weights and Loads Empty Weight	Loaded Weight	Carried Load
					(lbs.)	(lbs.)	(lbs.)
All Single Unit Vehicles (Continued)							
5 ton	4	0.1	8	0.2	17,025	27,863	10,838
6 ton	8	0.3	16	0.4	18,887	38,007	19,120
8½ ton	6	0.2			27,517		
12½ ton	2	0.1			45,250		
20 ton	1	0.0			55,500		
Truck-tractor Semitrailer, 3 Axle (Type 2-S1)	1,295	100.0	2,175	100.0	17,108	30,192	13,084
1-1½ ton	9	0.7	10	0.5	12,472	19,110	6,638
2 ton	666	51.4	955	43.9	16,126	29,251	13,125
2½ ton	124	9.6	192	8.8	16,524	30,061	13,537
3 ton	266	20.5	437	20.1	17,514	30,383	12,869
3½ ton	68	5.3	160	7.1	19,252	31,604	12,352
4-4½ ton	155	12.0	392	18.0	20,141	31,724	11,583
5 ton	6	0.5	24	1.1	22,333	35,491	13,158
6 ton	1	0.1	5	0.2	30,500	29,380	
4 Axle Truck Combinations	2,475	100.0	4,825	100.0	23,409	47,001	23,592
1-1½ ton	3	0.1	3	0.1	10,767	17,833	7,066
2 ton	258	10.4	428	8.9	18,989	43,670	24,681
2½ ton	63	2.5	76	1.6	19,539	44,093	24,554
3 ton	350	14.1	524	10.9	21,783	45,403	23,620
3½ ton	127	5.1	210	4.4	22,167	47,538	25,371
4 ton	1,352	54.6	2,698	55.9	24,373	47,284	22,911
4½ ton	41	1.7	96	2.0	25,463	44,441	18,978
5-5½ ton	142	5.7	363	7.5	25,167	48,645	23,478
6-6½ ton	118	4.8	397	8.2	26,820	50,179	23,359
7–8½ ton	21	0.9	30	0.6	28,624	49,853	21,229
5 Axle Truck Combinations	125	100.0	630	100.0	29,650	50,192	20,542
2 ton	1	0.8	2	0.3	20,600	31,550	10,950
3 ton	2	1.6	7	1.1	31,125	52,500	21,375
3½ ton	1	0.8	3	0.5	34,200	55,567	21,367
4 ton	69	55.2	345	54.8	28,657	48,717	20,060
4½ ton	7	5.6	18	2.9	28,871	43,588	14,717
5 ton	14	11.2	65	10.3	30,107	49,714	19,607
6 ton	28	22.4	180	28.6	30,596	52,890	22,294
8½-12½ ton	3	2.4	10	1.6	43,833	68,039	24,206
All Truck and Trailer Combinations	3,895	100.0	7,630	100.0	21,515	42,472	20,957
1-1½ ton	12	0.3	13	0.2	12,046	18,815	6,769
2 ton	925	23.8	1,385	18.2	16,929	33,710	16,781
2½ ton	187	4.8	268	3.5	17,540	34,040	16,500
3-3½ ton	814	20.9	1,341	17.6	20,275	39,256	18,981
4-4½ ton	1,624	41.7	3,549	46.5	24,198	45,608	21,410
5-5½ ton	162	4.2	452	5.9	25,489	48,100	22,611
6-6½ ton	147	3.8	582	7.6	27,564	50,839	23,275
7-up ton	24	0.6	40	0.5	30,525	54,400	23,875

*Note: When vehicles of under 1½ ton capacity are included in a percentage distribution, it should be noted that of the panel and pick-up trucks counted only 5.14 percent were weighed, whereas 35.28 percent of other 2-axle vehicles passing the loadometer stations during sampling intervals were stopped and weighed. Data for other types of vehicles are as follows:

Type of Vehicle	Percentage Weighed Of Total Counted
Single Unit Trucks, 3-Axle	43.75
Tractor-Semitrailers:	
3-axle	42.08
4-axle	41.04
5-axle	48.44
Sub-total, Single Unit Trucks	16.15
Sub-total, Tractor-Semitrailer	41.79
Total, All Trucks and Combinations	25.64

Vehicles rated at ¾ ton are included in the 1 ton class.

TABLE 19

AVERAGE EMPTY AND LOADED WEIGHTS AND AVERAGE CARRIED LOADS OF 18,877 VEHICLES IN TEXAS LOADOMETER SAMPLE, APRIL 18 TO DECEMBER 31, 1955 BY AXLE TYPE, BODY TYPE, AND MANUFACTURERS' RATED CAPACITY

VEHICLE TYPE and Rated Capacity*	Number Empty	Average Empty Weight	Number Loaded	Average Loaded Weight	Average Carried Load	Empty Weight Estimate	Carried Load Estimate
		(lbs.)		(lbs.)		(lbs.)	(lbs.)
Single Unit Trucks, 2 Axle, Under 8 feet wide:	1,122	5,069	893	8,577	3,508		
Covered Body							
½ ton	5	4,180	10	4,550	370		
1 ton	7	6,557	41	8,239	1,682		
1½ ton	6	7,250	69	9,601	2,351		
2 ton	11	8,518	49	12,818	4,300		
2½ ton	2	9,100	2	9,950	850	8,600	1,350
3 ton			1	8,200		7,700	500
Platform Body							
½ ton	4	3,725	1	3,500		3,200	300
1 ton	6	5,233	6	6,250	1,017		
1½ ton	7	5,928	10	9,370	3,442		
2 ton	24	6,771	8	12,600	5,829		
2½ ton			2	10,450		7,700	2,750
Stakes Body							
½ ton	44	4,248	19	5,000	752		
1 ton	33	4,985	24	6,958	1,973		
1½ ton	16	6,181	19	11,205	5,024		
2 ton	9	7,111	42	12,021	4,910		
2½ ton			5	15,940		8,200	7,740
3 ton			1	12,300		8,500	3,800
Tank Body							
1½ ton	7	7,471	6	12,367	4,896		
2 ton	3	7,700	17	13,135	5,435		
Open-top Body							
½ ton	637	4,038	293	4,864	826		
1 ton	77	4,900	93	6,464	1,564		
1½ ton	22	6,014	24	9,383	3,369		
2 ton	160	7,899	71	16,968	9,069		
2½ ton	8	7,888	5	14,220	6,332		
3 ton	3	8,700					
Refrigerated Body							
1 ton	1	8,600	4	8,400		7,300	1,100
1½ ton			8	10,650		8,500	2,150
2 ton	1	10,900	15	13,027	2,127	9,800	3,227
2½ ton			3	16,000		11,200	4,800
3 ton			1	17,200		12,000	5,200
Special Body							
½ ton	1	4,400	3	6,567	2,167		
1 ton	8	5,250	15	8,153	2,903		
1½ ton	5	5,740	11	10,509	4,769		
2 ton	13	6,338	14	11,236	4,898		
2½ ton	2	6,950	1	11,600	4,650		
Single Unit Trucks, 2 Axle, 8 feet wide:	1,751	8,559	3,222	14,020	5,461		
Covered Body							
1 ton	4	6,600	28	7,975	1,375		
1½ ton	37	8,108	154	10,230	2,122		
2 ton	157	9,412	635	13,777	4,365		
2½ ton	38	10,116	121	15,600	5,484		
3-3½ ton	14	10,814	47	17,446	6,632		
4 ton	13	12,008	15	17,759	5,751		
Platform Body							
1 ton	5	6,160	6	8,083	1,923		
1½ ton	65	6,714	65	10,569	3,855		

*Vehicles rated at ¾ ton are included in the 1 ton class.

TABLE 19—Continued

VEHICLE TYPE and Rated Capacity	Number Empty	Average Empty Weight	Number Loaded	Average Loaded Weight	Average Carried Load	Empty Weight Estimate	Carried Load Estimate
		(lbs.)		(lbs.)		(lbs.)	(lbs.)
Single Unit Trucks, 2 Axle, 8 feet wide: (Continued)							
2 ton	206	7,731	280	13,964	6,233		
2½ ton	17	8,024	32	14,969	6,945		
3 ton	7	10,029	14	19,729	9,700		
4 ton	2	11,200	8	18,537	7,337		
6 ton			1	21,400		13,000	8,400
Stakes Body							
½ ton	2	5,050	1	9,100	4,050		
1 ton	14	5,200	18	8,261	3,061		
1½ ton	53	7,172	87	11,803	4,631		
2 ton	143	8,164	337	13,636	5,472		
2½ ton	10	8,310	41	15,641	7,331		
3 ton	2	9,250	7	20,142	10,892		
4 ton			9	19,766		10,000	9,766
Tank Body							
1½ ton	15	8,107	25	13,068	4,961		
2 ton	67	9,946	142	14,552	4,606		
2½ ton	6	13,167	19	18,253	5,086		
3-3½ ton	2	13,150	11	18,182	5,032		
4 ton	2	13,350	7	22,785	9,435		
Open-top Body							
½ ton	2	5,950	4	4,975		4,500	475
1 ton	23	5,974	27	7,811	1,837		
1½ ton	92	7,209	115	11,694	4,485		
2 ton	448	8,125	429	15,227	7,102		
2½ ton	36	8,825	32	15,844	7,019		
3 ton	8	9,525	16	20,575	11,050		
4 ton	1	9,100	9	23,600	14,500	10,000	13,600
Refrigerated Body							
1 ton			1	7,500		7,000	500
1½ ton	3	11,667	13	12,446	779	10,500	1,946
2 ton	36	11,028	154	14,714	3,686		
2½ ton	17	12,871	48	15,931	3,060		
3-3½ ton	13	13,231	44	18,691	5,460		
4 ton			12	19,075		13,500	5,575
Special Body							
½ ton			1	8,200		6,000	2,200
1 ton	5	6,500	12	8,483	1,983		
1½ ton	4	7,875	35	11,189	3,314		
2 ton	70	8,120	108	12,946	4,826		
2½ ton	25	9,512	19	16,000	6,488		
3-3½ ton	28	9,714	19	17,389	7,675		
4-4½ ton	51	11,661	11	21,382	9,721		
5 ton	2	12,100	1	13,700	1,600		
(Gasoline) 6 ton	3	14,500					
(Diesel) 6 ton	3	22,133	2	24,500	2,367		
Single Unit Truck, 2 Axle, With 1 Axle Trailer: (Type 2-1)	8	11,188	44	15,772	4,584		
Covered Body							
2 ton			3	21,033		13,000	8,033
3 ton			1	17,900		12,000	5,900
Platform Body							
1½ ton			4	15,075		9,000	6,075
2 ton	3	9,767	7	12,457	2,690		
4 ton			1	14,200		10,000	4,200
Stakes Body							
1½ ton	1	6,500	1	11,200	4,700		
2 ton			2	13,150		8,500	4,650
Tank Body							
2 ton			1	33,500		17,000	16,500

TABLE 19—Continued

VEHICLE TYPE and Rated Capacity	Number Empty	Average Empty Weight	Number Loaded	Average Loaded Weight	Average Carried Load	Empty Weight Estimate	Carried Load Estimate
		(lbs.)		(lbs.)		(lbs.)	(lbs.)
Single Unit Truck, 2 Axle with 1 Axle Trailer: (Type 2-1) (Continued)							
Open-top Body							
½ ton			1	7,200		5,200	2,000
1½ ton			3	12,067		8,000	4,067
2 ton	1	14,000	8	16,462	2,462	12,500	3,962
Special Body							
1 ton			1	9,000		7,000	2,000
1½ ton			2	15,650		9,000	6,650
2 ton	1	13,800	7	17,928	4,128	12,500	5,428
2½ ton			1	24,100		13,000	11,100
3-3½ ton	1	12,200	1	15,300	3,100		
8½ ton	1	13,700					
Single Unit Truck, 3 Axle	93	18,381	219	30,280	11,899		
Covered Body							
1½ ton			1	30,200		13,000	17,200
2 ton	4	13,950	4	30,075	16,125		
2½ ton	1	8,500	7	29,928	21,428	14,000	15,928
3 ton			5	22,600		15,000	7,600
4 ton	2	20,150	23	29,991	9,841	18,000	11,991
5 ton			2	24,650		19,000	5,650
6 ton			3	33,133		20,000	13,133
Platform Body							
2 ton	5	10,200	3	29,533	19,333		
2½ ton	1	12,900	1	25,300	12,400		
3 ton			3	29,567		14,000	15,567
6 ton	1	24,100	2	49,400	25,300		
12½ ton	2	45,250					
Stakes Body							
2 ton	2	10,950	4	23,125	12,175		
2½ ton	1	14,600	1	31,300	16,700		
4 ton			2	31,300		16,000	15,300
Tank Body							
1½ ton	1	17,400					
2 ton			1	31,800		17,000	14,800
2½ ton	3	16,300	1	18,500	2,200		
3 ton	2	17,500	2	25,050	7,550		
4 ton	4	20,225	4	28,050	7,825		
Open-top Body							
1 ton	1	10,700					
2 ton	11	12,491	33	26,136	13,645		
2½ ton	3	10,867	9	27,266	16,399		
3-3½ ton	4	15,450	10	34,960	19,510		
4 ton	2	15,850	2	32,600	16,750		
Refrigerated Body							
2 ton			4	28,025		16,000	12,025
3 ton			4	24,075		16,000	8,075
4 ton			1	29,200		20,000	9,200
Special Body							
2 ton	3	15,067	1	30,700	15,633		
2½ ton	1	14,600	16	25,819	11,219		
3-3½ ton	3	17,833	6	35,967	18,134		
4 ton	27	20,448	51	33,337	12,889		
5 ton	2	21,950	5	31,980	10,030		
6 ton	1	17,100	8	42,438	25,338	22,000	20,438
8½ ton	5	30,300					
20 ton	1	55,500					
Truck-Tractor Semi-trailer, 3 Axle	1,295	17,108	2,175	30,192	13,084		
Covered Body							
1½ ton			4	17,925		11,500	6,425
2 ton	100	16,860	218	24,794	7,934		
2½ ton	32	17,241	71	26,213	8,972		

TABLE 19—Continued

VEHICLE TYPE and Rated Capacity		Number Empty	Average Empty Weight	Number Loaded	Average Loaded Weight	Average Carried Load	Empty Weight Estimate	Carried Load Estimate
			(lbs.)		(lbs.)		(lbs.)	(lbs.)
Truck-Tractor Semi-trailer, 3 Axle (Continued)								
	3 ton	102	18,429	213	27,261	8,832		
	3½ ton	35	19,386	102	28,712	9,326		
	4-4½ ton	70	20,445	257	30,423	9,987		
	5 ton			15	33,593		21,000	12,593
	6 ton			3	29,100		21,500	7,600
Platform Body								
	1 ton			1	16,300		10,000	6,300
	1½ ton	2	16,850	1	14,700		11,500	3,200
(Private Use)	2 ton	84	14,300	124	29,089	14,789		
(Hired Use)	2 ton	39	16,210	35	31,869	15,659		
	2½ ton	29	16,686	26	32,330	15,644		
	3 ton	57	17,184	69	31,345	14,161		
	3½ ton	2	15,050	5	32,720	17,670		
	4 ton	17	19,112	35	34,091	14,979		
	5 ton			2	43,050		20,000	23,050
	6 ton			1	24,200		20,000	4,200
Stakes Body								
	1½ ton	1	8,350					
(Private Use)	2 ton	44	16,750	43	31,152	14,402		
(Hired Use)	2 ton	39	17,944	42	33,372	15,428		
	2½ ton	19	17,326	27	33,296	15,970		
	3 ton	28	17,775	35	34,003	16,228		
	3½ ton	9	19,511	19	36,105	16,594		
	4 ton	22	19,527	24	33,358	13,831		
	6 ton			1	35,400		20,400	15,000
Tank Body								
	2 ton	27	15,611	24	30,712	15,101		
	2½ ton	1	17,500	4	28,600	11,100		
	3 ton	21	18,048	9	31,067	13,019		
	3½ ton	4	22,025	11	38,791	16,766		
	4-4½ ton	20	21,130	15	39,587	18,457		
	5 ton	2	20,300	2	37,200	16,900		
	6 ton	1	30,500					
Open top Body								
	1 ton	1	10,300	1	11,400	1,100	9,000	2,400
	1½ ton	1	14,800					
	2 ton	83	14,258	125	32,107	17,849		
	2½ ton	23	15,170	32	33,609	18,439		
	3 ton	35	15,606	55	35,836	20,230		
	3½ ton	10	17,540	12	37,608	20,068		
	4 ton	16	17,931	23	36,417	18,486		
Refrigerated Body								
	2 ton	13	19,231	22	27,559	8,328	19,147	8,412
	2½ ton			8	31,012		19,147	11,865
	3 ton	4	18,875	25	33,420	14,545	19,147	14,273
	3½ ton	7	20,886	9	37,333	16,447		
	4 ton	5	19,720	26	30,292	10,572		
	5 ton	3	23,233	3	37,866	14,633		
Auto Carrier Body								
	1½ ton	1	17,600	1	29,000	11,400		
	2 ton	219	17,026	286	30,485	13,459		
	2½ ton	12	18,050	15	31,120	13,070		
	3 ton	10	17,730	15	34,340	16,610		
	3½ ton			1	33,700		20,000	13,700
	4 ton	1	20,300					
	5 ton	1	23,700	1	36,300	12,600		
Special Body								
	1 ton	1	8,800					
	1½ ton	2	9,350	2	24,000	14,650		
	2 ton	18	11,106	36	27,511	16,405		
	2½ ton	8	12,650	9	29,589	16,939		
	3 ton	9	13,756	16	32,288	18,532		
	3½ ton	1	15,200	1	30,700	15,500		

TABLE 19—Continued

VEHICLE TYPE and Rated Capacity	Number Empty	Average Empty Weight	Number Loaded	Average Loaded Weight	Average Carried Load	Empty Weight Estimate	Carried Load Estimate
		(lbs.)		(lbs.)		(lbs.)	(lbs.)
Truck-tractor, Semi-trailer, 3 Axle (Continued)							
4 ton	4	26,950	12	33,492	6,542		
5 ton			1	37,500		27,500	10,000
Truck-Tractor Semi-trailer, 4 Axle							
Covered Body	2,457	23,420	4,805	47,058	23,638		
2 ton	17	20,382	37	37,941	17,559		
2½ ton	7	20,614	8	45,162	20,548		
3 ton	25	21,660	119	40,858	19,198		
3½ ton	15	21,380	54	42,337	20,957		
(Private) 4 ton	78	23,029	337	42,327	19,298		
(For-hire) 4 ton	129	23,649	745	43,600	19,951		
4½ ton	10	23,940	43	36,977	13,037		
5 ton	38	24,726	191	45,608	20,882		
6-6½ ton	22	25,786	154	47,018	21,232		
7 ton			2	41,450		26,000	15,450
8½ ton	4	27,450	13	45,923	18,473		
Platform Body							
1 ton	1	11,400	1	25,100	13,700		
(Private) 2 ton	56	18,351	84	42,951	24,600		
(For-hire) 2 ton	41	19,263	49	43,993	24,730		
2½ ton	24	20,000	30	41,118	21,118		
(Private) 3 ton	74	21,566	76	44,015	22,449		
(For-hire) 3 ton	54	22,419	62	45,862	23,443		
(Private) 3½ ton	20	20,242	19	48,066	27,824		
(For-hire) 3½ ton	26	21,548	19	49,266	27,718		
(Private) 4 ton	138	23,169	180	45,769	22,600		
(For-hire) 4 ton	53	26,721	113	49,141	22,420		
4½ ton	10	28,790	9	50,200	21,410		
5-5½ ton	26	26,738	33	49,230	22,492		
6 ton	16	26,606	35	47,814	21,208		
8½ ton	2	31,650	2	56,750	25,100		
Stakes Body							
2 ton	13	19,508	20	41,245	21,737		
2½ ton	2	20,050	3	46,533	26,483		
3 ton	13	21,869	19	48,337	26,468		
3½ ton	7	24,386	6	49,283	24,897		
4 ton	43	23,172	49	46,953	23,781		
5 ton			2	36,600		26,000	10,600
6 ton	2	26,950	4	49,725	22,775		
Tank Body							
2 ton	14	20,464	15	44,680	24,216		
2½ ton	1	24,700	1	53,400	28,700		
3 ton	47	24,081	42	51,710	27,629		
3½ ton	26	24,231	34	52,682	28,451		
(Gas, Private) 4 ton	180	24,056	177	54,526	30,470		
(Gas, Hired) 4 ton	348	24,736	394	53,609	28,873		
(Butane) 4 ton	90	29,083	91	54,850	25,767		
4½ ton	16	24,850	19	52,805	27,955		
5 ton	32	24,866	45	54,293	29,427		
6 ton	16	27,506	19	56,763	29,257		
8½ ton			1	57,200		28,000	29,200
Open-top Body							
2 ton	85	19,282	130	47,556	28,274		
2½ ton	16	19,444	20	50,385	30,941		
3 ton	93	20,588	115	47,951	27,363		
3½ ton	23	20,791	42	50,788	29,997		
4 ton	133	22,271	265	48,908	26,637		
4½ ton	3	22,733	7	52,271	29,538		
5 ton	27	23,530	21	53,495	29,965		
6 ton	15	25,513	26	50,753	25,240		
8½ ton	10	26,550	4	53,050	26,500		

TABLE 19—Continued

VEHICLE TYPE and Rated Capacity		Number Empty	Average Empty Weight	Number Loaded	Average Loaded Weight	Average Carried Load	Empty Weight Estimate	Carried Load Estimate
			(lbs.)		(lbs.)		(lbs.)	(lbs.)
Truck-tractor Semi-trailer, 4 Axle (Continued)								
Refrigerated Body								
	2 ton	9	22,256	21	46,024	23,768		
	2½ ton	2	24,500	3	46,966	22,466		
	3 ton	25	23,608	43	47,079	23,471		
	3½ ton	7	25,443	18	44,494	19,051		
	4 ton	110	26,428	261	45,860	19,432		
	4½ ton	1	30,400	14	49,121	18,721		
	5 ton	15	27,000	65	52,096	25,096		
	6 ton	46	27,465	151	52,942	25,477		
	7 ton			1	49,600		28,000	21,600
	8½ ton	2	32,000	6	54,750	22,750		
Auto Carrier Body								
	2 ton	1	17,200	7	31,028	13,828		
	4 ton	1	25,300					
Special Body								
	1 ton	2	10,450					
	2 ton	21	15,567	60	42,410	26,843		
	2½ ton	7	15,714	11	37,691	21,977		
	3 ton	19	18,695	45	43,973	25,278		
	3½ ton	3	24,133	18	45,928	21,795		
	4 ton	36	20,375	76	47,941	27,566		
	4½ ton	1	20,500	4	41,900	21,400		
	5 ton	4	25,725	6	49,416	23,691		
	6 ton	1	31,700	8	51,950	20,250		
	8½ ton	3	32,833	1	54,700	21,867		
Other 4 Axle Truck Combinations (Type 3-S1: 15 empty and 6 loaded vehicles. Type 3-S1A: 3 loaded vehicles. Type 2-2: 3 empty and 11 loaded vehicles.)		18	21,955	20	33,250	11,295		
Covered Body								
	2 ton			1	19,200		16,860	2,340
	4 ton			4	37,875		23,029	14,846
Platform Body								
	2 ton			1	32,500		16,210	16,290
	3 ton			1	47,600		21,566	26,034
Stakes Body								
	2 ton			1	20,600		16,750	3,850
	2½ ton	1	13,800					
	4 ton	1	19,900					
Tank Body								
	4 ton	7	24,614	1	45,900	21,286		
Open-top Body								
	1 ton			1	13,300		10,300	3,000
	2 ton			1	28,600		14,258	14,342
	4 ton			1	22,600		17,931	4,669
Special Body								
	1½ ton			1	15,100		10,450	4,650
	2 ton	1	11,900	1	16,800	5,100		
	2½ ton	1	21,800					
	3 ton			2	42,450		24,133	23,667
	4 ton	5	23,860	4	41,600	17,740		
Auto Carrier Body								
	2½ ton	2	18,100					
5 Axle Truck Combinations (Type 2-S3: 1 loaded vehicle. Type 3-S2: 68 empty and 272 loaded vehicles. Type 3-S2 A:		125	29,650	630	50,192	20,542		

TABLE 19—Continued

VEHICLE TYPE and Rated Capacity		Number Empty	Average Empty Weight	Number Loaded	Average Loaded Weight	Average Carried Load	Empty Weight Estimate	Carried Load Estimate
			(lbs.)		(lbs.)		(lbs.)	(lbs.)
56 empty and 353 loaded vehicles. Type 3-2: 4 loaded vehicles.)								
Covered Body								
	2 ton			1	19,900		16,860	3,040
	3 ton	1	28,500	2	51,000	22,500		
	3½ ton			1	50,100		27,128	22,972
	4 ton	47	27,195	291	47,577	20,382		
	4½ ton	4	28,150	16	40,137	11,987		
	5 ton	5	29,640	53	47,578	17,938		
	6 ton	16	29,025	102	48,636	19,611		
	8½ ton			2	56,450		29,640	26,810
Platform Body								
	3 ton	1	33,750	1	48,900	15,150		
	3½ ton	1	34,200	1	50,800	16,600		
	4 ton	11	32,627	19	57,590	24,963		
	4½ ton	2	31,850					
	5 ton	5	30,000					
	6 ton	3	34,100	12	57,975	23,875		
	8½ ton	2	40,000					
Stakes Body								
	4 ton			2	48,100		23,172	24,928
	6 ton			1	48,000		26,950	21,050
Tank Body								
	4 ton	1	27,000	2	46,300	19,300		
	4½ ton			1	64,500		29,083	35,417
	5 ton	1	25,600					
Open-top Body								
	2 ton	1	20,600					
	4 ton	1	20,400	6	53,833	33,433		
	6 ton	1	35,800	1	63,600	27,800		
Refrigerated Body								
	3 ton			1	48,600		23,608	24,992
	3½ ton			1	65,800		27,465	38,335
	4 ton	2	30,950	13	49,146	18,196		
	5 ton	1	27,200	8	62,413	35,213		
	6 ton	7	30,428	56	56,229	25,801		
	8½ ton			5	61,280		32,000	29,280
Special Body								
	2 ton			1	43,200		15,567	27,633
	3 ton			3	56,000		18,695	37,305
	4 ton	7	33,000	12	59,783	26,783		
	4½ ton	1	25,800	1	77,900	52,100		
	5 ton	2	35,250	4	52,625	17,375		
	6 ton	1	41,200	8	75,400	34,200		
	8½ ton	1	51,500	2	80,595	29,095		
	12½ ton			1	99,900		55,000	44,900

16. In this table the body types which account for more than 25 percent of the total trips recorded for a mileage block are listed separately, those accounting for less than 25 percent of the trips are listed as "All Others", and both groups are combined in column (4) into a grand total.

By inspection it is seen that the imbalance noted for covered body types is present also in column (3), the "All Others" group. Loads again increase with distance. Fortunately, however, the effect of combining all types in the column (4) total is such that the relationship is largely neutralized.

When all body types are combined there is no clear pattern of loads increasing or decreasing with distance. Consequently there is but little difference in the total ton-miles estimated for these 4-axle 4-ton combinations when calculated by either of the methods discussed above. The difference is only 1.15 percent of the larger value, which again was that obtained by the summation of subtotals method.

We conclude that grand total ton-mile estimates applying to a vehicle, commodity, or industry group are in peril, so to speak, of any significant pattern that exists in the sizes of loads at different distances. Such patterns appear more apt to occur in commodity and industry groups than in vehicle axle classes. Therefore the possibility of such occurrance deserves special attention when industry or commodity ton-mile estimates are being constructed.