

Transportation Uses and Preferences of the Texas Food Industry

By

CHARLEY V. WOOTAN

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Co-operative Research Project Between the
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TEXAS TRANSPORTATION INSTITUTE
College Station, Texas

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THD and TTI Research Project 2

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TEXAS TRANSPORTATION INSTITUTE
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SUMMARY

Transportation services in Texas are constantly changing to meet the changing requirements of different industries. Striking improvements have been made in both facilities and service during recent years. Other improvements and changes are needed, however, if Texas industries are to continue to expand at their recent rates.

This report attempts to measure and analyze the use of transportation by firms in the Texas food industry. An attempt is also made to determine the trends in usage and to point out those facets of transportation service which most need improvement.

TOTAL TRANSPORTATION USE

The Texas food industry utilizes all three of the major types of surface transportation—truck, rail and water—in the movement of its goods. Air transportation is utilized infrequently and is not considered as an economic alternative to the other types under present conditions. Specialized forms of surface transportation, such as railway express and parcel post, are used only for very small shipments and constitute a minor part of the total transportation requirements. For these reasons this report is primarily confined to an analysis of and the preferences for truck, rail and water shipments.

There were 482 food industry firms interviewed during this study. They handled a total of almost 2 million truck, rail and water shipments during 1956. These shipments weighed almost 23 billion pounds, for an average weight per shipment of over 11 thousand pounds. More than 93 percent of all shipments were handled by truck, about 6 percent by rail and less than 1 percent by water. Because of the heavier weights of rail and water shipments, however, the distribution of tonnage by carrier was quite different. Trucks handled 60

percent of the total weight while 38 percent was shipped by rail and 2 percent by water.

INCOMING AND OUTGOING

When the incoming and outgoing operations were examined separately, it was found that rail transportation was used almost twice as often in moving goods into the plants. Because of the greater number of L.C.L. shipments, however, the average weight per shipment was considerably lower on the incoming movement.

Outgoing operations accounted for slightly more than 75 percent of the truck shipments. A large number of these shipments, however, were local delivery runs, and were very small in size. This resulted in a lower average weight per shipment for the outgoing movement. A little over 60 percent of the total truck volume was outgoing movement.

The use of water transportation was also confined largely to the outgoing operation. Almost 90 percent of all water shipments and 95 percent of the total carried weight were recorded in the outgoing movement. The average weight per shipment was more than twice as heavy for outgoing shipments.

AREA, CITY SIZE AND FIRM SIZE

The comparison of transportation uses by areas of the state, size of the city in which the firm was located, and the size of the firm itself revealed several interesting differences in transportation usage.

West Texas, Area III, was the only area in which all the firms used truck transportation. There was also a greater percentage of firms in this area using rail transportation and a smaller percentage using water transportation than in either of the other two areas. A smaller percentage of

firms in Area I, the Gulf Coast Area, used truck and rail, while a larger percentage used water transportation than in either of the other areas.

The use of rail and water transportation was generally greater by the larger firms and by firms in the larger cities. This use generally declined with a decrease in the size of city in which the firm was located and the size of the firm itself. The percentage of both total shipments and total weight carried by truck was generally higher for the smaller size firms and firms located in the smaller cities.

TYPES OF FACILITIES

There are several alternative facilities available within each major type of surface transportation. A firm using trucks can ship in its own truck, a hired truck or a buyer's or seller's truck. It may also want to ship in less-than-truckload quantities, in single-unit truck, or in the larger tractor-trailer combinations. If shipping by rail, the shipment may be a carload, less-than-carload or car pool shipment. It may also be handled by a forwarding company. Water shipments may go by sea-train, by ship or by barge.

The selection of a specific method and type usually depends upon the characteristics of the shipment to be made — the perishability, ratio of weight and bulk to value, distance, speed required, cost, and the availability of the firm to different facilities.

DISTANCE

Distance is also very important in determining which type and kind of facility will be used for particular shipments. The average distance per shipment for all intercity truck and rail shipments combined was just over 300 miles. Rail shipments averaged almost 525 miles in length. Truck shipments, on the other hand, moved only about half that distance. The incoming movements by both truck and rail involved considerably longer

distances than the outgoing movements.

When truck shipments were examined by ownership it was found that hired trucks traveled longer distances — an average of over 400 miles per shipment. Sellers' and buyers' trucks were second in average distance with over 225 miles per shipment, while a firm's own trucks, traveled the shortest distance, 165 miles per shipment.

Comparisons by types of trucks revealed that the longer shipments were the truckload shipments made in tractor-trailer combination trucks. They averaged more than 345 miles per shipment. They were followed closely by the L.T.L. movement with an average of over 325 miles per shipment. The shortest shipments were made in the single-unit or straight trucks and averaged only 90 miles.

It was found that less than carload rail shipments traveled a much greater distance than carload shipments. L.C.L. movements averaged 635 miles per shipment compared to 490 miles for the C.L. movement.

TRENDS IN USE

There have been significant changes in the relative use of truck, rail and water transportation by Food Industry firms during recent years. This trend has generally been toward using more trucks and less rail in the total transportation picture. The trend toward greater use of trucks has been particularly strong in the incoming phases of the business. Over 20 percent of the interviewed firms stated that the use of trucks in bringing goods into the plant is proportionately greater and the use of rail proportionately less now than 5 years ago. The shift from rail to truck has been less pronounced in the outgoing phase of Food Industry operations. There has been little change in the relative use of water transportation over the past 5 years.

The shift from rail to truck will continue over the next few years, although at a decelerated rate. About

9 percent of the firms expect to shift their incoming operations from rail to truck during the next 5 years, and only 3 percent expect to shift their outgoing operations. The percentage of firms anticipating an increase in the proportionate use of rail is insignificant in both incoming and outgoing operations. Very little change is expected in the use of water transportation.

SUBSTITUTABILITY OF TRANSPORTATION

Many people consider that all forms of transportation are freely competitive with each other and that a high degree of physical substitution exists between them. This concept is very often erroneous. Certain types of transportation are best suited for certain types of shipments and are entirely unsuited for others. Frequently it was found, for instance, that truck shipments could not be economically shifted to rail. Over 83 percent of the firms interviewed reported that none of their outgoing truck shipments could be handled by rail. Most of the remaining firms felt that only a relatively small proportion of their incoming truck business could be shifted to rail.

The ability to shift rail shipments to truck was more generally reported. Almost a fourth of the firms felt that they could shift almost completely from rail to truck. Even here, however, the facilities were far from interchangeable. Over 20 percent of the firms could not shift any of their incoming rail to truck. Almost a third could not shift their outgoing rail operations.

Less than 5 percent of the firms could substitute water transport for any of their rail and truck operations. Only one firm could shift as much as 50 percent of its truck and rail movement to water. The ability to shift from water to rail or truck was also very limited. Over 75 percent of the firms felt that they could not economically shift any of their water operation.

The flexibility of use between different kinds of transportation is in general very limited.

PRIVATE VS. HIRED TRUCKS

Most food industry firms used both their own and hired trucks. The advantages of each type of operation depend upon many factors. Firms using their own trucks believed that they were more economical and convenient, and that a firm could offer better service through having direct control of the shipment all the way to the customer's door.

Advocates of hired trucks, however, felt that it was more economical for a firm to hire a commercial trucking company for truck shipments than to own its trucks. This point was particularly emphasized in long distance L.T.L. movements. They also felt that the lower capital requirements, wider geographic coverage, and reduced liability were all important advantages to using hired trucks.

Since little comparative cost accounting work has been done in this field, actual economic advantages are very difficult to determine. Many firms rely upon past experience in choosing the program they will use, and personal preference of management is sometimes the determining factor.

FACTORS INFLUENCING THE CHOICE OF TRANSPORTATION

Factors, other than cost and speed of service, which most influenced a firm's choice of either truck or rail transportation were determined. Better service to customers, convenience, less damage to merchandise, and better refrigeration service were among the major advantages listed for trucks. Another reason often given for using trucks was that they provide the only adequate service for a local operation. The most frequently mentioned factors influencing a firm's choice of rail transportation were convenience of handling and the in-transit billing privileges offered by rail.

Many miscellaneous factors were listed for both rail and truck. In addition it was generally concluded that under certain conditions both truck and rail facilities offered different advantages for different types of shipments.

IMPROVEMENTS NEEDED IN TRANSPORTATION

Although both the rail and trucking industry have done a tremendous job in providing the continually increasing services demanded by the food industry, there are still areas in which further improvements are needed.

According to the firms interviewed, improvements in rail transportation are most needed in increasing the speed of service, preventing damage to merchandise, improving overall service, reducing freight rates and speeding up terminal transactions.

Users of commercial truck transportation feel that major improvements could be made by lowering freight rates, reducing damage to merchandise, improving organization and routing, and improving delivery service.

Private truck operators feel that a system of uniform laws between states, an increase in weight limits, lower taxes, fees and licenses, and an increase in speed limits are the most needed improvements in private trucking.

Other needed improvements were mentioned by a smaller number of firms. The transportation industry could well afford to review these suggestions in their program of continual service improvement.

TRUCK WEIGHTS AND LOAD LIMITS

The adequacy of legal load limits in Texas has long been debated with-

in the trucking industry and by legislative and regulatory groups. Most of these arguments, however, have been advanced by either the trucking industry or its opponents. Little effort has been made toward determining the needs of the industries which actually make the shipments. In an attempt to do this, the normal maximum size of truckloads handled by the food industry firms was determined and each firm was asked if present load regulations were adequate for its business. Suggestions for amending these regulations were then recorded.

Almost 50 percent of the firms normally handle truck loads in excess of 30,000 pounds. Twenty-seven percent handle loads over 35,000 pounds, and less than 5 percent handle loads of over 40,000 pounds. The size of the loads handled was influenced greatly by the size of the firm questioned. The larger the firm the greater the proportion of heavier loads carried.

The desire for increased weight limits was also influenced by the size of the firm. About 35 percent of the large firms desired an increase in load limits. In contrast, only about 5 percent of the smaller firms felt that higher limits were needed.

Of the 482 firms in the study, over 16 percent stated that increases were needed in weight limits. There were 37 different suggestions made regarding the proper limits at which new regulations should be set. Most of these suggestions were directed toward increasing the overall gross load limit. Increases in axle limits were also suggested along with numerous other special changes. These suggestions should be considered in any review or revision of present regulations.

INTRODUCTION

The cultural pattern of Texas prior to the Civil War revealed a sparsely settled and extensively rural population with meager communication and transportation facilities. The more or less self-sufficing family unit produced about all the food products that were required by rural people. Home-canned fruits and vegetables and home-cured meats were supplemented by fresh eggs, milk and garden produce in season. Only a few products such as sugar, tea, coffee, salt and spices were transported or traded extensively. There were no large cities in the state to stimulate an extensive off-farm movement of food products.

Since that time, however, Texas has become progressively urbanized. Now less than 12 percent of the people live on farms, and few of these have a self-sufficing food supply. This altered cultural pattern emphasizes the requirements and importance of transportation in the food industry.

The concentration of population in urban centers has increased the need for rapid and dependable conveyance of food supplies from the farm to local markets, food processors, and centers of population. The farm-to-market roads, modern highways and railways all lead in the proper direction to nourish the cities.

Because food is available in abundance and in almost any form, size or type of package that is desired, it is largely taken for granted. Few realize the extensive network and tremendous volume of transportation that is required to assure an effective

distribution of this food in our urbanized economy.

In 1956, Texas had an estimated population of almost 9 million people. Studies have shown that the average per capita consumption of food is approximately 1,628 pounds annually. Simple arithmetic would then show that well over 7 million tons of food would be required just to feed our own state population. In addition, since Texas is a surplus food producing state, other vast quantities of food products are shipped to other states or exported each year.

The great majority of all this food must be transported several times before it is available to the consumer. For example, the fresh tomato, which is consumed as a fresh vegetable with no processing, will usually require three separate movements between harvesting and its appearance on a grocer's shelves. It is moved from the farm to the packing shed, shipped from there to a wholesale terminal market where it is purchased by the retailer and shipped on to his store. Several additional transportation steps may be required if manufacturing or processing are necessary.

When one realizes that this is only one of hundreds of food products that are consumed daily by families in Texas and that each product will have a different transportation pattern, it is much easier to appreciate the complexity of our transportation problem. It is the purpose of this report to try to analyze this complex system so that we may gain a better understanding of its operation.

METHOD OF STUDY

This study is based on 482 questionnaires which were completed in the summer and fall of 1956. These schedules were taken by personal interview with food manufacturing and wholesaling firms. They were designed to show the amounts and types of

transportation used by each firm in both its receiving and shipping operations, the trends in this usage, and the amount or degree of possible substitution that exists between types of transportation. In addition, an attempt was made to determine the

AREA DIVISIONS OF THE STATE

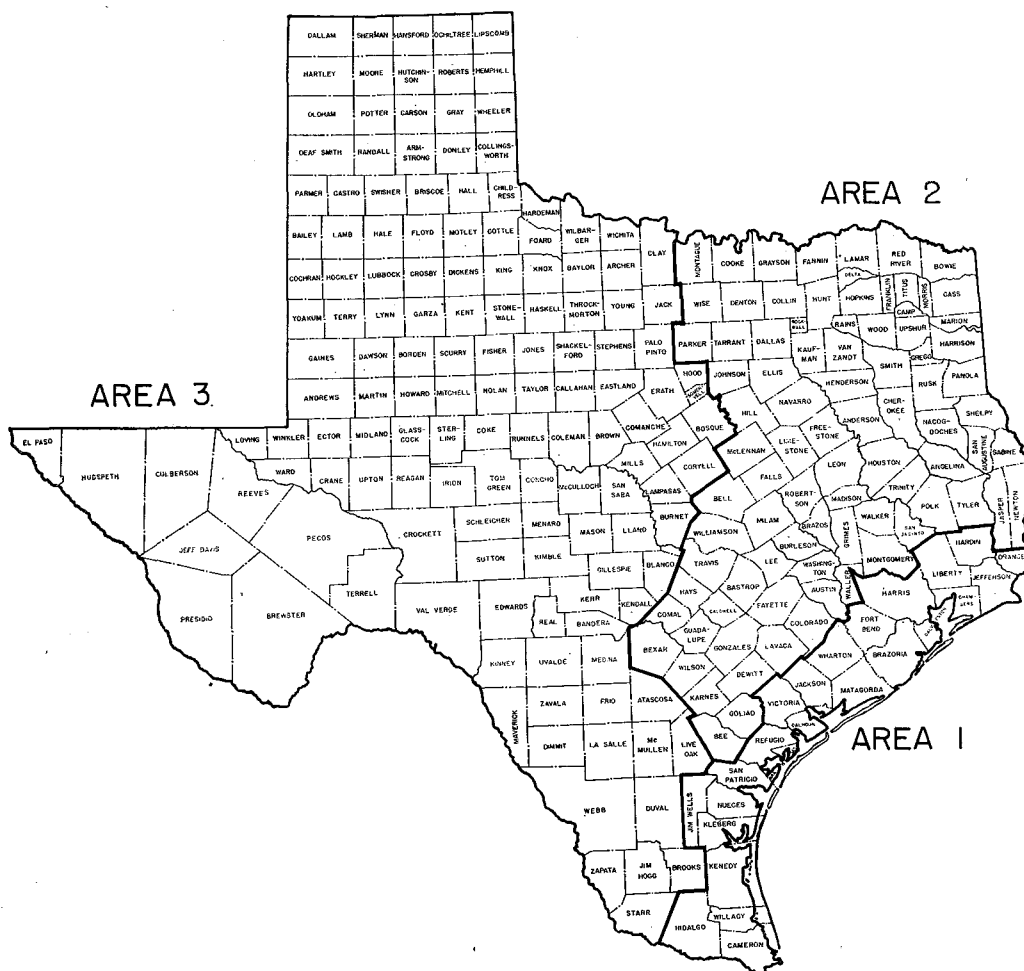


Figure 1.

transportation preferences of each firm and find what changes are needed to make each type of transportation more suitable to the individual firm's operation.

Texas Employment Commission records, based on the Standard Industrial Classification system of industry identification and grouping, were used to determine the universe of the

TABLE 1—FOOD INDUSTRIES STUDIED

Standard Industrial Classification Code		Number of Firms Studied
MANUFACTURING INDUSTRIES		
2011	Slaughtering and Meat Packing	32
2015	Poultry Dressing and Packing	13
2024	Ice Cream and Flavored Ices	17
2033	Canned Fruits, Vegetables, Soups and Jellies	17
2035	Pickled Fruits, Vegetable and Salad Dressings	10
2037	Frozen Fruits, Vegetables and Sea Foods	4
2041	Flour and Grain Mill Products	15
2044	Rice Cleaning and Polishing	4
2051	Bread and Other Bakery Products	46
2071	Candy and Other Confectionery Products	14
2081	Bottled Soft Drinks and Carbonated Water	58
2082	Malt Liquors (Beer)	6
2094	Corn Sirup, Sugar, Oil and Starch	3
2097	Ice	34
2099	Miscellaneous Food Preparations	21
	TOTAL	294
WHOLESALE INDUSTRIES		
5041	Groceries and Food Specialties	71
5042	Beer, Wine and Liquors	35
5051	Farm Products, Consumer Goods	50
5141	Assemblers of Farm Products	32
	TOTAL	188

study. A variable stratified sample of firms was selected from each representative group of firms. The different industries included in the study and the number of firms studied in each are shown in Table 1.

As can be seen from this table, the firms have been grouped into the two major classifications of food manufacturers and food wholesalers. The Standard Industrial Classification numbers in the first column identify the different kinds of industries within each of those major categories.

To develop greater homogeneity within industries, each of the industries listed above were stratified as shown below before the sample was drawn. The stratification included three steps as follows:

1. Areas

The state was divided into three areas according to density of population and proximity to water transportation facilities. These areas are shown in map (Figure 1).

Area 1: Gulf Coast
Area 2: East Texas
Area 3: West Texas

2. City Size

To isolate characteristics which may be peculiar to firms located in cities of different size, the firms in each industry were further divided into three classes in accordance with the size of the city in which they were located. These classes are:

City Size 1: Over 50,000 population
City Size 2: 10 - 50,000 population
City Size 3: Under 10,000 population

TABLE 2—NUMBER OF MANUFACTURING AND WHOLESALE FIRMS BY AREA, CITY SIZE AND FIRM SIZE

STRATA			NUMBER OF FIRMS		
Area	City Size	Firm Size	Manufacturing Industries 2011 to 2099	Wholesaling Industries 5041 to 5141	Total
1	1	1	16	7	23
1	1	2	22	19	41
1	1	3	7	6	13
1	2	1	6	4	10
1	2	2	15	10	15
1	2	3	5	3	8
1	3	1	5	2	7
1	3	2	8	9	17
1	3	3	2	5	7
Sub-Total					
AREA I			86	65	151
2	1	1	22	10	32
2	1	2	39	21	60
2	1	3	9	11	20
2	2	1	12	1	13
2	2	2	23	8	31
2	2	3	6	5	11
2	3	1	7	2	9
2	3	2	12	14	26
2	3	3	11	8	19
Sub-Total					
AREA II			141	80	221
3	1	1	10	6	16
3	1	2	19	11	30
3	1	3	3	5	8
3	2	1	4	0	4
3	2	2	12	7	19
3	2	3	3	3	6
3	3	1	3	1	4
3	3	2	6	8	14
3	3	3	7	2	9
Sub-Total					
AREA III			67	43	110
TOTAL					
All Areas			294	188	482

TABLE 3—PERCENTAGE DISTRIBUTION OF FIRMS IN THE SAMPLE BY CITY SIZE AND FIRM SIZE BETWEEN AREAS OF THE STATE

	Area 1	Area 2	Area 3
	Percent	Percent	Percent
City Size			
1	51	51	49
2	28	25	26
3	21	24	25
Firm Size			
1	26	24	22
2	55	53	57
3	19	23	21

3. Firm Size

To further isolate characteristics which may be peculiar to firms of different sizes, the universe was divided into three groups on the basis of employment of the individual firm. These classes are:

- Firm Size 1: Over 50 employees
- Firm Size 2: 9 - 49 employees

Firm Size 3: Under 9 employees

This procedure allowed the firms within each four-digit industry to be classified into homogeneous groups according to their location within the state, the size of the city in which they were located and the size of the firm itself. It was possible to have a maximum of 27 separate strata within each of the 19 industries. Sample firms were then randomly selected from each stratum by industries. The rate of sampling was determined by the number of firms within the stratum, and varied from 15-100 percent. The number of manufacturing and wholesaling firms selected from each sample stratum is shown in Table 2.

The percentage distribution of firms by city size and firm size within each area is shown in Table 3.

TOTAL TRANSPORTATION USE

Since the general term "Food Industry" implies a certain homogeneity, it would be well to emphasize at the beginning that the food industry is composed of many widely different kinds of industries. Their greatest point of similarity lies in the fact that they all either process or otherwise handle a product that is consumed by people as food. The actual production, warehousing, processing and distribution procedures and the resulting transportation requirements will vary markedly between different types of industries and often between firms within a single industry.

For purpose of simplicity and convenience, the term "food industry" will be used in this report to include all of the industries and firms studied. "Food manufacturers" will include the 294 manufacturing firms in 15 S.I.C. (Standard Industrial Classification) four digit industry groups, and "food wholesalers" will include the remaining 188 firms in 4 S.I.C. industry groups. Individual industries will be referred to by either their S.I.C. number, such as 2011, or its descriptive title, in this case, "Slaughtering and Meat Packing".

The food industry requires the service of all three of the major forms of surface transportation. The extent to which each is used may depend on one or many peculiarities or requirements of the individual firm. Factors such as the size of shipment, ratio of weight to bulk, distance of shipment, perishability of the product, urgency of shipment, availability of both owned and hired transportation equipment, physical design of the plant, and, of course, the cost are all to be considered when determining how a particular shipment shall be moved. In cases where two types of transportation will serve equally well, the decision as to which to use often depends upon the personal preferences of the firm's transportation management.

COMBINED USE

Table 4 readily shows the relative use made of the three major forms of transportation by the food industry. This table includes both the incoming and outgoing movement of goods and is intended to compare the extent of the use of truck, rail, and water transportation in the total operation of the industry.

The predominant use of truck transportation is indicated by the fact that over 93 percent of all shipments and 60 percent of the total weight were moved by truck (Figure 2). The difference between the two percentages may seem unreasonable until one examines the difference in the size of shipments carried by the three forms of transport. The average weight of shipments carried by truck was only a little more than 10 percent as large as those carried by rail, which was in turn less than two-thirds as large as the water shipments.

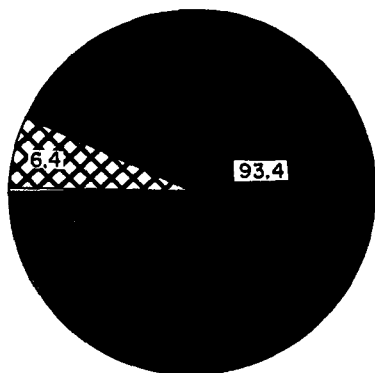
Truck shipments are limited in size by three major factors: the capacity of the truck, the legal weight limitations imposed by the state, and the nature of the operation the vehicle is to perform. Rail and water facilities, on the other hand, are primarily tailored to handle large shipments. Rather stringent minimum weight regulations are an added inducement to the rail or water shipper to move his goods in large quantities. These factors are all reflected to a certain extent in the proportion of the total business handled by each type of transportation. Since trucks are more suited to moving small loads

TABLE 4—COMPARATIVE USE OF TRUCK, RAIL AND WATER TRANSPORTATION BY 482 TEXAS FOOD INDUSTRY FIRMS, 1956

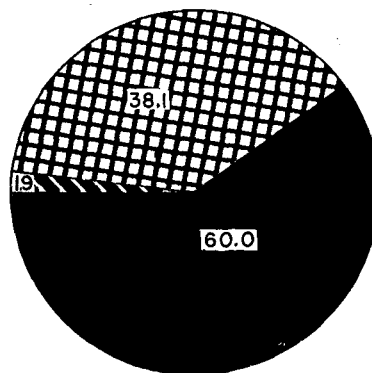
	Number of Shipments	Total Weight	Average Wt. Per Shipment
	Thousands		Pounds
Truck	1,847.9	13,695.7	7,411
Rail	127.4	8,682.7	68,122
Water	3.9	432.7	110,663
TOTALS:	1,979.2	22,811.1	11,525

COMPARATIVE IMPORTANCE OF TRUCK, RAIL AND WATER TRANSPORTATION IN TEXAS FOOD INDUSTRIES 1956

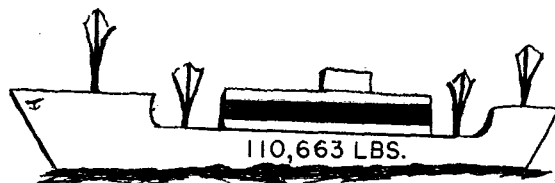
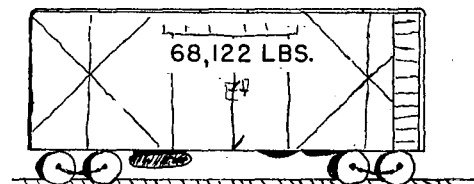
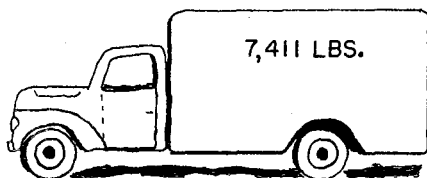
PERCENT OF TOTAL
SHIPMENTS



PERCENT OF TOTAL
WEIGHT



AVERAGE WEIGHT PER SHIPMENT



+ 0.2% OF SHIPMENTS BY WATER

Figure 2.

for relatively short distances, they have taken over the major portion of that type of movement. Railroads can operate most economically by carrying heavy loads over long distances and have enjoyed a historically predominant position in moving this type of shipment to and from inland points. Water facilities in turn have a strong advantage in cost when large volumes are moved long distances through points convenient to port facilities. The advantages of each type of transportation are instrumental in determining the extent to which it is used by the food industry.

INCOMING AND OUTGOING

A better view of the transportation requirements of the food industry can be seen when incoming and outgoing requirements are viewed separately. The character of these movements vary quite markedly. The extent of the variation will, of course, depend upon the particular procurement practices and sales areas of the individual firms concerned.

As a general rule, however, goods being moved into a plant are shipped rather infrequently and in large quantities, while shipments out of the plant occur much more frequently and are considerably smaller in size. A bakery, for instance, will likely receive its flour and sugar in large quantities once or twice a month, but will make numerous shipments each day in distributing its bread and pastries. The same would hold true for a non-manufacturing industry such as a wholesale grocer. Infrequent large-volume incoming shipments are warehoused and then distributed in many small shipments to retail stores. With some notable exceptions, such as Industry 2044, Rice Cleaning and

Polishing, outgoing shipments are largely in the form of personalized deliveries of rather small quantities.

Table 5 shows the extent of the transportation required in both the incoming and outgoing movement of goods by the studied firms. The differences in both total number of shipments and the average weight per shipment for the two types of movement are pointed out quite dramatically here and in Figure 3. Not only is there a sharp difference in the number and size of incoming and outgoing shipments, but there are also striking differences between the types of transportation used.

The great majority of all firms studied used trucks to some extent at least in both their incoming and outgoing operations. Because of the smaller size requirements and the personalized delivery practices of most outgoing shipments, and local deliveries in particular, more firms used trucks for this purpose than to bring goods into the plant. The actual difference is rather small, however, since over 96 percent of all firms studied used trucks for both purposes.

In contrast, rail, while used by considerably fewer firms for either incoming or outgoing shipments, was used much more extensively in bringing goods into the plant. Almost 60 percent of the firms received some goods by rail while less than 20 percent utilized rail for their outgoing shipments.

There was little difference in the water transport for incoming or outgoing shipments. Less than five percent of the firms used water transportation for either purpose.

TABLE 5—COMPARISON OF INCOMING AND OUTGOING TRANSPORTATION USE BY 428 FIRMS OF THE TEXAS FOOD INDUSTRY, 1956

	Firms Using		Number of Shipments		Total Weight		Average Weight Per Shipment	
	In	Out	In	Out	In	Out	In	Out
			Thousands	Thousands	Million Pounds	Million Pounds	Thousands	Thousands
Truck	465	475	459.4	1,388.5	5,194.3	8,501.4	11.3	6.1
Rail	285	94	79.6	47.8	4,978.9	3,703.8	62.5	77.5
Water	20	18	.5	3.4	23.9	408.8	50.8	118.9
TOTALS:			539.5	1,439.7	10,197.1	12,614.0	22.2	8.8

Several other distinct differences in the use of the three types of transportation should be pointed out here. Trucks carried 85 and 96 percent respectively of the total incoming and outgoing shipments with rail accounting for most of the remainder. Wa-

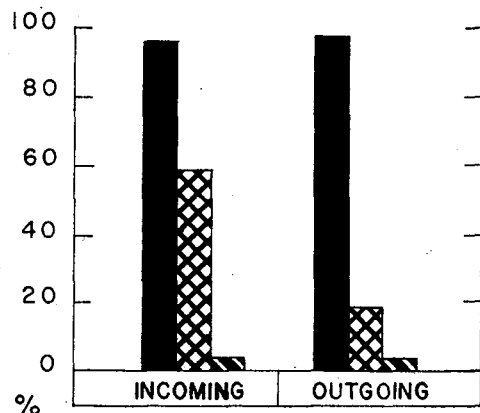
ter transportation was used for less than 1 percent of the shipments in each case.

Rail transportation was used much less frequently than truck. Due to the much greater weights carried per

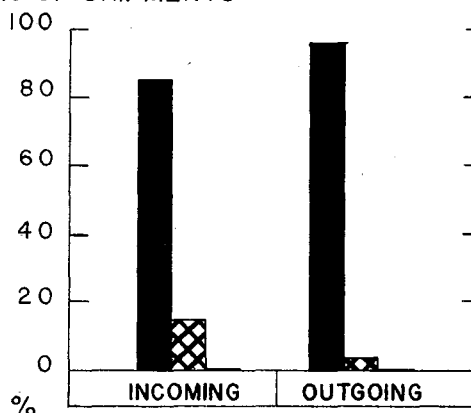
PERCENTAGE OF INCOMING AND OUTGOING TOTALS BY CARRIER

1956

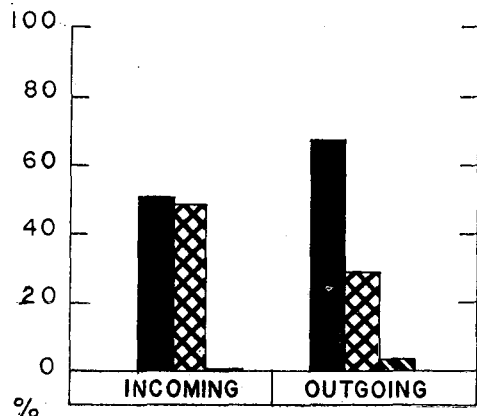
% OF USING FIRMS



% OF SHIPMENTS



% OF WEIGHT



AVERAGE WEIGHT PER SHIPMENT

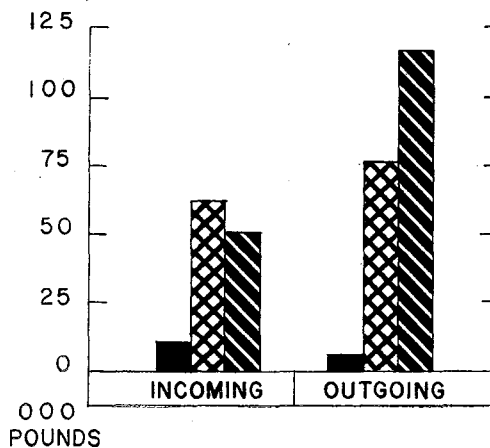


Figure 3.

TABLE 6—TRANSPORTATION USE BY INDUSTRIES

TOTALS				TRUCK				RAIL				WATER				
INDUSTRY	Total Firms	Shipments	Weight	Average Weight	Firms Using	Percent Shipments	Weight	Average Weight	Firms Using	Percent Shipments	Weight	Average Weight	Firms Using	Percent Shipments	Weight	Average Weight
	Number	Number	Million Pounds	Pounds	Percent	Percent	Percent	Pounds	Percent	Percent	Percent	Pounds	Percent	Percent	Percent	Pounds
INCOMING																
Manufacturing																
2011	32	42,112	393.2	9,337	100.0	95.3	98.6	9,655	31.2	4.6	1.4	2,814	8.1	0.1		600
2011	13	13,203	124.0	9,382	100.0	99.0	99.9	9,360	15.4	0.1	0.4	42,500				
2024	17	18,642	40.7	2,183	100.0	97.8	90.3	2,016	70.6	2.2	9.7	9,768				
2033	17	36,014	421.5	11,704	100.0	96.5	88.4	10,719	70.6	3.4	10.2	34,600	5.9	0.1	1.4	500,000
2035	10	11,906	176.3	14,808	100.0	94.4	82.3	12,912	70.0	5.6	17.6	46,960				
2037	4	2,881	25.9	8,990	75.0	99.3	96.5	8,738	50.0	0.7	3.5	42,857				
2041	15	39,680	1,476.1	37,200	100.0	72.3	53.9	18,467	93.3	27.7	64.1	86,108				
2044	4	4,672	309.1	66,160	50.0	21.2	4.5	13,938	100.0	78.8	95.5	80,245				
2051	46	28,021	195.3	6,970	100.0	92.9	51.3	3,848	50.0	6.9	48.4	49,159	2.2	0.2	0.3	10,000
2071	14	7,829	54.0	6,897	100.0	83.3	43.4	3,517	64.3	16.4	54.3	22,819	7.1	0.3	3.3	75,000
2081	58	20,992	146.5	6,979	100.0	87.6	90.9	7,242	63.8	12.4	9.0	5,075	1.7		0.1	50,000
2082	6	16,420	428.6	26,102	100.0	67.5	39.5	15,289	100.0	32.5	60.4	48,534	16.7		0.1	46,000
2094	3	8,027	352.7	43,939	100.0	78.1	55.3	31,149	66.7	21.9	44.7	89,432				
2097	34	4,108	17.4	4,236	100.0	98.3	96.0	4,133	20.6	1.7	4.0	9,704				
2099	21	17,744	188.6	10,629	100.0	94.8	83.7	9,339	66.7	5.2	16.3	33,229				
Wholesaling																
5041	71	78,050	630.8	8,082	85.9	79.3	48.3	4,925	67.6	20.4	50.0	19,805	12.7	3.0	1.7	42,996
5042	35	18,878	456.9	32,923	88.6	71.1	46.7	21,619	85.7	28.1	52.3	61,330	11.4	0.8	1.0	38,763
5051	50	63,644	598.5	9,404	100.0	94.5	80.9	8,045	46.0	5.5	19.1	32,797	2.0			1,000
5141	32	111,719	4,161.2	37,247	100.0	79.0	42.4	19,973	71.9	21.0	57.6	102,194				
OUTGOING																
Manufacturing																
2011	32	115,753	284.6	2,459	100.0	99.9	97.0	2,389	28.1	0.1	2.7	57,948	6.2		0.3	40,000
2015	13	39,367	140.9	3,579	100.0	100.0	100.0	3,578								
2024	17	32,610	100.1	3,070	100.0	100.0	100.0	3,069								
2033	17	23,618	326.5	13,824	100.0	97.1	87.6	12,484	52.9	2.0	7.4	52,072	29.4	0.9	5.0	75,595
2035	10	23,510	196.9	8,375	100.0	99.9	100.0	8,378	10.0	0.1		3,000				
2037	4	1,330	31.5	23,684	100.0	92.1	73.3	18,819	25.0	7.9	2.67	80,000				
2041	15	37,880	1,226.2	32,371	93.3	70.8	41.6	19,040	86.7	27.8	49.9	58,076	13.3	1.4	8.5	197,570
2044	4	4,564	263.8	57,800	75.0	52.6	7.7	8,454	100.0	31.8	40.9	74,412	100.0	15.6	51.4	190,309
2051	46	147,677	266.4	1,804	97.8	100.0	100.0	1,804	2.2			100				
2071	14	22,292	51.4	2,306	100.0	98.9	99.8	2,325	14.3	1.0	0.2	674	7.1	0.1		100
2081	58	234,407	1,761.9	7,516	100.0	100.0	100.0	7,516								
2082	6	55,083	1,152.3	20,919	100.0	93.5	78.5	17,561	83.3	6.5	21.5	69,643				
2094	3	8,399	374.8	44,624	100.0	48.8	23.2	21,149	33.3	28.6	38.4	60,000	33.3	22.6	38.4	75,949
2097	34	187,167	400.4	2,139	97.1	98.6	89.3	1,937	11.8	1.4	10.7	16,276				
2099	21	47,182	303.6	6,435	95.3	99.6	97.1	6,277	14.3	0.4	2.9	44,233				
Wholesaling																
5041	71	156,629	592.7	3,784	100.0	99.3	89.0	3,394	9.9	0.7	10.9	55,820	1.4		0.1	130,000
5042	34	74,884	573.0	7,652	100.0	97.9	88.6	6,930	40.0	2.1	11.4	40,719				
5051	50	128,270	655.9	5,113	100.0	99.8	100.0	5,123	2.0	0.2		250				
5141	32	99,085	3,910.9	39,470	93.8	76.7	39.2	20,173	59.4	23.3	60.6	102,715	6.2		0.2	154,981

rail shipment, however, there was little difference in the amounts of incoming goods carried by the two means. Trucks handled 51 percent of the total incoming weight while rail carried almost 49 percent. In the outgoing movement trucks handled over two-thirds of the total weight and less than 30 percent was shipped by rail.

There were marked differences in the average weights carried by each type of transportation for both incoming and outgoing movements. Incoming truck shipments were almost twice as large as the outgoing shipments. Rail and water shipments, however, had an opposite relationship. Outgoing rail shipments averaged almost 25 percent heavier than the incoming shipments while outgoing water shipments were more than twice as heavy.

This "reversal of form" can be explained by examining the firms that use rail and water to distribute their outgoing goods. Table 6 shows the relative use and average weight of shipments handled by the 19 different sub-industries. Two four-digit industries, the "Assemblers of Farm Products" and "Flour and Grain Mills Products" industries, accounted for over 80 percent of the outgoing rail volume. Both of these industries bought in small individual quantities and shipped in bulk to large quantity

buyers. Their products, mainly grain and flour, are of the type that load very heavy. Consequently, the outgoing rail shipments from these firms were larger than the average of all incoming rail shipments, which included a larger proportion of high bulk, low weight and less-than-car-load shipments.

The difference in size between incoming and outgoing water shipments can be similarly explained. Over half of the total outgoing weight was handled by the two sub-industries, "Rice Cleaning and Polishing" and "Flour and Grain Mill Products." Their shipments averaged over 190,000 pounds and were generally export shipments to foreign markets. A much larger proportion of the incoming water movement on the other hand was coastal shipping between Texas and other U.S. points. These coastal movements were much smaller than the export movement.

The total weight of outgoing shipments exceeded the total weight of incoming shipments by almost 20 percent. The gain in weight may be attributed to the food manufacturing rather than to the wholesaling firms. Water, added in the production of beverages and used in the manufacture of ice, was the factor that contributed most heavily to the increase in weight.

TRANSPORTATION USE BY AREA, CITY SIZE, AND FIRM SIZE

Previous work has suggested that the area of the state, the size of city in which a firm is located, and the size of the firm itself may be important factors in determining the transportation requirements of a particular firm.

That is, similar-sized firms, within the same sub-industry classification and located within similar size cities, could have rather dissimilar requirements for conducting the transport part of their business, depending upon their location in the state. This difference could be caused by any of several possible factors such as distance to the area of supply, extent of the normal marketing or distribution area, differences in the availability of certain forms of transportation, differences in rate struc-

tures or services, and customary practices within a certain area.

The transportation requirements of similar firms located in the same area of the state, but in different size cities could also be influenced by these same factors. In addition, factors such as ease of delivery, accessibility of the firm, and traffic conditions could also influence a particular firm's choice of transportation.

Firm size is an important factor in determining both the choice of transportation and the extent of its use. Two firms differing in size although of the same sub-industry group and located within a given city, expectedly would have different transportation requirements. The larger firm would be expected to en-

PERCENT OF FIRMS IN THE TEXAS FOOD INDUSTRY USING TRUCK,
RAIL OR WATER FOR INCOMING GOODS-1956

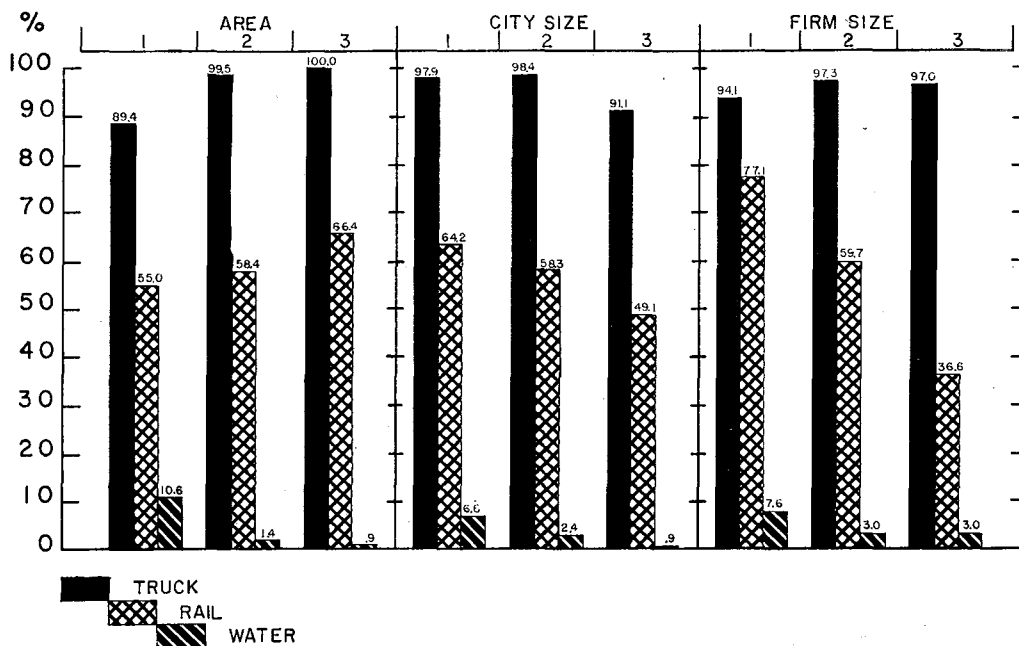


Figure 4.

TABLE 7—TOTAL INCOMING TRANSPORTATION
USE BY AREA, CITY SIZE & FIRM SIZE, 1956

		Truck	Rail	Water	Totals
FIRMS USING					
		Number	Number	Number	Number
Area	1	135	83	16	151
	2	220	129	3	221
	3	110	73	1	110
City Size	1	238	156	16	243
	2	125	74	3	127
	3	102	55	1	112
Firm Size	1	111	91	9	118
	2	256	157	8	263
	3	98	37	3	101
TOTAL INCOMING SHIPMENTS					
		Thou- sands	Thou- sands	Thou- sands	Thou- sands
Area	1	120.6	22.0	0.4	143.0
	2	164.6	33.8	0.0	198.4
	3	174.2	23.9	0.0	198.1
City Size	1	231.7	53.7	0.4	285.8
	2	117.0	16.1	0.1	133.2
	3	110.8	9.7	0.0	120.5
Firm Size	1	196.4	50.5	0.2	247.1
	2	218.6	25.8	0.2	244.6
	3	44.5	3.3	0.0	47.8
TOTAL INCOMING WEIGHT					
		Million Pounds	Million Pounds	Million Pounds	Million Pounds
Area	1	1,121.5	942.2	21.2	2,084.9
	2	1,879.3	2,496.3	2.1	4,377.7
	3	2,193.4	1,540.5	0.7	3,734.6
City Size	1	2,913.7	3,559.7	19.9	6,493.3
	2	945.5	351.1	3.9	1,300.5
	3	1,335.1	568.1	0.1	1,903.3
Firm Size	1	3,009.2	3,695.2	20.2	6,724.6
	2	1,967.4	1,201.1	3.5	3,172.0
	3	217.8	82.6	0.2	300.6

joy certain economies, such as being able to buy in larger quantities and to schedule deliveries over more economical routing, that would not be available to the smaller firm. Both their total and proportionate transportation usage could be quite dissimilar.

This section examines the differences in the use of truck, rail and water transportation by firms of varying size, firms located in different size cities, and firms located in different areas of the state. An attempt will also be made to explain, in general terms, the reasons for these differences and to determine the extent to which the data conform to the expected pattern.

INCOMING

Figures 4, 5, and 6, and the summary table show the incoming use of truck, rail and water transportation by firms within each of the three areas, city sizes and firm sizes. The

PERCENT OF INCOMING SHIPMENTS BY TYPE OF CARRIER FOR
FIRMS IN THE TEXAS FOOD INDUSTRY,
1956

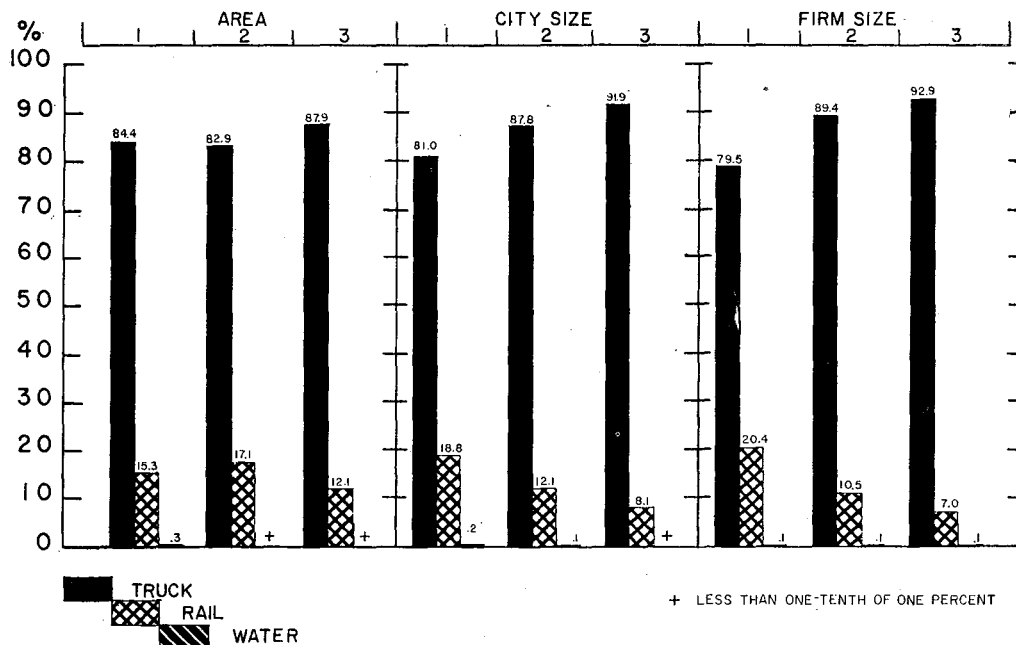


Figure 5.

first chart, Figure 4, shows the percentage of firms using each kind of transportation within each division.

Since over 90 percent of all firms included in the study used trucks for movement of goods into their plants, it could be expected that this use would remain relatively high throughout the various breakdowns. This is substantially true, although there are some variations. Fewer firms in Area I, the Gulf Coast Area, used truck than in either of the other two areas. This is explained in part by the fact that several firms in this area are shrimp processors who receive most of their goods directly from shrimp boats. Since these firms used few other products in their operations, they did not use trucks to any extent in moving goods into their plants. Other than these firms, the use of truck transport was almost universal within all three areas.

The shrimp processors are also largely responsible for the differences

in the use of trucks within the city size and firm size breakdowns. Most of the shrimp firms are located in the small coastal cities. Furthermore, since shrimp processing requires a high amount of hand labor in heading and cleaning, a larger percent of the firms contacted fell into the larger size classification; that is, they normally employed more than 50 employees.

Rail facilities were used by a greater percentage of firms in Area III, West Texas, than in either of the other two areas. As will be shown later, however, this use is much less intensive in this area. Both the percentage of shipments and percentage of total weight moved by rail was lower in Area III than in either of the other two areas.

It would be expected that the use of rail transportation would be more general in large cities due to their more extensive rail facilities. Since railroads are more suited to moving

PERCENT OF INCOMING WEIGHTS BY TYPE OF CARRIER FOR FIRMS
IN THE TEXAS FOOD INDUSTRY, 1956

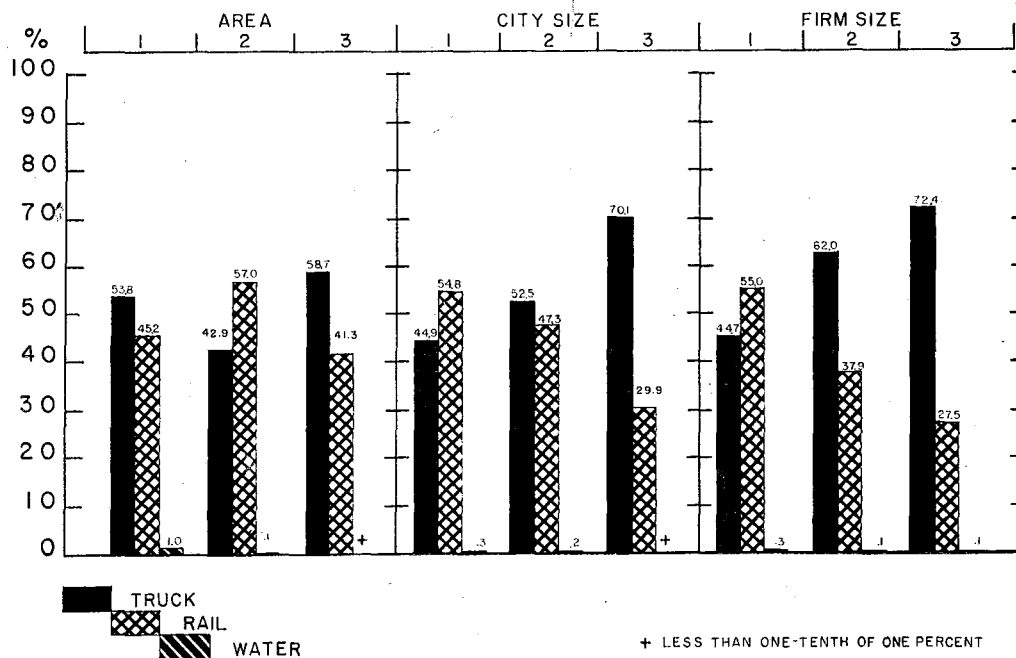


Figure 6.

goods in large quantities it could also be anticipated that rail would be more widely used by the larger firms, which normally ship in larger quantities. Figure 4 shows that this is the situation that exists in the food industry. The percentage of firms using rail decreased both with the decrease in the size of city in which the firm was located, and with the decrease in the size of the firms themselves.

For these same reasons—more extensive facilities and greater economies of size—the use of water facilities by firms in the three city and firm size groups followed the same pattern. Use of water transportation declined as the size of city and size of firm decreased. The use of water transportation, while not extensive in any area, was largely confined to firms in the Gulf Coast Area where all of the port facilities are located.

The frequency and total use of truck, rail and water transportation

for the incoming movement is shown in Figures 5 and 6. With the exception of the breakdown by areas, which reveals a definite pattern only in the case of water transportation, there is a definite progressive relationship shown in both the percentage of shipments and percentages of total weight carried by truck and rail. As the size of the city decreases there is a marked increase in both the percentage of shipments handled and percentage of weight carried by trucks, and corresponding decline in the use of rail. This same relationship is shown in the breakdown by firm sizes with the proportionate use changing even faster.

These relationships can be largely explained by the transportation opportunities available to small cities and small firms. Some of the smaller towns are not served directly by railroad facilities. Those towns have little incentive or opportunity to use rail facilities for other than occasional shipments, since there is an ad-

PERCENT OF FIRMS IN THE TEXAS FOOD INDUSTRY USING TRUCK,
RAIL OR WATER FOR OUTGOING GOODS-1956

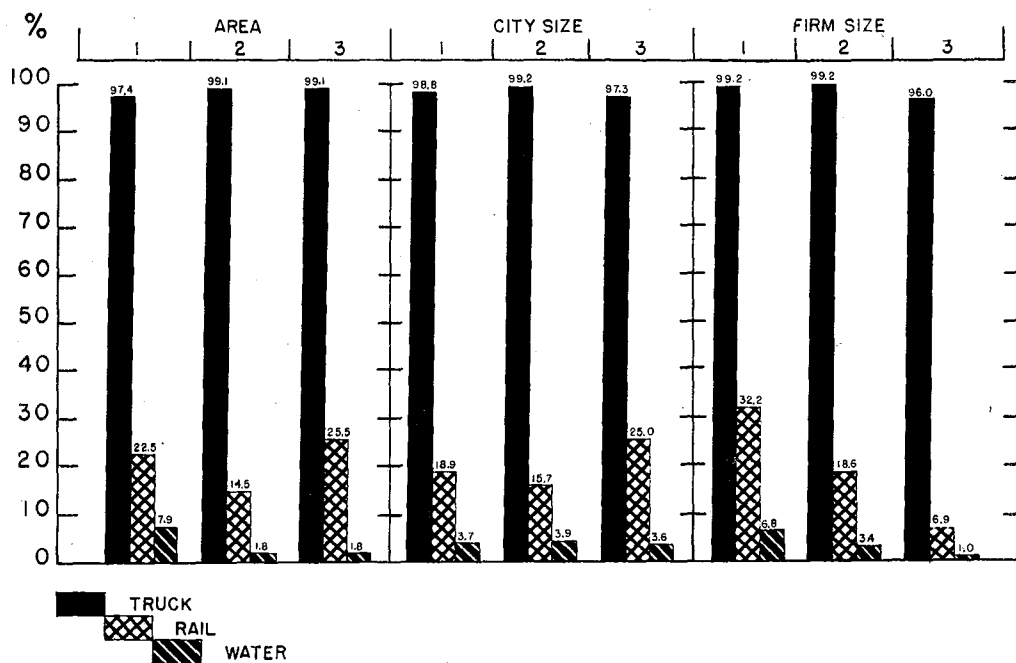


Figure 7.

ditional expense involved in moving the goods from the nearest railroad point to the plant. In addition, the smaller towns that do have rail services usually do not receive the frequency of service that is available in the larger cities. These two factors, availability of facilities and frequency of service, are of primary importance in determining the extent of use of rail transportation by firms in the smaller cities.

The more limited use of rail by the smaller firms can be explained by the size of incoming shipments handled by these firms and the direct rail connections available. Since the smaller firms naturally operate on a lower volume of business than the large ones, their total incoming movement is generally much smaller. And, since inventory costs are just as important to them, inventories are kept in line with sales by frequent, but smaller, purchases. Many of these purchases, if shipped by rail, would require L.C.L. rates, but could possibly be shipped as full truck loads. In addition, the smaller firms generally have insufficient rail volume to justify the building of rail sidings to the plant. In these cases, which are fairly general in the size 3 and the smaller of the size 2 plants, an additional cartage charge is incurred in moving the rail goods into the plant. All of these plants do, however, have some facilities for handling truck shipments. Since truck service is tailored more closely to the requirements of the small firms, it is only natural that the proportionate use of trucks would be greater in this size group.

The use of water transportation, expressed either as a percentage of total shipments or a percentage of total weight, is relatively minor. The Gulf Coast area, which uses more water transportation than all the rest of the state combined, had only one percent of its incoming goods moved by water, and only 0.3 of one percent of its incoming shipments were moved in that manner.

OUTGOING

The comparative use of truck, rail and water in the outgoing movement of goods was somewhat different from these uses in the incoming movement. This difference, however, was one of degree rather than kind. The basic pattern of use, with truck, rail and water being used in that order of importance, was accentuated in the movement of goods out of the firm. Table 8 shows the number of shipments, total weight carried and number of firms using each type facility.

The percentage of firms using trucks showed little significant variation between area, city size or firm size breakdowns. In general, the use of trucks was more widespread in the outgoing phase of the business. Over 96 percent of all the firms studied in each division used truck to some extent (Figure 7).

The use of rail within the industry showed a consistent relationship only with respect to firm size. A much greater percentage of the large firms used rail to ship at least part of their

TABLE 8—TOTAL OUTGOING TRANSPORTATION USE BY AREA, CITY SIZE & FIRM SIZE, 1956

		Truck	Rail	Water	Totals
FIRMS USING					
		Number	Number	Number	Number
Area	1	147	34	12	151
	2	219	32	4	221
	3	109	28	2	110
City Size	1	240	46	9	243
	2	126	20	5	127
	3	109	28	4	112
Firm Size	1	117	38	8	118
	2	261	49	9	263
	3	97	7	1	101
TOTAL OUTGOING SHIPMENTS					
		Thou-	Thou-	Thou-	Thou-
		sands	sands	sands	sands
Area	1	556.3	10.6	2.8	569.7
	2	495.4	23.3	0.5	519.2
	3	336.7	14.0	0.1	350.8
City Size	1	832.9	28.1	2.9	913.9
	2	307.5	11.0	0.4	318.9
	3	198.0	8.7	0.1	206.8
Firm Size	1	542.5	33.6	2.4	578.5
	2	632.5	13.4	1.0	646.9
	3	213.4	0.9	0.0	214.3
TOTAL OUTGOING WEIGHT					
		Million	Million	Million	Million
		Pounds	Pounds	Pounds	Pounds
Area	1	2,389.4	541.6	296.2	3,227.2
	2	3,430.9	1,807.9	104.3	5,343.1
	3	2,681.0	1,354.3	8.2	4,043.5
City Size	1	5,679.8	2,475.0	325.5	8,480.3
	2	1,617.9	587.4	68.7	2,274.0
	3	1,203.7	641.4	14.6	1,859.7
Firm Size	1	5,255.0	2,766.5	232.5	8,254.0
	2	2,834.3	920.1	176.0	3,930.5
	3	412.1	17.2	0.2	429.5

outgoing goods than did either of the other two size groups. Over a third of the large firms utilized this means of shipment compared to less than 19 percent of the middle-size firms and less than 7 percent of the small firms. As with incoming shipments, the progressive use of rail in relation to firm size can be largely attributed to the characteristics of shipments handled by firms in the different groups.

This same progressive pattern of use was also revealed in the percentage of firms using water transportation. Again the most general use was by those firms with 50 or more employees. Only one percent of the smaller firms used water facilities. As with the incoming shipments, however, there was a marked difference in the use of water transportation in relation to location within the state. The Gulf Coast Area, Area I, had a much greater proportionate use of water than did either of the other two areas. This, of course, is explained by their location near the deep

water ports and other channels of water commerce.

Perhaps the most striking comparison of uses is the percentage of total outgoing shipments moved by truck in relation to that moved by rail and water (Figure 8). This chart shows the tremendous utilization of trucks for the movement of goods out of the plant. Over 95 percent of all shipments were moved by truck in each division by area and city size, with little difference between the various divisions. There were, however, more significant differences between the firms of different sizes. The larger firms used a smaller percentage of truck and correspondingly more rail than did firms in the smaller size groups. The percentage of shipments handled by truck increased from 93.8 percent of the total for size 1 firms to 99.6 percent for those in firm size 3.

Because of the differences in average carried loads between different

PERCENT OF OUTGOING SHIPMENTS BY TYPE OF CARRIER FOR FIRMS
IN THE TEXAS FOOD INDUSTRY, 1956

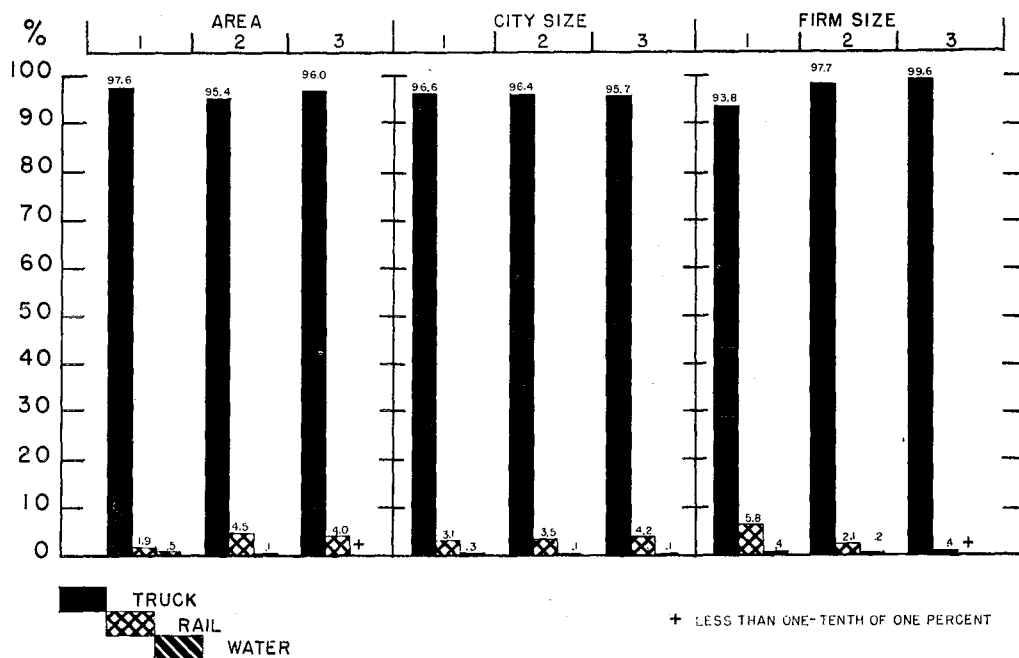


Figure 8.

type facilities, the proportion of total outgoing weight handled by truck was considerably lower than the percentage of shipments handled. Figure 9 shows the percentage of outgoing weight handled by each type of carrier. Here again the differences between strata are most pronounced in the classification by firm size. Large firms shipped less total volume by truck than did either of the other size groups. They also shipped more of their total volume by rail. Truck shipments accounted for less than 64 percent of total outgoing volume for size 1 firms, while over 33 percent were moved by rail. The smallest-

size firms moved almost 96 percent of their volume by truck and only 4 percent by rail.

The volume of movement by water was most significant for firms located in the Gulf Coast area. Over 9 percent of this group's outgoing volume was moved by water. West Texas firms, on the other hand, shipped only 0.2 of a percent of their outgoing goods by water. Both the small size firms and the firms in small cities used water facilities to move less than 1 percent of their total volume of goods.

PERCENT OF OUTGOING WEIGHT BY TYPE OF CARRIER FOR FIRMS
IN TEXAS FOOD INDUSTRY, 1956

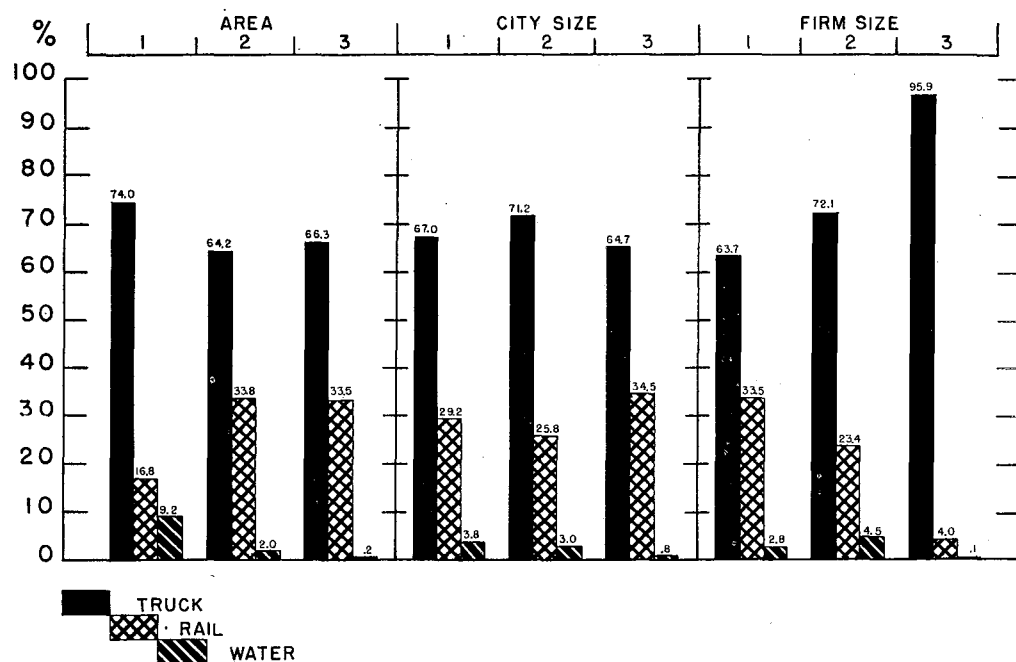


Figure 9.

TRANSPORTATION USE BY TYPE OF CARRIER

The preceding comparisons of the use of truck, rail and water transportation were concerned primarily with the relationship existing between them as major types of surface transportation. Actually, however, each of these major types offer different kinds of facilities and services. After deciding on the type of transportation he will use, the shipper may have a choice of more than one facility that is offered. For instance, if he ships by truck he may use his own truck, a hired truck or may require that the buyer pick up the goods in his truck. Depending on the size of the shipment, he may ship in less-than-truckload lots, in the smaller

single-unit trucks, or in large tractor-trailer combination trucks. If he uses rail he may ship in either carload or less-than-carload lots. He may also use the services of a forwarding company or join with another shipper to make up a pooled carload. If he uses water, he may have a choice between ship, barge, or sea train.

As a rule, no one firm will seriously consider all these alternatives. The characteristics of the shipment itself and the firm's own shipping facilities may limit the choice to only a very few. In consideration of the entire industry, however, all of these possibilities do exist. The use being made

TYPE OF TRUCK TRANSPORTATION USED BY TEXAS FOOD INDUSTRY, 1956

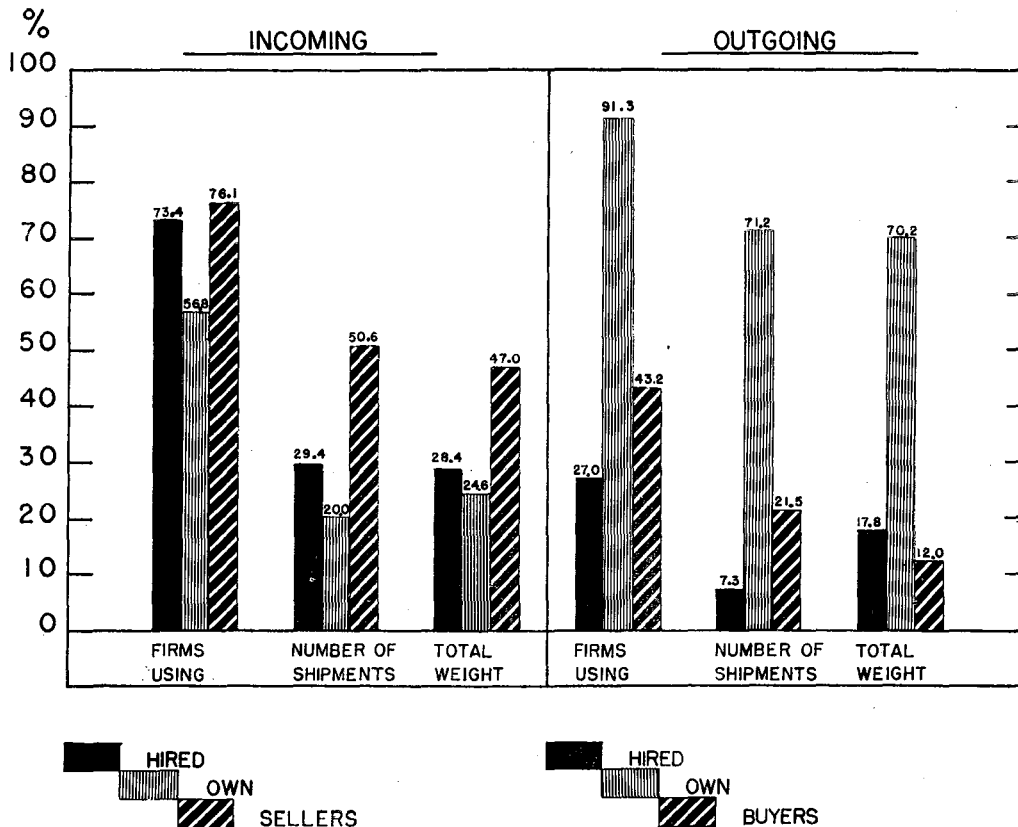


Figure 10.

TABLE 9—TOTAL TRUCK TRANSPORTATION
USE BY TRUCK OWNERSHIP, 1956

Type of Truck	Firms Using	Number Shipments	Average Weight	Total Weight
	Number	Thousand	Thousand Pounds	Million Pounds
—INCOMING—				
Hired	354	135.2	10.9	1,472
Own	274	91.6	14.0	1,279
Sellers	367	232.6	10.5	2,443
Totals	465	459.4	11.3	5,194
—OUTGOING—				
Hired	130	100.5	15.0	1,509
Own	440	989.0	6.0	5,971
Buyers	208	299.0	3.4	1,021
Totals	475	1,388.5	6.1	8,501

of these facilities by firms in the Texas food industry are discussed below.

TRUCKS

For purposes of this discussion, the three truck ownership classes are designated as "Own Truck", "Hired Truck", and "Buyer's or Seller's Truck" (with seller's truck being used to move the incoming goods and buyer's truck to move the outgoing shipments). Table 9 and Figure 10 show the comparative use made of the three types of trucks for both incoming and outgoing shipments within the Texas Food Industry.

Owned Trucks

It has become a general practice for firms in the Texas Food Industry to use their own trucks to move at least part of the goods they buy and sell. As a rule, every firm that operates locally or uses trucks for deliveries will own at least one truck. It is more common for these trucks to be used in the distribution than in the procurement phase of the business. In most cases, however, the firm's own truck will be used in both phases of the operation if at all possible. This permits more complete utilization of the vehicle, with a resulting cheaper over-all transportation cost.

For example, if a firm sends one of its own trucks to another city 200 miles distance with a load of goods, it will try to arrange a backhaul for that truck to carry on the way back home. This will add little to the cost of the return trip and will save the

shipping charges on the load that is carried on the return trip. A canning plant in the Rio Grande Valley, for instance, may ship a load of canned vegetables to the Midwest or East Coast by its own truck and have that same truck pick up a load of empty cans on the return trip. This procedure is becoming more common as firms seek to find ways of reducing their over-all transportation expenses.

Most firms shipping over long distances are not so fortunate as to have both their customers and suppliers located in the same general area. As a result, the majority of return trips are still run empty. With the exception of soft drink bottles and beer wholesalers, who pick up reusable bottles, firms with extensive local operations also usually find it inconvenient to try to schedule return loads. They often find it less expensive to keep their local delivery fleet separate from the receiving phase of their operation.

As shown in Figure 10, food industry firms use their own trucks much more intensively for the outgoing than the incoming phases of their business. Over 70 percent of both the total outgoing truck shipments and weight are made on the firms' own trucks. In comparison, only 20 and 24 percent of the total incoming truck shipments and weight are handled by firm-owned trucks. This is due almost entirely to the personalized delivery services that are offered. In many cases the driver of the truck also acts as the company's agent. He represents the company to its customers; therefore, the company wants to have control over his training and his actions.

Hired Trucks

Hired trucks are also used extensively by firms in the food industry. A hired truck is defined as one that hauls, for compensation, goods belonging to someone other than the owner of the truck. They are usually considered to be common carriers, although this is not always the case.

INTER-CITY AND LOCAL TRUCK TRANSPORTATION BY TYPE OF SHIPMENTS
1956

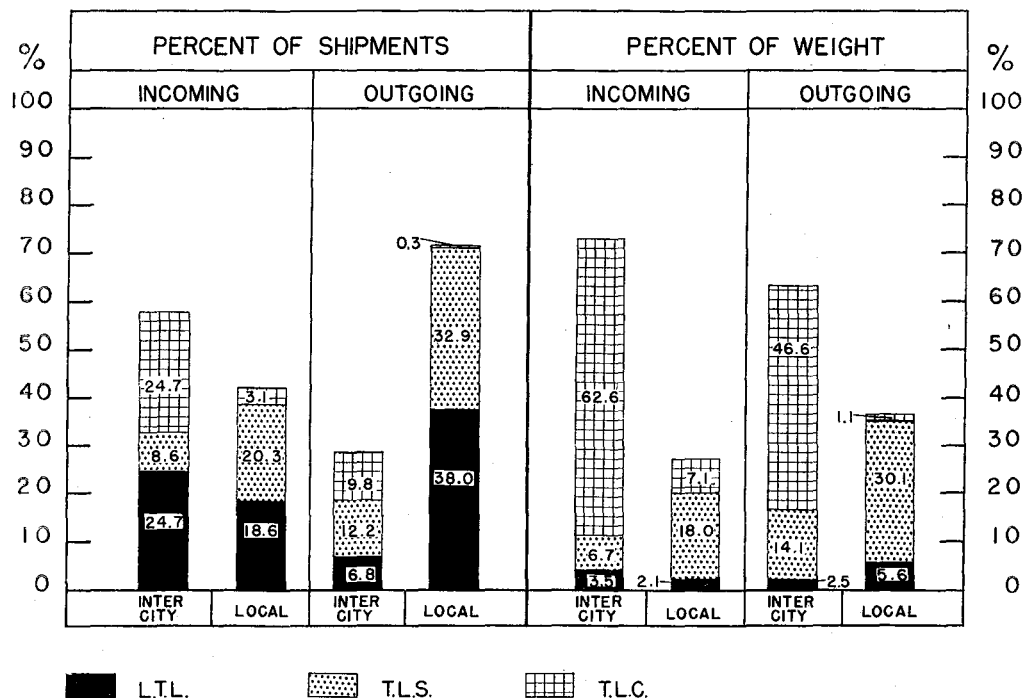


Figure 11.

Many are large exempt haulers; that is, they haul only unprocessed agricultural commodities and are not required to operate under the regulations of the Interstate Commerce Commission regarding rates, routes and schedules. There are also many smaller truck lines, often with only one or two trucks who operate as exempt haulers and haul considerable quantities of goods for firms in the food industry.

Hired trucks were used by over 73 percent of the firms to bring goods into the plant and by 27 percent in their outgoing business. In the incoming movement, where the average weight per shipment for all truck movements is relatively large, over 28 percent of the weight was carried by hired truck, compared to 29 percent of the shipments. In the outgoing movement, however, where the overall average weight per shipment was considerably smaller, hired trucks accounted for a much greater percent-

age of the total weight carried than of the total shipments. This is a reflection of the rate structure on the truckload and less-than-truckload shipments. Since with hired trucks it is much cheaper, on a per pound basis, to ship in truckload quantities, a firm will try to arrange a full loading for a hired truck whenever possible. For this reason, the average weight per shipment is much greater on the hired than firm-owned trucks. And, while the same rate structures are in effect with incoming movements, very small shipments are often brought into the plant by hired truck when the distance is so great that the cost of sending a firm-owned truck to pick them up would be prohibitive.

Other major users of hired trucks are those firms whose operations are distinctly seasonal in nature, such as the vegetable canners and frozen food processors. These firms have found that it is uneconomical for them to buy enough trucks to haul their goods

as rapidly as they need to be moved over a relatively short shipping season. In many cases this would require purchasing several expensive trucks which would only be used a few months out of the year. They find it more economical to own only enough equipment to satisfy their hauling requirements during the slack period of the year and hire commercial trucks to handle their peak movements.

In general, then, it could be stated that hired trucks are used in three principal situations. The first is when small quantities are shipped over long distances. The second when full loads are to be shipped to areas which have no backhaul potential for owned trucks or which are not served by either the firms' own trucks or the buyers' trucks. The third is the use by firms having a marked seasonality in operation.

This would seem to indicate that hired trucks are generally used to supplement a firm's normal operation of its own or buyers' trucks. This, again with certain exceptions, appears to be the case in the food industry. There does appear to be a tendency for more firms to make wider use of hired trucks, however, and a few firms which have no extensive local delivery operations are now using hired trucks exclusively.

Seller's or Buyer's Trucks

In this study a truck is said to be a "seller's truck" when, by terms of the purchase agreement, goods are delivered to the respondent firm in a truck either owned or hired by the seller. Conversely, it is considered to be a "buyer's truck" when, by terms of the sales agreement, goods are picked up by a truck either owned or hired by the buyer. These trucks may either be owned or hired by the seller or the buyer. The major consideration in this study is that they were not either owned or hired by the respondent firm.

Seller's trucks were used by more firms, carried more shipments, and

accounted for a greater percentage of the total incoming weight moved than either the owned or the hired trucks. Almost half of the total incoming truck movement was shipped by this method. This is not surprising when one considers that delivered prices are often standard quotations in many industries. The practice of free delivery on orders over a minimum quantity has become quite general in this industry. This is particularly true of those firms who make regular shipments to customers along an established delivery route.

The practice of free delivery, or of including the delivery charges in the price of the merchandise, is even more pronounced in the outgoing shipments. The shipping firms, through the use of either hired or their own trucks, delivered 88 percent of the total volume of merchandise to the buyer. Buyers' trucks handled only 12 percent of the total weight and less than 22 percent of the outgoing shipments. If one remembers that outgoing shipments are much smaller than incoming shipments, that the outgoing truck movement is largely one of personalized delivery, and that shipments sent out in the firm's own or hired truck will appear as a seller's truck movement to the firm receiving the shipment, the relationship between the use of sellers' and buyers' trucks is more easily understood.

Kinds of Trucks Used

In addition to ownership of trucks, it is also interesting to note the differences in the sizes of trucks and shipments used. Figure 11 shows the proportionate use of less-than-truckload (L.T.L.), single-unit truckloads (T.L.S.) and tractor-trailer combination truckloads (T.L.C.) in both the local and intercity movement of incoming and outgoing goods.

Small trucks, of course, are used primarily for the local and shorter intercity hauls. This can be seen by the large proportion of local shipments handled by the T.L.S. class of trucks. The large tractor-trailer com-

binations are designed for intercity operations and carry by far the greatest proportion of the total incoming and outgoing intercity truck business.

Less-than-truckload shipments may be carried on either the small single-unit or the large combination trucks. As a general rule, however, the longer intercity L.T.L. shipments are made on the large trucks while the local L.T.L. shipments are carried by the small ones.

The division between local and intercity shipments is primarily one of distance and city boundaries. A shipment was considered to be local when it originated and terminated within the same city or in the area immediately surrounding the city. An intercity shipment was one that originated within one city and terminated within another. In most instances the division into which a shipment fell was obvious. In a few cases, however, the determination was arbitrarily made by trained field interviewers.

RAIL

Several different kinds of rail shipments were investigated in this study. These are the carload, the less-than-carload, the forwarding company, and the car pool shipments.

Carload

Carload shipments were the most commonly used type of rail transportation both in terms of number of firms using and in the extent of this use. Figure 12 shows that most rail shipments were in carload quantities and that more than 98 percent of the total incoming and outgoing weight was moved in carload lots. Comparative data for all types of rail shipments are shown in Table 10.

Less-Than-Carload

The other forms of rail transportation are primarily important because they fill a need that is not satisfied by the services offered to carload shippers. Less-than-carload shipments, for example, were used to

TYPE OF RAIL TRANSPORTATION USED BY TEXAS FOOD INDUSTRY, 1956

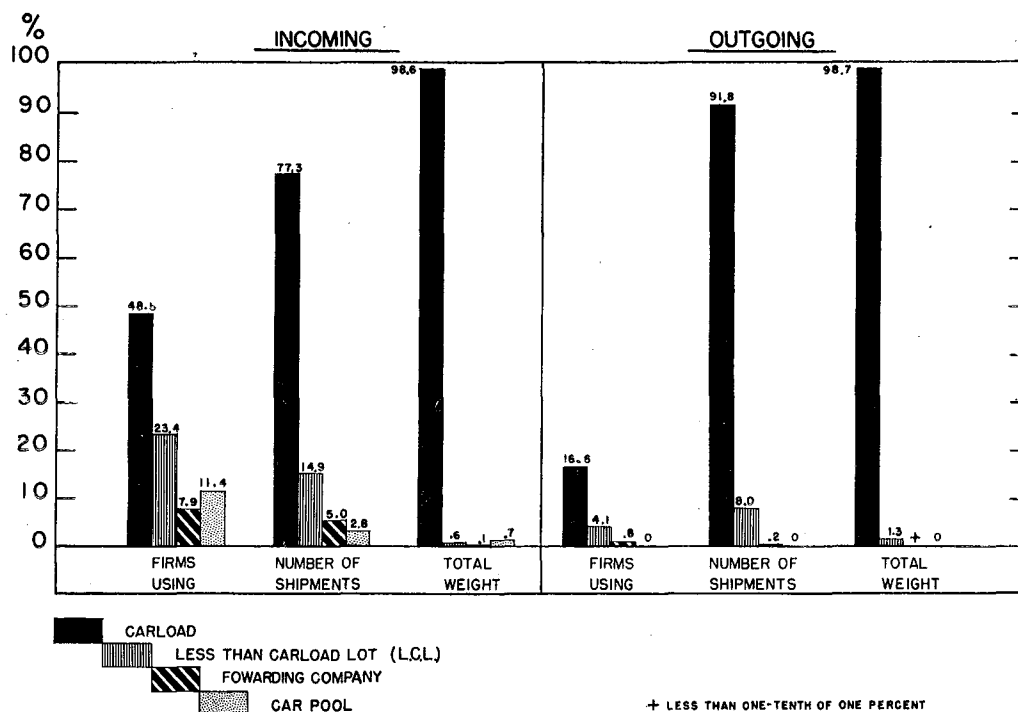


Figure 12.

TABLE 10—TOTAL RAIL TRANSPORTATION USE
BY TYPE OF RAIL SHIPMENT, 1956

	Firms Using	Number Shipments	Average Weight	Total Weight
—INCOMING—				
	Number	Number	Pounds	Thousand Pounds
Carload	234	61,550	79,800	4,911,156
Less-Than- Carload	113	11,893	2,300	27,809
Forwarding Company	38	3,983	1,500	5,813
Car Pool	55	2,215	15,500	34,168
Totals	285	79,641	62,500	4,978,946
—OUTGOING—				
Carload	80	43,911	83,200	3,654,465
Less-Than- Carload	20	3,818	12,900	49,263
Forwarding Company	4	89	400	38
Car Pool	0	0	0	0
Totals	94	47,818	77,500	3,703,766

some extent by almost 24 percent of the respondent firms to bring goods into their plants. Most of this use was in the movement of small shipments over long distances, so in terms of volume it was not a very important means of movement. In terms of number of shipments, however, it became much more important to the total rail picture. Over 14 percent of the incoming rail shipments and 8 percent of the outgoing rail shipments were in less-than-carload quantities.

Forwarding Company

Forwarding companies, while used to some extent by firms in their rail receiving operations, were practically unused in the movement of goods out of the plants. Forwarding companies are private organizations that have been established to aid the small user of rail transportation. They gather small consignments and hold them until a carload of merchandise to be shipped to one general destination has been collected. Upon arrival at the general destination the small shipments are delivered to the original consignees. There are certain speed and some rate advantages to this procedure since goods are shipped as carload lots instead of in individual less-than-carload shipments. To operate effectively, the forwarding company must be located in an area containing industries that normally ship in less-than-carload quantities

over long distances. Since the food industry does not generally follow this distribution pattern, the forwarding company was little used in the outgoing movement of their goods. Its use was confined largely to bringing in miscellaneous supplies.

Car Pool

The car pool method of shipping was used by more firms but was used less frequently than were the forwarding companies. A car pool is a shipment in which two or more purchasers combine their orders to make a full carload of merchandise. Two bakeries, for instance, could each order a half-car of sugar from the same refinery. If they asked that their shipments be combined in one railroad car, it would constitute a car pool shipment. The resulting rate would be lower than if each had ordered a half-car and paid shipping charges on an L.C.L. basis. As mentioned previously, this method of shipment is used frequently to bring goods into food industry firms, but is seldom used in the outgoing movement.

WATER

The three types of water transportation used by firms in the Texas food industry are sea, train, ship, and barge. Table 11 and Figure 13 show the importance of each of these types. It was stated earlier in this report that water transportation played a relatively minor part in meeting the over-all transportation needs of the food industry. In situations where it can be used effectively, however, water facilities offer a very economical means of movement.

Sea Train

More water shipments were made by sea train than by any other means. Almost two-thirds of both the incoming and outgoing water shipments used this means of transportation. Since a sea train combines both water and rail transportation, it has several advantages not offered by either barge or ship. For one thing, the using firm need not be lo-

TABLE 11—TOTAL WATER TRANSPORTATION
USE BY TYPE OF WATER SHIPMENT, 1956

	Firms Using	Number Shipments	Average Weight	Total Weight
	Number	Number	Thousand Pounds	Thousand Pounds
—INCOMING—				
Sea Train	16	296	32.3	9,550
Ship	7	111	89.5	9,937
Barge	3	64	69.4	4,441
Totals	20	471	50.8	23,928
—OUTGOING—				
Sea Train	6	2,145	61.6	132,036
Ship	16	1,294	218.8	276,729
Barge	0	0	0	0
Totals	18	3,439	118.9	408,765

cated at or near dock facilities. The goods can be loaded aboard a railroad car and then moved to the docks for loading—car and all—aboard either a ship or a barge. At the end of the water journey the car can be unloaded and moved by regular railroad facilities to the consignee. This eliminates the need for handling the commodities except at the time they are

loaded aboard the rail car and unloaded at the destination. This method also is often cheaper than either straight rail or water when all shipping and handling costs are included. The Canning, Rice Cleaning and Polishing and Corn Processing Industries were the largest users of sea train transportation.

Ship

The next most important means of water transportation observed in the study was the movement by ship. This method, while second to sea train in the number of shipments carried, accounted for over 40 percent of the incoming and over $\frac{2}{3}$ of the outgoing weight of water shipments. It was, of course, most suited to those industries which are able to ship very large quantities in a single shipment. The two industries which made the most extensive use of ships were the

TYPE OF WATER TRANSPORTATION USED BY TEXAS FOOD
INDUSTRY, 1956

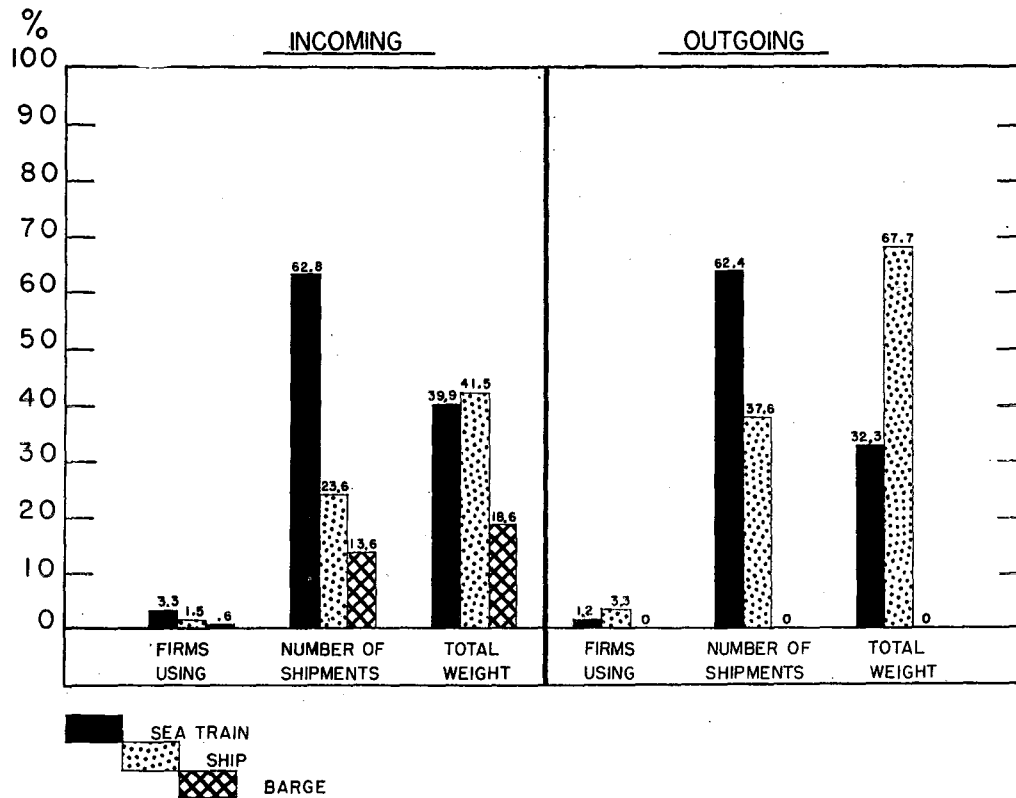


Figure 13.

Flour Milling and the Rice Cleaning and Polishing Industries. Both of these industries handled very large shipments, and had products which were suited to bulk handling procedures.

Barge

Barges were the least used of the three types of water transportation. Firms contacted in this study did not utilize barges in the outgoing movement of their goods. Less than 14 percent of the incoming water shipment and less than 20 percent of the

incoming weight was handled by barge.

The use of barges was confined almost exclusively to two wholesale grocery firms in the Gulf Coast Area. They used barges to bring in a few bulk shipments that were particularly suited to this type of movement. In most cases these were either canned goods or other similar items of low perishability and as a general rule were rather low in value relative to weight. In every case speed of delivery was less important than total cost to firms selecting this method of movement.

TRANSPORTATION CHARACTERISTICS BY DISTANCE

The distance that a firm must cover in procuring and distributing its goods is very important in determining the types of transportation that are used. A firm with a predominately local operation would, of course, be expected to make extensive use of trucks as compared to rail or water. One that must procure or ship large quantities of goods over long distances, on the other hand, would be expected to utilize more rail transportation. One which either imports, exports, or has a domestically procured or distributed product which is otherwise suitable for water shipment and has access to water facilities, would be expected to utilize water transportation.

Distance is also very important in determining the kind of transportation that will be used within each type. That is, if a firm has decided to use trucks to move its goods, the

kind of truck that will be used—either owned, hired, buyer's, or seller's—will depend to a large extent on the distance involved. This choice within uses has a much stronger relationship to distance in the case of trucks than with either rail or water. In fact, there are so many other important factors which influence the use of water transportation, that the influence of distance is not discussed here as a separate item.

In this study the average intercity distance per shipment by both truck and rail was determined for all interviewed firms in the food industry. The over-all average distance per shipment for all intercity shipments combined is about 300 miles (Figure 14). This same chart also shows the average distance for all intercity truck shipments and all rail shipments separately. It is apparent that there is a strong relationship between the type of transportation used and the distance the goods are moved.

Rail transportation can be characterized as having a high fixed cost and a relatively low operating cost per mile. Trucks, on the other hand, have a lower fixed cost and a proportionately higher operating cost per mile of operation. The difference in the ratios of fixed to operating costs between these two types of transportation make it more economical for rail to operate over long distances and trucks to handle the shorter runs. As can be seen in Figure 14, the average distance covered by rail shipments was slightly more than twice the distance of intercity truck shipments.

INTERCITY TRUCKS

Most of the expenses in making a truck shipment are incurred during that trip through payments to a driver, and the costs of gas, oil, and other miscellaneous operating expenses. The fixed costs, such as cost of equipment, depreciation, supervision, taxes,

AVERAGE DISTANCE PER SHIPMENT FOR FIRMS
IN THE FOOD INDUSTRY

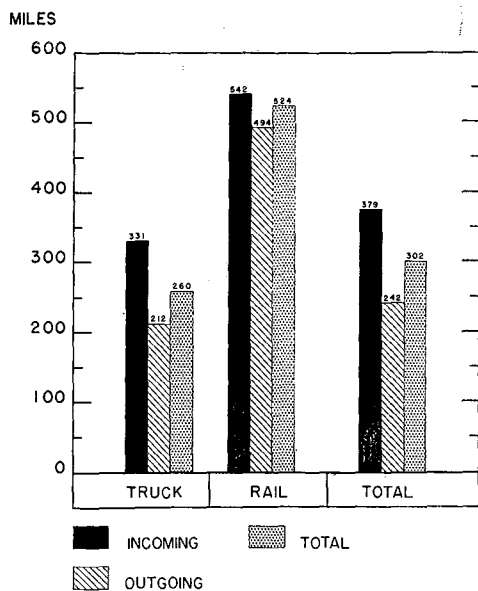


Figure 14.

PERCENT OF TOTAL INCOMING AND OUTGOING INTER-CITY TRUCK SHIPMENTS FOR THE FOOD INDUSTRY BY DISTANCES, 1956

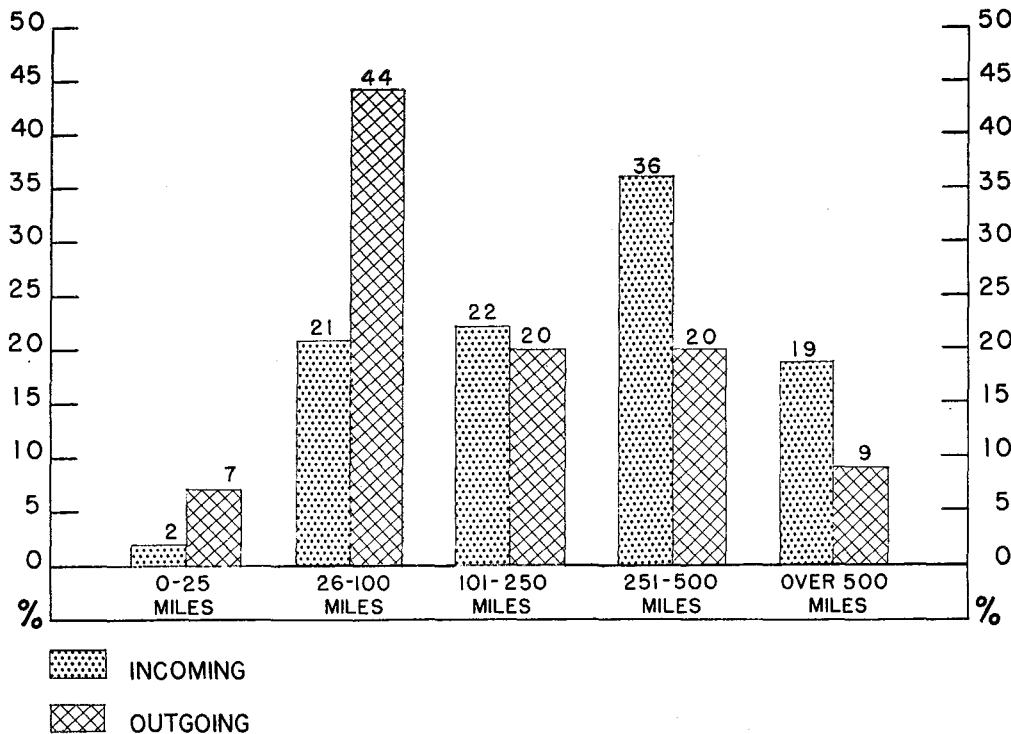


Figure 15.

etc., are relatively low when compared to these expenses of movement. Because of this fact, trucks have a greater comparative economic advantage in operating over short distances than over long distances. This together with their flexibility of operation, has permitted them to take over almost all of the shorter inter-city shipments. As the distance is increased, however, their competitive advantage is reduced and a greater proportion of the total business is handled by other means.

The distribution of all incoming and outgoing intercity truck shipments by mileage blocks is shown in Figure 15. The distance patterns are quite different for the two directions of movement. Incoming movements were generally shipped over longer distances than the outgoing movements. Only 23 percent of the incom-

ing shipments traveled less than 100 miles, for example, while 55 percent were moved more than 250 miles. Using these same distances, 51 percent of the outgoing shipments traveled less than 100 miles, while only 29 percent were moved more than 250 miles. The largest concentration of incoming shipments fell in the 251-500 mile range, while outgoing shipments were more concentrated in the 26-100 mile distances.

These differences may be explained in terms of the operational requirements of using firms. Incoming movements contain more supplies which are shipped from relatively long distances. Most food industry firms tend to locate within their distribution area and confine their outgoing shipments to a smaller geographic area. Miscellaneous supplies and equipment are then brought to

TABLE 12—AVERAGE DISTANCE OF INTERCITY TRUCK SHIPMENTS BY TYPES AND KINDS OF SHIPMENTS

	No. of Shipments	Average Miles	No. of Shipments	Average Miles	No. of Shipments	Average Miles	No. of Shipments	Average Miles
	Hired Truck		Own Truck		Sellers & Buyers Truck		Totals	
Incoming	131,513	408	53,947	280	79,364	246	264,824	333
Outgoing	98,034	403	244,780	139	57,071	198	399,885	212
Totals	299,547	406	298,727	164	136,435	226	664,709	260
	Less-Than-Truckload		Truckload-Single		Truckload-Combination		Totals	
Incoming	111,909	381	39,465	134	113,450	354	264,824	333
Outgoing	94,204	265	169,545	80	136,136	340	399,885	212
Totals	206,113	328	209,010	90	349,586	346	664,709	260

TABLE 13—TYPE OF INTERCITY TRUCK SHIPMENTS BY TRUCK OWNERSHIP

Type of Shipment	Hired		Own		Sellers or Buyers	
	Number of Shipments	Percent	Number of Shipments	Percent	Number of Shipments	Percent
Less-than-Truckload	140,206	61.1	22,725	7.6	43,182	31.6
Truckload Single Unit	7,556	3.3	165,483	55.4	35,971	26.4
Truckload Combination	81,785	35.6	110,519	37.0	57,282	42.0
Total	229,547	100.0	298,727	100.0	136,435	100.0

the plant from suppliers who may be a considerable distance away.

The kind of truck that will be used and the method in which a particular shipment will be handled are also influenced by distance. Table 12 shows the average distance of intercity truck shipments by truck ownership and by type of shipment, and Table 13 shows the frequency with which the different type shipments are handled by the different kinds of truck ownerships. Figure 16 shows the comparative mileage block distribution for the incoming and outgoing operation of the three types of trucks. It should be emphasized here that all of these shipments and distance data refer to intercity shipments only. Local shipments were not analyzed in this part of the study since distance is not considered a major factor within a local area.

Hired Trucks

As can be seen in Table 12, hired trucks traveled much greater distance in both bringing in and distributing goods for food industry firms than either the own, sellers' or buyers' trucks. There was also little difference in the distance they traveled in their incoming or outgoing operations. Of the 229,000 intercity shipments made by hired trucks there was an average distance of over 408

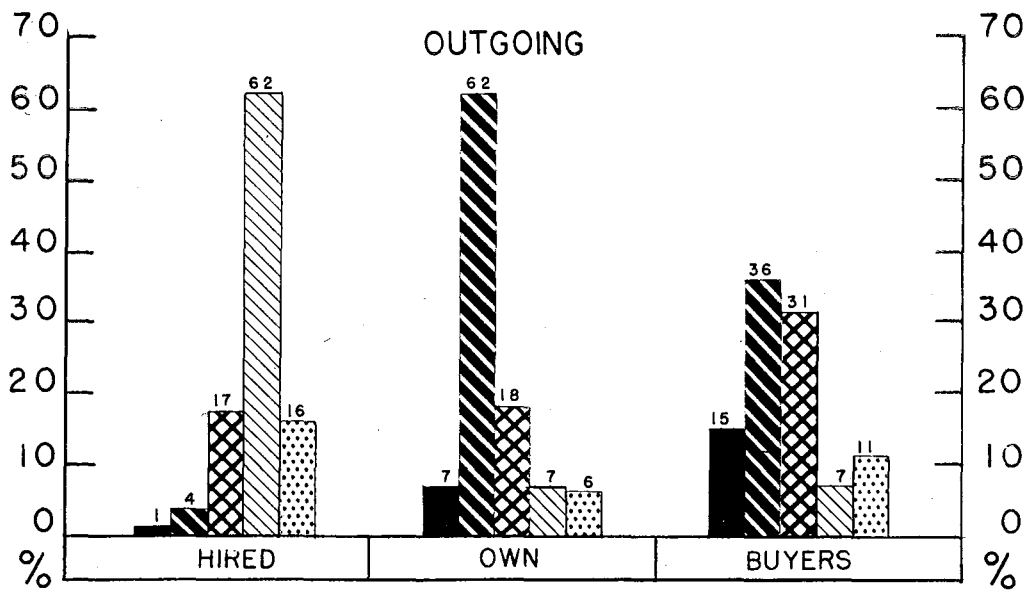
miles recorded for incoming shipments and 403 miles for outgoing movements. The average distance for all shipments was 406 miles. Table 13 also shows that over 60 percent of these shipments were less-than-truckload in size, and that single-unit trucks were seldom used by commercial carriers for intercity shipments.

Figure 17 shows the mileage block distribution of all hired truck shipments. The L.T.L. shipments followed the same pattern for both the incoming and outgoing movements. In each case around 70 percent of all shipments were made for distances of over 250 miles, and almost 25 percent were in the 101-250 mile range. In the case of incoming shipments, over 27 percent were made for distances of over 500 miles. A very large number of these were either low volume, high value ingredient shipments or were machines or parts shipped from out of state suppliers. These shipments were usually handled by one or more of the motor freight lines. It is also interesting to note that L.T.L. shipments of less than 100 miles were very seldom made via hired trucks. Most firms follow the practice of either delivering in their own trucks or having the purchasing firm pick up the merchandise for these shorter distances.

DISTANCES OF INTERCITY TRUCK SHIPMENTS FOR THE FOOD INDUSTRY BY THE TYPE OF TRUCK, 1956



+ LESS THAN ONE PERCENT



MILEAGE
BLOCKS

0-25



26-100



101-250



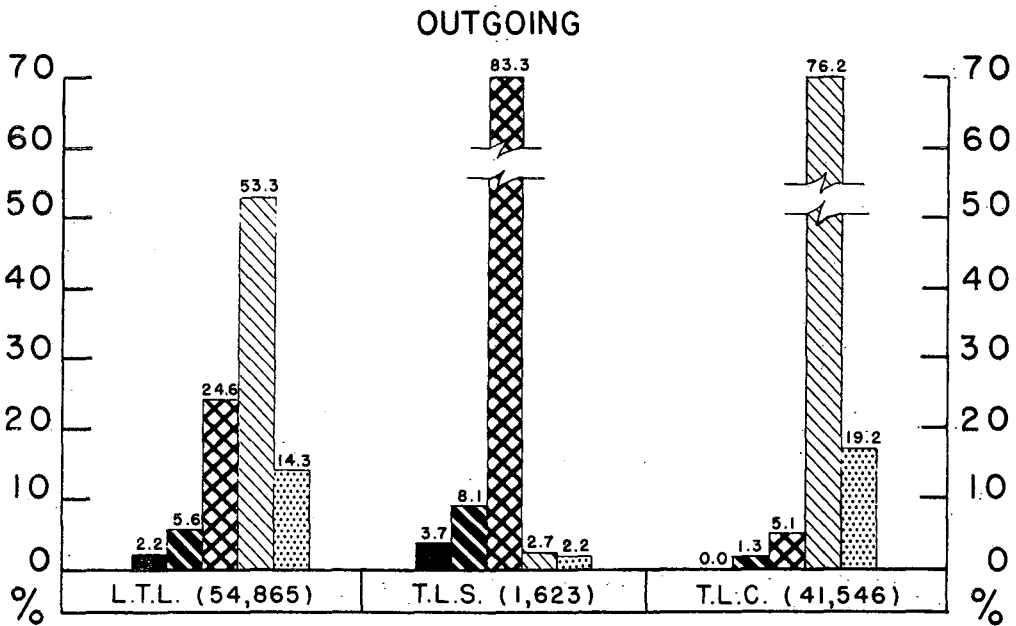
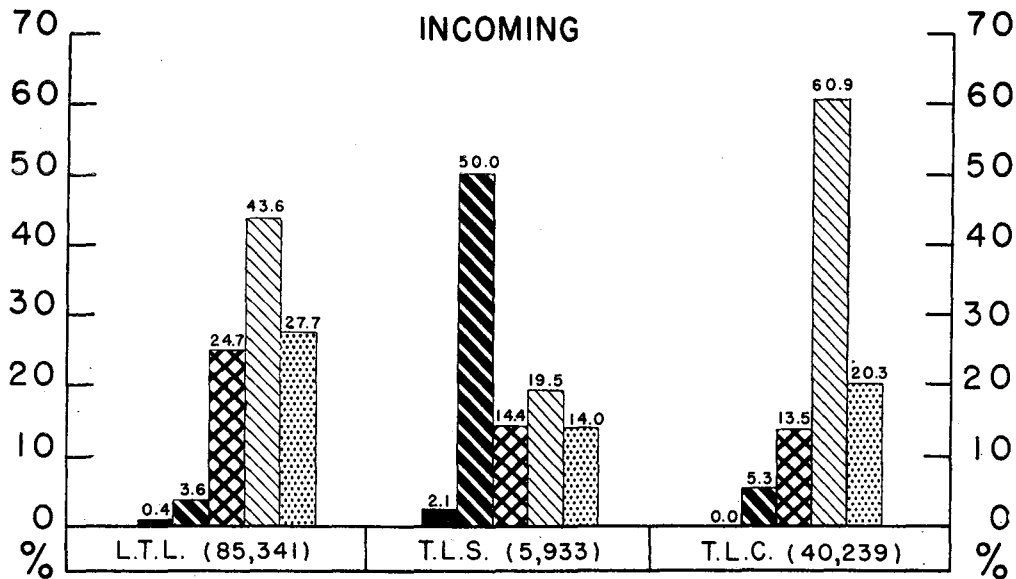
251-500



OVER 500

Figure 16.

DISTANCES OF INTERCITY HIRED TRUCK SHIPMENTS FOR THE FOOD INDUSTRY BY TYPE OF SHIPMENT 1956



MILEAGE
BLOCKS

0-25



Figure 17.

Single-unit trucks were seldom used by the commercial trucking firms for intercity runs. Consequently, very few T.L.S. shipments were recorded. Of the incoming T.L.S. shipments that were recorded, however, more than half were confined to distances of less than 100 miles. The remaining shipments were about evenly divided between the other three mileage blocks and probably could be considered as special situations.

Outgoing T.L.S. shipments were very heavily concentrated in the 101-250 mile category. The large majority of these shipments were made by one firm, however, and were the result of a special shipping problem. Since there were only a little over 1600 outgoing shipments made altogether, it is doubtful if this could be considered the normal or usual pattern of T.L.S. hired truck shipments. It does serve to illustrate the flexibility of truck operations, however, since a single firm's particular shipping problems were met by a method that is not considered usual within the industry.

Most of the tonnage shipped by hired trucks was moved by tractor-trailer combinations. Over 80,000 shipments, of about 32,500 pounds each, were recorded by the firms covered in this study. These shipments were about equally divided between incoming and outgoing movements and had a very similar pattern of distances moved. There were no hired truck T.L.C. movements for distances of under 25 miles, and very few shipments of less than 100 miles. The great majority of both the incoming and outgoing shipments (60 and 76 percent respectively) fell in the 251-500 mile range. This appears to be the distance at which commercial truck operators can operate fully loaded tractor-trailer units most competitively with both privately owned trucks and the railroads. At distances of less than 250 miles competition is stronger from privately owned trucks, and at over 500 miles rail becomes increasingly competitive. Hired trucks did carry a considerable number of T.L.C. shipments for dis-

tances over 500 miles, however. About 20 percent of the incoming shipments and 17 percent of the outgoing shipments were moved more than 500 miles. Valley vegetable canners and shippers in particular used hired trucks to move their products to market outside of the state.

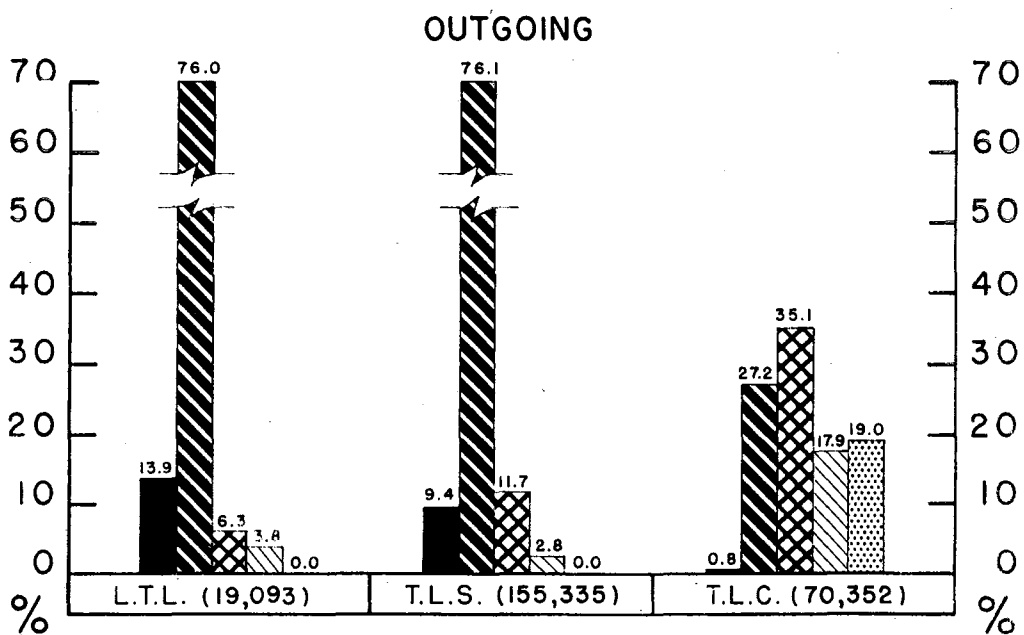
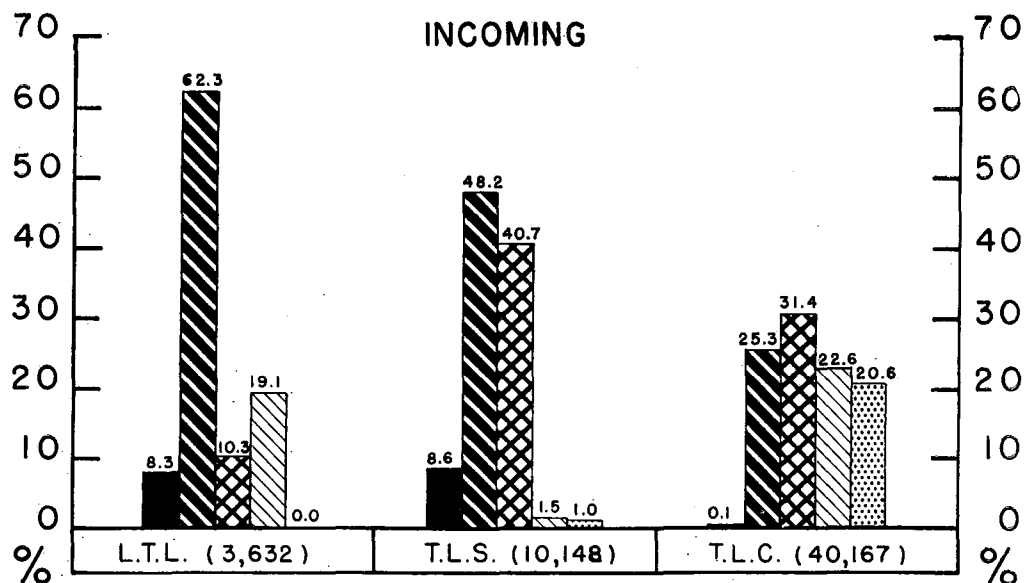
To summarize hired truck operations in relation to distance, it can be said that as a general rule hired trucks tend to operate most competitively at distances of over 250 miles. By far the greatest percentage of their operations involve these longer distances. It can also be generalized that, with the exception of single-unit (T.L.S.) shipments, very few hired truck shipments are made for distances of less than 100 miles.

Own Trucks

A firm's own trucks were more confined in their operational radius than either the hired or the buyers' or sellers' trucks. Table 12 shows that a firm's own trucks averaged about 280 miles per trip in bringing goods into the plant and only 139 miles per trip in distributing these goods. The average for the total intercity movement of over 300,000 shipments was about 164 miles per trip. This is about 80 miles less than was covered by buyers' and sellers' trucks and less than half the average distance covered by hired trucks.

It has been pointed out that single-unit trucks were seldom used by the commercial trucking firms serving the food industry. In contrast, single-unit vehicles were used extensively by firms operating their own trucks. Table 13 shows over one half of all the intercity shipments made on a firm's own truck were carried by the single-unit vehicles. The type of truck on which L.T.L. shipments were sent was not determined; therefore, in accordance with other uses of single unit and combination trucks, it is quite probable that a large part of the L.T.L. shipments were also shipped on the single-unit vehicles.

DISTANCES OF INTERCITY OWN TRUCK SHIPMENTS FOR THE FOOD INDUSTRY BY TYPE OF SHIPMENT 1956



MILEAGE
BLOCKS

0-25



26-100



101-250



251-500



OVER 500

Figure 18.

Figure 18 shows the mileage block distribution of all intercity shipments made by the studied firms' own trucks. Since, as was discussed previously, a firm uses its own trucks primarily in the distribution of its goods, over 80 percent of the total shipments were confined to the outgoing phase of the business.

Less-than-truckload shipments made up a relatively small part of the total intercity shipments by shipper-owned trucks. Most of these trips were confined to short distance movements. Over 70 percent of the incoming and 90 percent of the outgoing L.T.L. shipments were for distances of less than 100 miles, and none involved distances of over 500 miles. These shipments were generally confined to either local pick-ups and deliveries or to shipments to nearby communities. There is, of course, sound economic justification for this practice. Because of the costs involved, a firm cannot afford to send its own truck over long distances to either pick up or deliver small shipments except under emergency circumstances. This type of shipment can be handled much more economically by one of the commercial trucking firms.

It was mentioned briefly above that more than half of the shipments by firm-owned trucks were hauled by single-unit vehicles. These trucks range in size from $\frac{1}{2}$ ton, 2 axle pick up and paneled delivery trucks to the larger 3 axle covered vans with rated capacities of 6 tons or more. The mileage block distribution of shipments by these vehicles are also shown in Figure 18. The great majority (about 94 percent) of these shipments were made as a part of the outgoing delivery operations.

More than 10,000 incoming shipments were also recorded, however, and over half of these were confined to distances of less than 100 miles. The remaining shipments were made largely in the 101-250 mile range. Less than 3 percent of these incoming shipments were made for distances of over 250 miles.

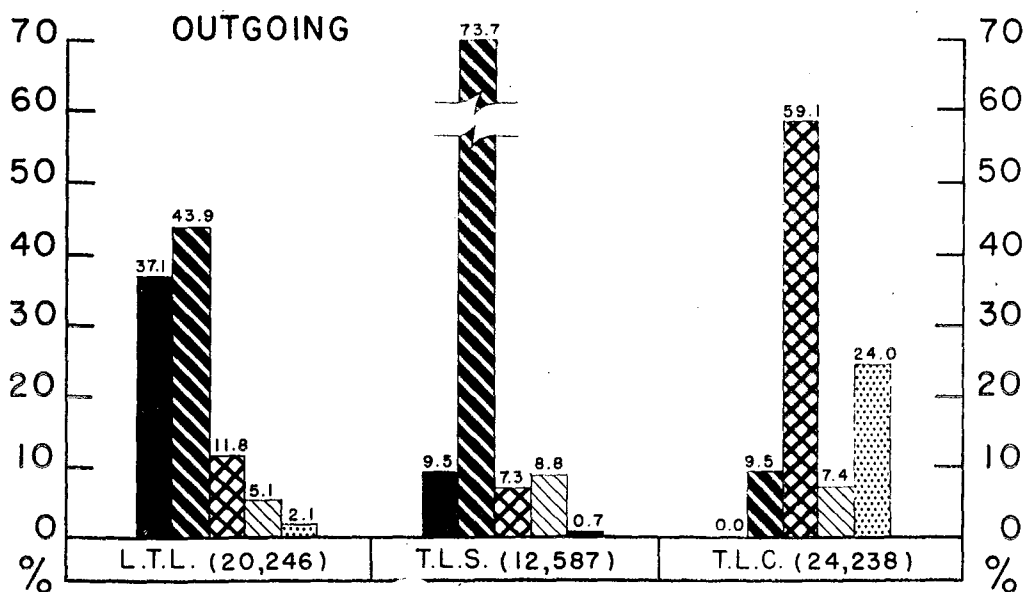
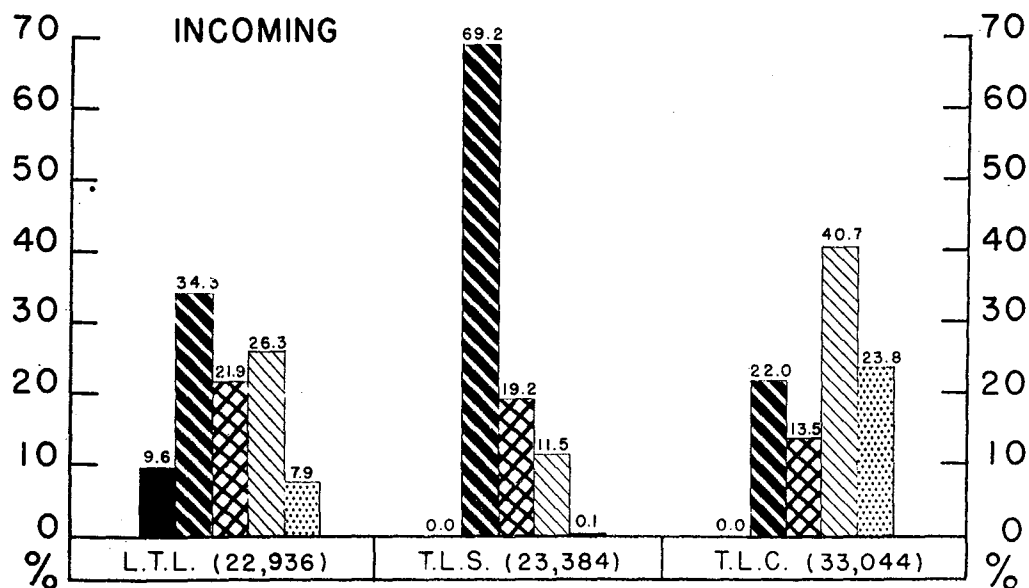
This same general pattern was repeated in the outgoing T.L.S. shipments. However, in this case, the percentage of shipments falling into the less than 100 mile category was much higher (85 percent) and a smaller proportion was shipped for distances of 101-250 miles. The percentage shipped over 250 miles was still negligible and no T.L.S. shipments were made at distances over 500 miles. Most of the outgoing T.L.S. shipments consisted of regularly scheduled deliveries. This accounted for the greater percentage of short distance shipments. A firm did not generally schedule regular delivery service, in which single-unit trucks were required, for distances of over 100 miles. If delivery service extended much beyond this distance, larger trucks were usually used.

That tractor-trailer combinations were often used for this purpose can be seen from Figure 18. Of the 70,000 T.L.C. outgoing shipments, well over a third were for distances in excess of 250 miles, and almost a fifth were over 500 miles in length. On the other hand, almost no shipments were made for distances of less than 25 miles and only a little over a fourth were for distances of less than 100 miles.

This is almost the exact pattern that was shown in the incoming shipments by T.L.C. Practically no shipments were made for distances of less than 25 miles and only 25 percent were less than 100 miles in length. About 43 percent of all incoming shipments were for distances of more than 250 miles.

To summarize the operation of firm-owned trucks in relation to distance, several general observations can be made. A firm's own trucks tended to have a shorter radius of operation than either of the other classes. This operation was particularly restricted in the operation of single-unit trucks and in L.T.L. shipments. No L.T.L. shipments were made at distances over 500 miles and very few at distances in excess of 100 miles. Very few single-unit truck

DISTANCES OF INTERCITY SELLERS AND BUYERS TRUCK SHIPMENTS FOR THE FOOD INDUSTRY BY TYPE OF SHIPMENT 1956



MILEAGE
BLOCKS

0-25



26-100



101-250



251-500



OVER 500

Figure 19.

shipments traveled more than 250 miles and practically no tractor-trailer combination shipments were sent less than 25 miles.

Sellers' and Buyers' Trucks

As defined earlier in this report, a shipment was considered to have moved in a seller's truck if it was delivered to the interviewed firm, as purchaser, in a truck either owned or hired by the seller of the goods. It was considered to move by a buyer's truck if it was picked up from the interviewed firm, as seller, by a truck either owned or hired by the purchaser of the goods. The incoming movement shown in Table 12 and Figure 19 would then be the movement by seller's trucks and the outgoing shipments would be handled by buyers' trucks.

There were almost 80,000 intercity shipments handled by sellers' trucks. These shipments were moved an average distance of 246 miles per shipment (Table 12). This is compared to less than 60,000 shipments moved by buyers' trucks at an average distance of 198 miles per shipment. The mileage block distribution of both types of shipments are shown in Figure 19.

Over 40 percent of both the sellers' and buyers' truck shipments were tractor-trailer combination movements. There was some difference, however, in the mileage distribution of these shipments. Almost 64 percent of the shipments by seller trucks were for distances of 250 miles or more. Over 68 percent of the buyer truck shipments, on the other hand, were for distances of less than 250 miles. In neither case, however, did the tractor-trailer combination shipments average less than 25 miles in length.

The pattern of T.L.S. shipments were very similar for the two kinds of ownerships. In both instances the movements were concentrated in the 25-100 mile range and practically no shipments were in excess of 500 miles in length.

The L.T.L. shipments were somewhat longer when shipped by seller trucks. Well over half of these shipments were sent 100 miles while more than 80 percent of the outgoing movement (by buyer trucks) were less than 100 miles in length. The proportion of very short—less than 25 miles—shipments was also much higher for the buyer operated trucks.

Since seller and buyer trucks can not be classified exactly by ownership, it is difficult to explain the variations in the distances over which they operate. The fact that both firm-owned and commercially operated for-hire vehicles are included in this classification is probably one reason for their pattern of operation to show as it does. Actually, the distances traveled fall between these two classes. The extent of variation likely reflects the proportionate use of both firm-owned and for-hire vehicles in the particular group.

RAIL

Because of the high ratio of fixed to operating costs, rail movements become increasingly competitive with truck as the distance of shipments are increased. It can be seen from Table 14 that both the carload and less-than-carload rail shipments travel considerably further than truck shipments. Carload rail shipments averaged 492 miles in length, the L.C.L. shipments 635 miles, and all rail shipments combined 512 miles. This is compared to an average of

TABLE 14—AVERAGE DISTANCE OF INTERCITY RAIL SHIPMENTS BY TYPES AND KINDS OF SHIPMENTS .

	Carload		Less-Than-Carload		Totals	
	No. of Shipments	Average Miles	No. of Shipments	Average Miles	No. of Shipments	Average Miles
Incoming	61,550	515	15,876	650	77,426	542
Outgoing	43,911	459	1,281	454	45,192	459
Totals	105,461	492	17,157	635	122,618	512

260 miles for all intercity truck shipments.

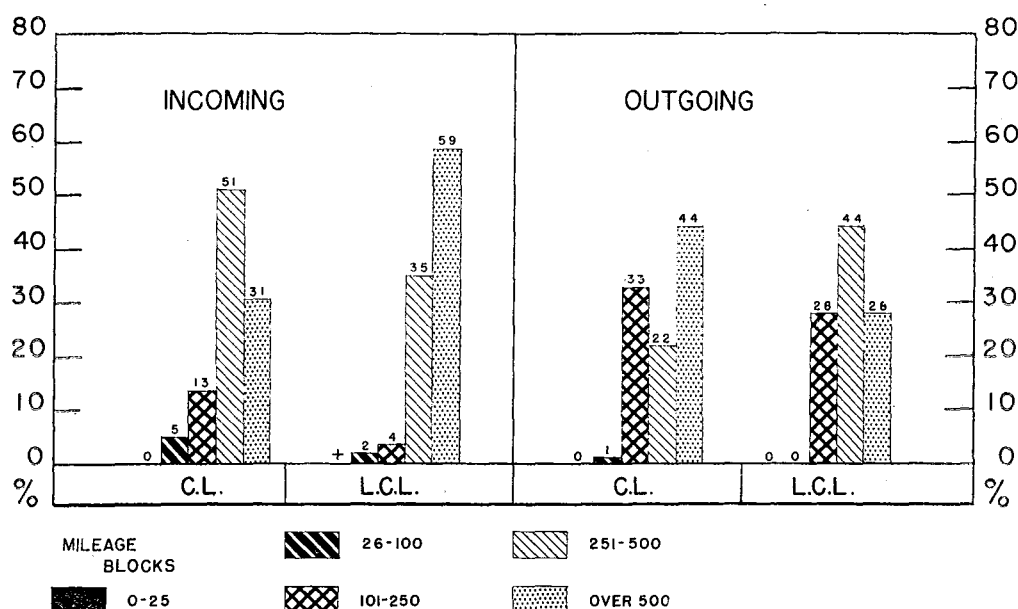
There were also striking differences between the incoming and outgoing movements by rail. Incoming carload shipments averaged 515 miles per shipment while the outgoing movement was only 459 miles. The difference was even greater on less-than-carload shipments. The incoming L.C.L. shipments averaged 650 miles per shipment against 454 miles for the outgoing. Many incoming L.C.L. shipments consisted of miscellaneous supplies and materials from distant suppliers. The outgoing shipments, however, were usually a part of a firm's regular distribution system. In general, firms received supplies from more distant points than were included in their distribution area.

The mileage block distribution of rail shipments is shown in Figure 20. This chart points up the very limited

operation of rail transportation at distances of less than 100 miles, and the large proportion of the total rail business that is conducted at distances in excess of 250 miles. On carload movements, for instance, there were no shipments of less than 25 miles and only 6 percent of the shipments traveled less than 100 miles. Eighty-two percent of all incoming carload shipments traveled 250 miles or more. The pattern was much the same for the outgoing carload movements. Only one percent of the shipments were moved less than 100 miles, while 65 percent were in excess of 250 miles in length. The main difference in incoming and outgoing carload shipments was in the percentage of shipments traveling the intermediate distances of 100-500 miles.

Over 90 percent of both the incoming and outgoing L.C.L. shipments were made over distances of 250 miles or more. The outgoing

DISTANCES OF CARLOAD AND LESS THAN CARLOAD RAIL SHIPMENTS
BY THE TEXAS FOOD INDUSTRY, 1956



+ LESS THAN ONE HALF OF ONE PERCENT

Figure 20.

movement, however, was skewed more sharply toward the longer distance. Over 70 percent of all outgoing L.C.L. shipments were in excess of 500 miles.

To sum up rail operations in relation to distance, it could be said that rail transportation was utilized very sparingly for shipments of less

than 100 miles. The use of rail for movements of 100-250 miles was confined largely to carload shipments. At distances over 250 miles, however, rail became increasingly competitive with truck and the relative use for all types of rail shipments increased sharply.

TRENDS IN TRANSPORTATION USE

One of the objectives of this study was to determine the significant changes that have occurred in the use of different types of freight transportation over the past few years. Another objective was to determine the changes, if any, that are being planned by firms in the food industries. To fulfill these objectives, each firm was asked the question, "Other than changes in the size of your operation, what changes have occurred in your transportation pattern over the last 5 years?" They were then asked if they now use more, less or the same amount of each type of transportation in relation to their total transportation use. In this manner, it was possible to determine the tendency of firms to change their use of various types of transportation.

CHANGES BETWEEN TYPES OF TRANSPORTATION

The nature of this shift in usage is shown in Figure 21. As can be seen from this chart, the largest shifts have occurred in the relative use of trucks and rail. Over 20 percent of the firms interviewed indicated that they now use more truck and less rail to move their incoming goods than they did five years ago. The change has been less sharp in the outgoing movement, however, with only about 6 percent of the firms indicating a shift from rail to truck.

There has been very little change in the relative use of either incoming or outgoing water transportation. There was a very slight increase in the use of water to move incoming goods, but no change in its usage in the outbound movement.

After the past changes had been determined, each firm was asked about the changes that were anticipated in its relative use of transportation types over the next five-year period. The answers to this question were largely conjectural or were con-

tingent on such factors as changes in freight rates, services, availability of equipment, and eventual changes in company policy. Some firms, however, were either in the process of changing from one type of transportation to another or had made definite plans for doing so in the future. Positive answers were recorded only when a firm was fairly sure of an impending shift.

The anticipated changes are shown in Figure 22. Again the shift is toward using more truck, less rail and slightly more water transportation, and again the anticipated change is more pronounced in the incoming phase of the business.

SHIFTS IN THE USE OF DIFFERENT KINDS OF TRUCKS

Interviewed firms were then asked about shifts in usage between different kinds of trucks. This was done to determine if there had been significant shifts in the relative use of hired, owned, buyers' or sellers' trucks. Figure 23 shows the percentage of firms that have significantly changed their use of each kind of truck over the last 5 years. It should be remembered that the percentages shown here do not necessarily coincide with the changes in truck use shown in the preceding set of charts. In the first place a firm that shifts from rail or water to truck may increase its use of one or more kinds of trucks. Secondly, a firm may shift from one kind of truck to another without increasing or decreasing its total trucking operation.

There did not appear to be a strong trend toward shifting from any one kind of truck to another. From 9 to 12 percent of the firms indicated that they use more of each kind of truck in their incoming operation now than they did 5 years previously. The percentage of firms increasing the use of each type of truck in outgoing operations ranged from approximately

CHANGES IN THE USE OF TRUCK, RAIL AND WATER TRANSPORTATION DURING THE 5 YEAR PERIOD, 1952-56, BY FIRMS IN THE FOOD INDUSTRY

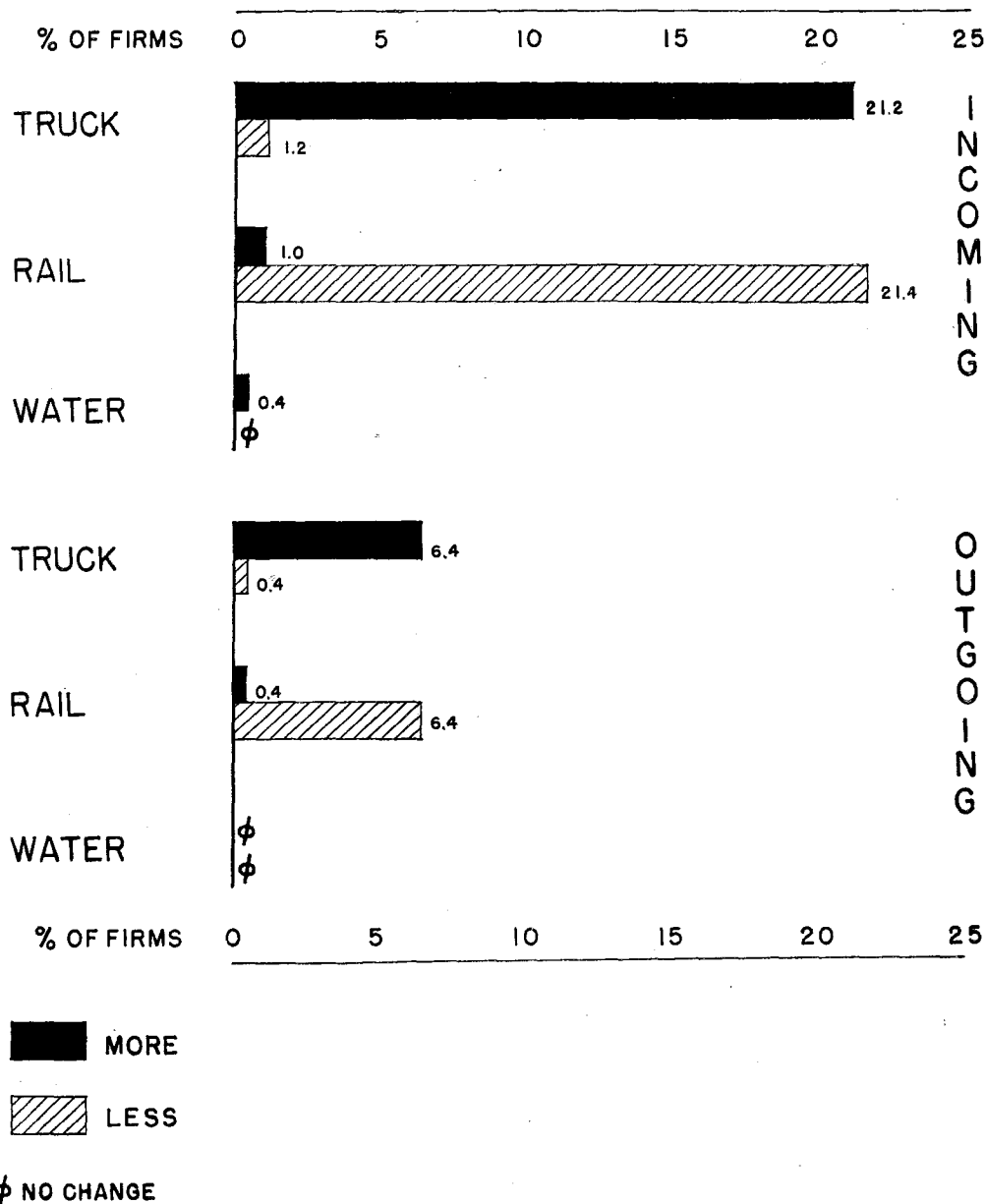


Figure 21.

CHANGES ANTICIPATED IN THE USE OF TRUCK, RAIL AND WATER TRANSPORTATION BY FIRMS IN THE FOOD INDUSTRY

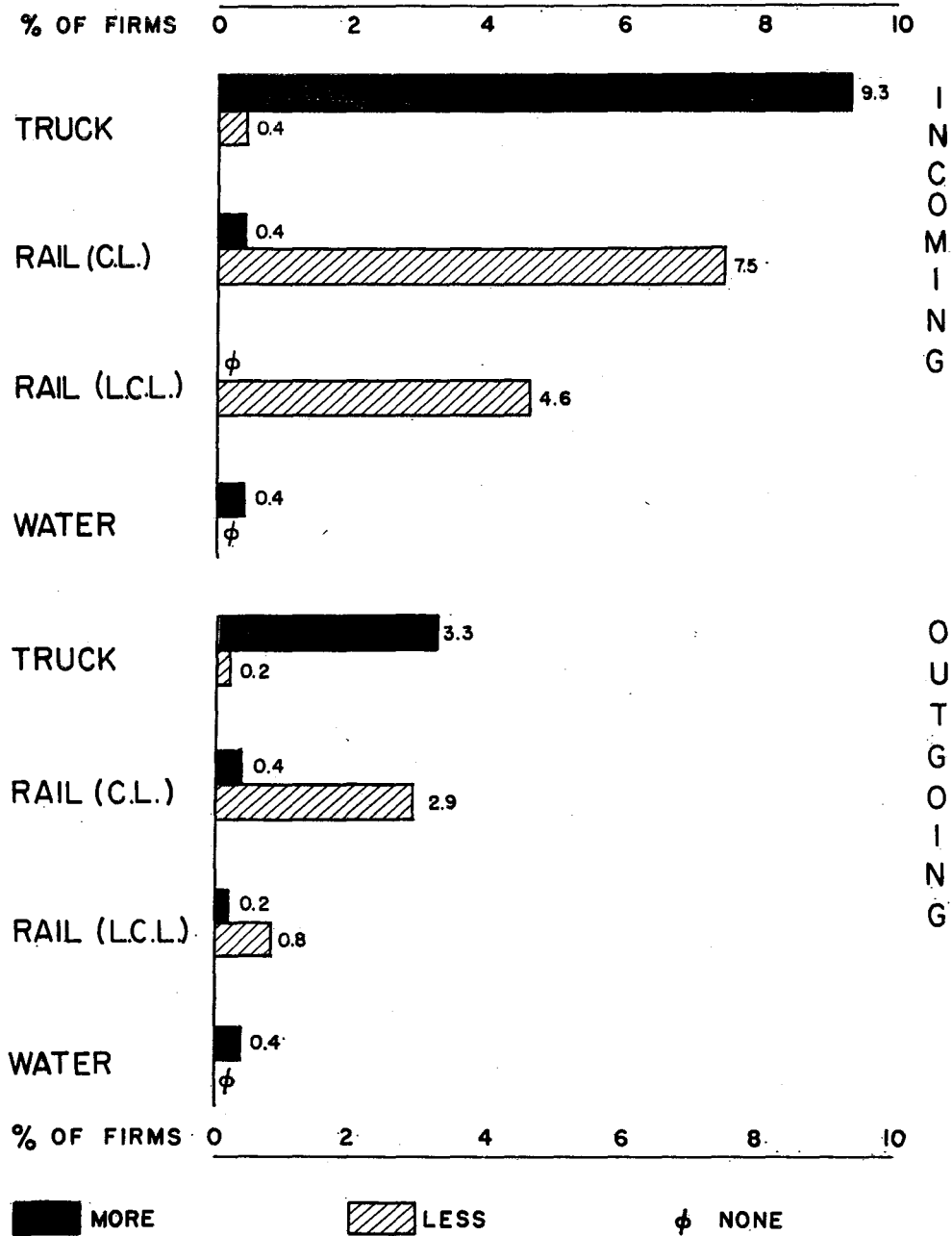


Figure 22.

CHANGES ANTICIPATED IN THE USE OF TRUCK TRANSPORTATION BY FIRMS IN THE FOOD INDUSTRY



Figure 23.

CHANGES IN USE OF TRUCK TRANSPORTATION DURING THE 5 YEAR PERIOD, 1952-56, BY FIRMS IN THE FOOD INDUSTRY

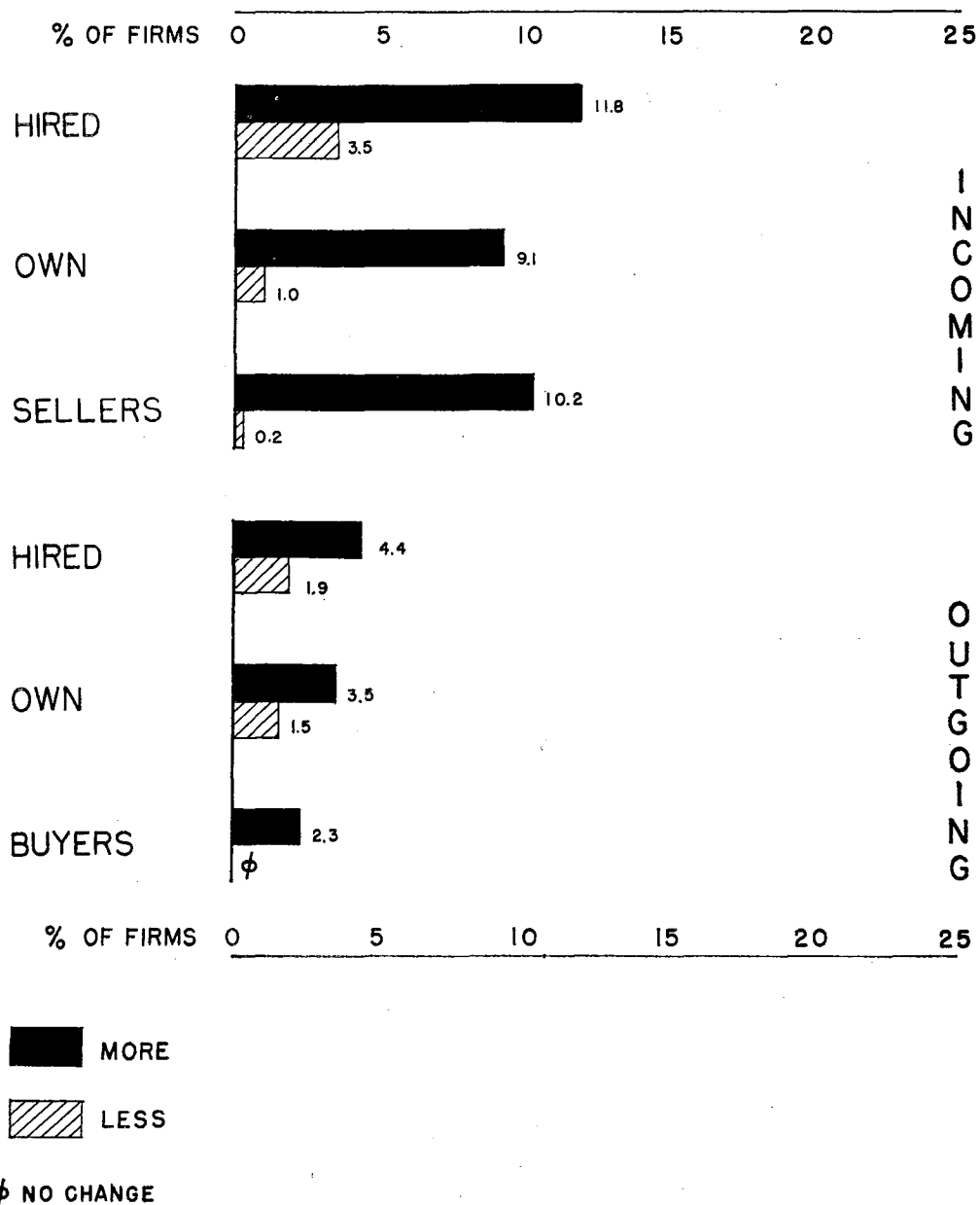


Figure 24.

2 to less than 5 percent. A slightly larger percentage of firms increased their use of the other two classes.

The chart of anticipated changes (Figure 24), indicates that no pronounced shifts are in store over the next 5 years. Only a little more than 5 percent of the firms reported that they are considering shifting to hired trucks in their incoming business while 5 percent plan on using more own trucks and less than 4 percent more sellers' trucks. Outgoing operations were expected to be affected even less than the incoming operations.

From the data presented here several conclusions can be drawn regarding trends in transportation usage. The first is that significant changes in use have occurred over a relatively short period of time. The second is that the trend in usage has been toward an increase in the use of all 3 kinds of trucks and a corresponding

decrease in the use of rail, with little change in the over-all use of water. The third is that either the rate of change has decreased or most of the changes in usage have been caused by immediate situations or needs and have not been the result of long-range planning. These possibilities are based upon the relationship between past changes and anticipated changes as reported by the firms interviewed. Unless one assumes that the rate of change has been slowed for some reason, it must be concluded that only a part of actual changes are included in a company's long-range plans. Otherwise, the rate of past changes and proposed changes would be more nearly equal than is indicated by the data presented here. If the trend has not been slowed and all the changes are not included in company planning, then future shifts between transport types may be greater than is indicated by the responses given.

SUBSTITUTABILITY OF TRANSPORTATION

Some people, in comparing different types of transportation, follow a basic assumption that all types are freely competitive to each other. This in turn assumes that a firm can use different types of transportation interchangeably in its business. One of the objectives of this study is to determine the extent to which the different types of transportation could be substituted for each other in the studied firms' normal operations.

To do this, each firm was asked to estimate the extent that its truck operation could be shifted to rail or water, its rail operation shifted to truck or water, and its water operation shifted to truck or rail. This question was further qualified by an explanation that any shift in the method of movement could allow for some reduction in either efficiency, economy or service, but must allow the firm to remain in business. The respondent then estimated the percentage of each type of transportation that could be shifted to another facility.

To simplify the estimating procedures all firms were given a choice of five percentage groupings from which to choose in estimating their ability to shift. These were:

1. Almost completely (76-100%)
2. Substantially (51- 75%)
3. Some (25- 50%)
4. Very little (Under 25%)
5. None 0

The extent of the interviewed firms' ability to switch from truck to rail is shown graphically in Figure 25, and their ability to switch from rail to truck is shown in Figure 26. The number of firms indicating their ability to shift from each type of transportation to another different type is shown in Table 15.

It is apparent from an examination of the charts and table that the ability to shift between types of transportation facilities is, in general, very restricted. In many instances, a firm is forced, through the nature of its operation, to use a particular type of transportation, and would be unable to change to a different type under any ordinary conditions. Other firms are able to shift a part of their operation to different facilities, but practically none are able to change all of each type of operation to another transportation facility.

The least possibility for shifts occurs in those movements that fall in what may be termed the "non-competitive areas" with regard to kinds of shipments, distance, and volume. Speciality movements, movements over extremely long or short distances, and movements over or through areas not directly served by other forms of transportation offer little opportunity for shifting. A firm in the export business, for example, could not possibly shift its export trade from water to truck or rail transportation. Likewise, a firm with locally delivered sales could not

TABLE 15—INDUSTRY RESPONSE REGARDING POSSIBLE SHIFTS IN USE OF TRANSPORT TYPES

	Number of Using Firms		Under present conditions, to what extent could your operation be shifted:									
			Almost Completely		Substantially		Some		Very Little		None	
	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out
From Truck To Rail	467	478	42	7	5	3	29	10	143	57	248	401
From Rail To Truck	186	96	10	23	18	3	57	19	81	19	60	31
From Rail or Truck To Water	471	480	1	0	0	0	5	1	16	5	449	474
From Water to Rail or Truck	16	18	1	1	0	0	1	0	2	3	12	14

ALL INDUSTRY RESPONSE REGARDING POSSIBLE SHIFTS IN USE OF TRANSPORT TYPES -FROM TRUCK TO RAIL

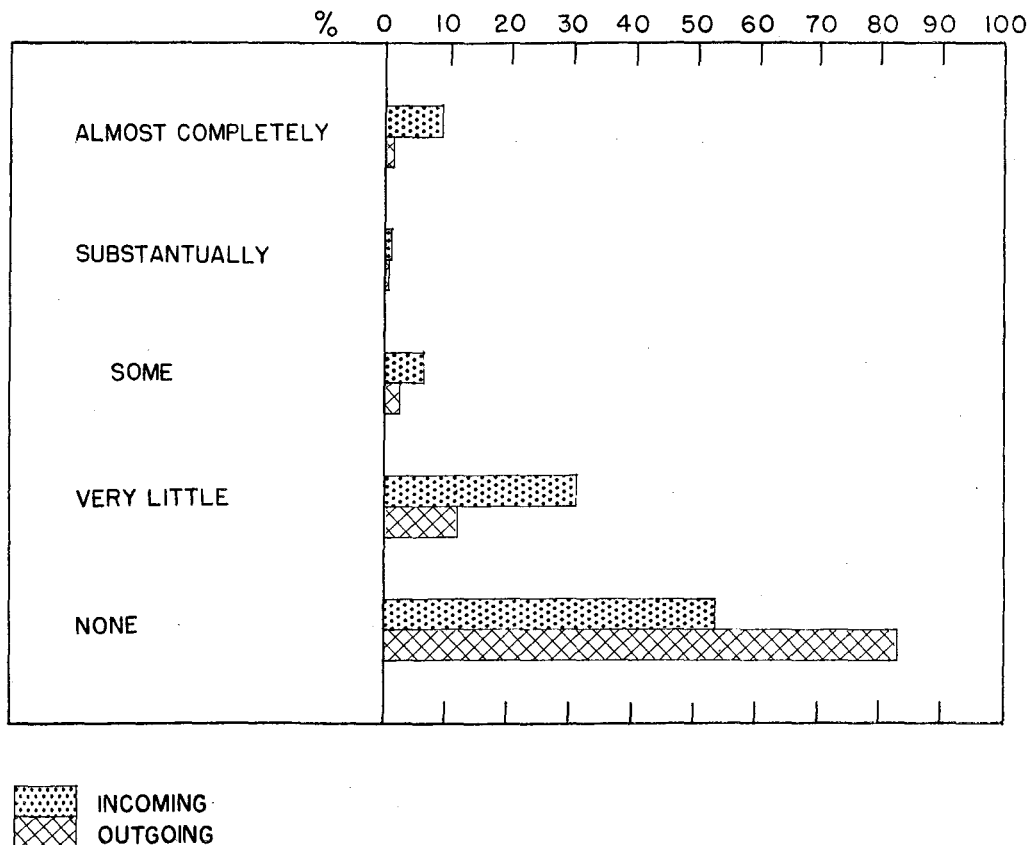


Figure 25.

continue in business if forced to deliver by rail or water. These types of shipments are obviously not competitive between types of transportation.

Competition between types of transportation is most intense and the opportunity of a firm to shift its transportation is greatest for those shipments that fit in the operational requirements of more than one type of transportation. A 60,000 pound shipment of dry freight from Corpus Christi to Dallas, a distance of under 400 miles, could possibly be shipped by either truck or rail. Competition for this type of shipment would be active, and a firm could possibly shift freely between the two competing facilities. A firm making a similar

shipment from Corpus Christi to New York City would likely give less consideration to shipping by truck, but could also have the alternative of shipping by water. In either case, two types of transportation would be available.

TRUCK

Most firms in this study did not consider that very much of their truck business could be shifted to rail. This was particularly true of those firms with extensive local delivery operations. Almost 84 percent of all firms interviewed indicated that it would be impracticable to shift any of their outgoing truck shipments to rail, while only 1.5 percent considered it

ALL INDUSTRY RESPONSE REGARDING POSSIBLE SHIFTS IN USE OF TRANSPORT TYPES-FROM RAIL TO TRUCK

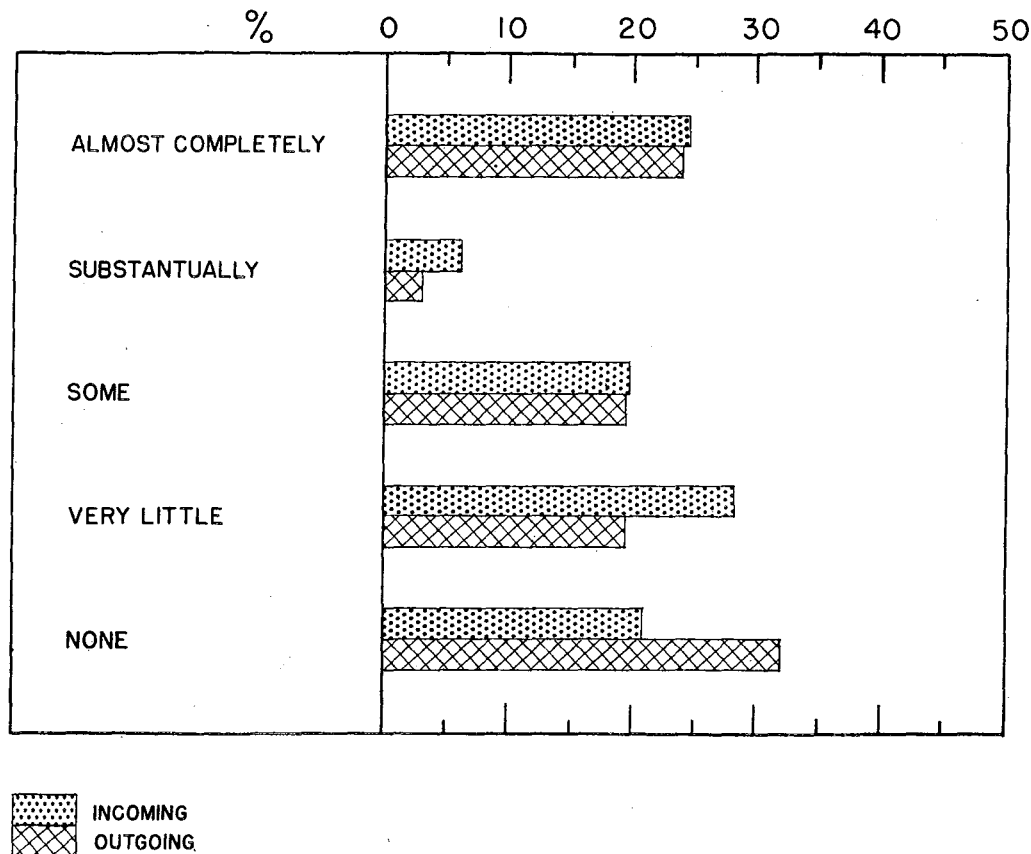


Figure 26.

possible to shift all their outgoing truck shipments in this manner. Incoming operations, however, appeared to be somewhat more flexible. This is due to the basic differences between the incoming and outgoing operations. The incoming truck shipments were generally larger and were shipped over a longer distance than were the outgoing shipments, which included a larger proportion of local delivery operations.

RAIL

Both the incoming and outgoing rail operations were considerably more flexible than the truck shipments. About 25 percent of the firms reported that as much as 75 percent

of their rail business could be handled by truck, while less than a third indicated that none of their outgoing rail movement could be shifted to truck. This greater ability to substitute was largely caused by the fact that more of a firm's rail operation lies within an area of truck-rail competition. That is, a large part of the rail movements were of a type that could also be handled by truck if the necessity arose, while more of the truck shipments (particularly in cases of local delivery) could not be handled by rail.

WATER

The extent to which shipments could be shifted either to or from wa-

ter transportation is even more restricted. Of the firms using either truck or rail, over 95 percent felt that they could not shift any of either their incoming or outgoing business to water. The situation was almost as inflexible with respect to changing from water to one of the other forms of transportation. Over 75 percent of the firms indicated that they could not change their water shipments to either rail or truck.

This inability to shift between types of transportation is understandable when one considers the operational requirements of the different types of shipments made by a firm, and the inherent advantages in speed, flexibility, and economy offered by the competing types of transportation.

In this age of specialization it is not surprising that each type of transportation would tend to specialize within itself to fulfill the demands of each industry it serves. That is what has happened with the transportation agencies serving the food industry. As total transportation needs have increased and the requirements of the using firms have become more precise, the different types and kinds of transportation have tailored their operations to meet these new requirements. This has tended to create specialized transportation for the handling of certain types of shipments. A firm is justifiably reluctant to change from a type of transportation which is tailored to its needs to one which may not completely fulfill all its requirements.

PRIVATELY-OWNED VS. HIRED TRUCKS

It has been recognized for some time that the use of privately-owned and hired trucking is practiced without a great deal of uniformity by almost all types of firms. It is not uncommon for one firm to use its own trucks while another, with a very similar operation, hires its trucking from a commercial firm. A third firm may use its own trucks for parts of its operation and hired trucks for the remainder. Various advantages have been frequently stated by advocates of each type of operation, but often the same advantages are listed for each type of ownership.

As a part of the over-all effort to determine transportation preferences, it was decided to try to determine and categorize the major advantages and disadvantages to a firm in using either its own trucks or hired trucks. It was hoped that in this way some useful information could be made available to new firms which were faced with the problem of either buying their own fleet of trucks or hiring their trucking from commercial sources. This information would also be useful to those firms which were contemplating changing from one system to another.

Because of the nature of the study, no actual cost information was obtained. The discussion here is concerned only with comparative advantages reported by the interviewed firms.

Each firm that was using or had recently used its own trucks as a part of its transportation operation was asked to describe the major advantages of owning its own trucks rather than using hired trucks. Likewise, each firm that was using or had recently used hired trucks was asked to describe the major advantages of hiring its transportation rather than owning or leasing its own trucks. Firms that were using both types were asked to list the major advantages

of each. Actually, most of the firms fell into this latter category. Of the 482 firms interviewed, 446 used their own trucks and 420 used hired trucks.

OWN TRUCKS

The advantages of using firm-owned trucks are shown in Table 16. Of the 446 firms questioned, only 21 felt that there were no major advantages to a firm in owning its trucks. Some of these firms had sold their trucks and others had reduced their owned-truck operations.

The remaining 425 firms listed a total of 608 advantages which have been grouped into eight broad classifications. By far the most frequently listed advantage was that it was more economical for a firm to do its own trucking than to hire it done. Over half the firms listed this as a major advantage of private trucking. (It is interesting to note that this was also the most frequently mentioned advantage to using hired trucks, Table 17).

Most of the remaining advantages listed were concerned with some aspect of the firm's ability to serve its customers and were directed primarily toward the outgoing phase of its operation. Better service to customers was a strong selling point in a highly competitive field such as the food industry and many firms considered that the advantages of being able to provide more frequent deliveries and quicker service through using their own trucks offset any extra

TABLE 16—MAJOR ADVANTAGES OF OWN OVER HIRED TRUCKS

Advantages	Number of Firms
More economical	225
Better service	142
More convenient	98
Better control and scheduling of routes	55
More flexible operations	43
Better control	28
Drivers also salesmen	11
Less damage to goods	6
No advantages	21

TABLE 17—MAJOR ADVANTAGES OF HIRED OVER OWN TRUCKS

Advantages	Number of Firms
More economical on L.T.L. shipments	162
More economical over-all	60
Less capital outlay	58
Less responsibility and liability	39
Wider geographic coverage	37
Cheaper for seasonal operation	19
More convenient	13
No advantages	99

expense and bother involved. Firms with extensive local operations, for example, did not feel that they could properly serve their businesses without operating their own trucks. Some firms, principally bottled drink distributors, required their drivers to act as salesmen. They did not feel that this job could be handled adequately by a commercial trucking firm. A few firms also felt that their own drivers took better care of their merchandise and that they had less damage when hauling in their own trucks.

HIRED TRUCKS

There were 420 firms interviewed concerning the advantages of hired trucks. Of this number, 99 felt that hired trucking offered no particular advantages to them. Most of these used commercial trucks only to supplement their own operations. Some were in the process of building up their own truck fleets, and a few used both commercial trucks and their own trucks and did not feel that there were any strong advantages to either system.

The 321 firms that believed there were advantages to hired trucking, however, listed a total of 388 advantages. These are grouped into 7 categories in Table 17. The major advantage listed was that it was more economical to ship L.T.L. shipments by commercial carriers than to haul them by firm-owned trucks. This fact was stressed by the larger firms in particular. Many firms with an extensive truck operation of their own still shipped all their long distance L.T.L. movements by commercially operated truck lines. In fact, this was one of the few advantages listed

on either side that was almost non-controversial and is generally an accepted practice within the industry.

The next most frequently listed advantage to using hired trucks was that they were more economical overall. The argument is advanced here that when all fixed costs, such as supervision, executive time, garaging, etc. are considered, it is cheaper to hire commercial trucking. Many firms suggested that all of these costs were not charged to the truck operation by most of the firms using their own trucks. A very few firms stated that they had made cost studies of their own truck operations and as a result switched to hired truck.

Cost also enters into most of the other advantages given. Less capital outlay is a reflection of the cost or expense of capital necessary to finance truck purchases, while less responsibility and liability is a risk cost assumed by the truck owner.

A somewhat different aspect of the cost picture was presented by the 19 firms stating that hired trucks were cheaper for seasonal operations. These firms did not feel that they were justified in buying enough trucks to move the volume of goods that must be handled during peak seasons, since the equipment would remain idle during several months of the year. They felt that it was more economical to own no more than the number of trucks required for normal operations during their slack period. All additional movements were then handled by hired trucks.

Wider geographic coverage was listed by 37 firms as a major advantage of hired trucks. They felt that hired trucks permitted them to extend their distribution into areas that they could not otherwise serve properly. The fact that commercially operated truck lines, through their connecting carrier operations, can serve all parts of the country makes this an important consideration.

In summarizing these advantages, it should be pointed out that most

firms, with exceptions of course, use both their own and hired trucks as one trucking system. Actually, the two are often complementary. Each has definite advantages for certain types of shipments, and are used for these purposes. Own trucks, for example, are almost universally used for regular local movements while hired trucks are used as extensively for the long distance L.T.L. shipments. It is in the area between these two extremes that the two kinds of

trucks are most competitive. Many identical advantages are claimed for each kind, particularly in the area of cost, but little cost analysis work has been done on the comparative economic advantages of the two systems for the industry as a whole. The extent of their use at the present time depends largely upon the personal experiences and requirements of individual firms, and actual transportation cost is not always the most important determining factor.

FACTORS INFLUENCING THE CHOICE OF TRANSPORTATION

Cost and speed of service have been generally recognized as two of the most important factors in determining whether a firm will use rail or truck. They are generally listed as the major comparative advantages of rail and truck respectively. Recognizing this fact, the following question was asked of each interviewed firm. "What factors, other than cost and speed of service, do you consider as the major influences on your choice of either rail or truck transportation?" Respondent firms were encouraged to list both exceptionally favorable and unfavorable factors. In this way, it was hoped to point up some of the stronger features of each type of transportation and draw attention to the ones that need improvement.

The factors listed are shown in Table 18. The answers were divided into two groups. The first group contains the reasons for using truck and the second lists the reasons for using rail. Twenty-two firms stated that their transportation use was largely determined by their customers or suppliers, and listed this as the only factor influencing their choice. In several of these cases, a firm received incoming goods by transportation designated by a supplier which was also its parent company. Local beer distributors, for instance, often have sales arrangements whereby their merchandise is delivered to the plant by the brewery. A few firms also indicated that their outgoing shipments were largely determined through their customers either specifying a certain kind of transportation or picking up purchases in their own trucks.

TRUCKS

Of the firms making their own decisions, however, better service and greater convenience were the factors most frequently listed as influencing

their choice of trucks. The term "service", in this instance, emphasizes the aspects of over-all service other than speed. More personalized service, better local coverage, more attention to condition of shipments, and better over-all customer relations were stressed as aspects of service more readily obtainable through truck than rail. "Convenience" refers to fitting in the transportation operation with the regular operation of the firm. Many firms felt that their regular operations were disrupted less when shipping by trucks.

Firms with extensive local operations felt that their type of business necessitated the use of trucks and that any other type of transportation would be completely unsuitable.

Excessive damage by rail and better refrigeration service by truck were the next most frequently listed reasons for using trucks. Damage to merchandise was frequently quite expensive to the firm involved. This cost was not usually reflected in the damage to the merchandise itself, since the carrier was generally liable for damages incurred. Rather, it was the loss in time, extra work, and customer good will that was considered to be the real cost in damage claims. Firms are continually seeking ways in which excessive damages to merchandise can be eliminated.

TABLE 18—FACTORS OTHER THAN COST AND DELIVERY TIME WHICH INFLUENCES CHOICE OF TRANSPORTATION

Factors	Number of Firms
Better service by truck	56
More convenient by truck	55
Use of truck dictated by local operation	31
Excessive damage by rail	28
Better refrigeration service by truck	28
Poor attitude of rail personnel	8
Miscellaneous reasons for truck	17
Choice of shippers	22
More convenient by rail	20
In-transit rail privileges	15
Miscellaneous reasons for rail	15

RAIL

The most frequently offered reason for using rail transportation (other than cost) was the convenience of handling rail shipments. Firms listing this as a major advantage pointed out that there is not the same urgency involved in loading or unloading a rail car as there is in handling a truck shipment. When a rail shipment is delivered to the plant, the manager can work out the unloading schedule so that it interferes as little as possible with regularly scheduled work. When a truck shipment arrives, however, it must be handled immediately so that the truck and driver can leave. This often disrupts other plant activities or necessitates hiring additional personnel for unloading work.

The other major factor influencing the choice of rail transportation was the in-transit billing privileges offered by rail. The fact that some raw materials can be shipped into a

plant, processed, and then shipped to another destination on an in-transit billing contributes toward substantial savings in cost. This same privilege is not offered by trucks.

Other factors listed were grouped into a miscellaneous category. Each of these items was listed by only one or two firms and can not be considered as being generally recognized as major advantages by the industry as a whole.

It would appear, then, that other than cost and speed, the use of trucks was influenced by their ability to serve the more personalized needs of the individual industries. Rail, on the other hand, was used because of its ability to complement a plant's normal operating procedure during loading and unloading, and because of the in-transit billing privileges available. The disadvantages of each type of transportation are discussed in some detail in the next section of the report.

IMPROVEMENTS NEEDED IN TRANSPORTATION

To continue to fulfill the increasing demands of the industries it serves, transportation must continue to improve the services rendered. Service that was completely satisfactory even a few years ago may be barely adequate today, and, with continued growth and increasing competition, be wholly inadequate tomorrow. To remain competitive and retain its share of the business, each type of transportation must continue to meet the increasing demands for service as they arise.

Since the demands on transportation are continually increasing, it is not always possible for the serving industry to realize the extent to which it is fulfilling the demands placed upon it or to recognize immediately the areas in which it is failing to provide all the required services. This section of the report is devoted to helping outline the areas in which improvements are needed for both the rail and trucking industries.

RAIL

Each firm in the study was asked this question: "How could rail transportation be improved to better serve the transportation needs of your firm? To limit possible bias, this was stated as an "open-end" question and no answers were suggested to the interviewed firm. The answers given were then grouped into more-or-less homogeneous classes for presentation in summary form. Only those firms who were using or were in a position to use rail transportation were asked for comment. Responses were obtained from 338 firms. Of this number, 88 firms, or 26 percent of the number questioned, were satisfied with their present rail service and could offer no suggestions for improvement. Twenty-seven firms were dissatisfied, but suggested no means whereby rail could be improved to better serve their needs. The remaining 223 firms offered a total of 316 suggestions for improving rail trans-

portation. Many firms suggested more than one way in which improvements could be made, and some had no constructive criticism to offer. Table 19 shows the summary of all comments arranged in descending order of frequency.

It appears from these data that most of the criticism against railroads are leveled at some aspect of service. With the exception of rates, (Item 3 in Table 19) all suggestions for improving the usefulness of rail transportation were directed toward some part of the service that was rendered. These suggestions can further be grouped into broad categories of service such as speed, damage prevention, equipment, and personnel training.

It is interesting to note that by far the most frequently mentioned deficiency in present rail transportation is the speed of service. Over a third of all the comments made were concerned with improving this aspect of rail transportation. Each of the three next most frequently mentioned factors, "less damage to merchandise," "lower rates," and "better over-all service," was listed by less than 11 percent of the firms. These four factors together, however, accounted for over two-thirds of all the suggestions for improvement that were offered.

All of these factors have received and continue to receive corrective at-

TABLE 19—WAYS IN WHICH RAIL TRANSPORTATION COULD BE IMPROVED TO BETTER SERVICE THE FOOD INDUSTRY

Factors	Number of Firms
1. Faster point to point service	108
2. Less damage to merchandise	37
3. Lower rates	36
4. Better over-all service	34
5. Speed up terminal operations	25
6. Better attitude of personnel	15
7. More and better cars at peak seasons	13
8. Quicker notification of arrivals and deliveries	9
9. Better unloading service	7
10. Settle claims quicker	6
11. Better pool car packing and handling	6
12. More refrigerated cars	3
13. Miscellaneous	17

tention by the railroads, but continue to be the weak points of this facility's operation. It is entirely possible that some of these deficiencies such as speed cannot be greatly improved without disproportionate increases in costs. It is quite likely, however, that other weaknesses such as damage control and employee training could be improved without unduly raising the total costs of service.

COMMERCIAL TRUCK

The question, "How can commercial truck transportation be improved to better serve your firm?" was also asked of each interviewed firm as a free response question. Again the answers have been group into more-or-less homogeneous units for presentation in tabular form. Table 20 shows the most frequent answers given and the number of firms making each suggestion for improvement.

A total of 405 firms that were either using or in a position to use commercial truck transportation were asked for their comments. Of this number, 258 firms or about 64 percent of those interviewed stated that they were satisfied with the present commercial trucking industry and could offer no suggestions for improvement. The remaining 147 firms offered a total of 166 suggestions that have been consolidated into 12 general groupings and one miscellaneous category.

By far, the most frequently heard complaint against the commercial or "for-hire" trucking industry concerned their rate structures. Over a third

of all suggestions were directed toward lowering freight rates. This is in rather sharp contrast to rail, where rates were only the third most frequently mentioned item needing improvement.

In addition to rates, the comments for improving commercial truck transportation can also be grouped into four broad categories. These categories, however, were not exactly the same as the ones for rail. Improvements in damage prevention, improved equipment, and greater speed of service were desired here too, but in addition another category, governmental regulations, must be added. No complaints were made against the attitude of the commercial trucking employees.

Most of the complaints against governmental regulations were concerned with the difficulties incurred in shipping out-of-state. Several firms complained about the differences in regulations concerning weight limits between different states, and strongly recommended that uniform regulations be adopted between all states. Other firms felt that the I.C.C. exercised too much restrictive control over truck transportation and that the amount of red tape connected with operating under their supervision should be reduced.

PRIVATE TRUCKING

Private trucking, as defined in this study, is the operation of a truck or trucks by a firm to move its own goods. Since the shipments made by a firm on its own trucks are under its own management, each firm is responsible for the service that is performed. Therefore, the question of improving the service rendered, as was asked users of rail and commercial truck transportation, is not applicable in this case. Instead, each firm that used its own trucks was asked what changes it considered desirable in the regulation and control of private trucking to make this type of transportation more effective.

From the answers to this question, it appears that most of the firms

TABLE 20—WAYS IN WHICH COMMERCIAL TRUCK TRANSPORTATION COULD BE IMPROVED TO BETTER SERVE THE FOOD INDUSTRY

Factors	Number of Firms
1. Lower rates	61
2. Less damage to merchandise	25
3. Better organization and routing	11
4. Improved delivery service	11
5. Quicker claim adjustment and tracing service	9
6. Quicker loading and distribution of L.T.L. shipments	6
7. Quicker terminal transactions	6
8. Standardized equipment	6
9. Uniform laws and regulations	5
10. More available equipment	4
11. More refrigerated equipment	4
12. Less interference by I.C.C.	3
13. Miscellaneous	15

TABLE 21—WAYS IN WHICH PRIVATE TRUCKING COULD BE IMPROVED TO BETTER SERVE THE FOOD INDUSTRY

Factors	Number of Firms
1. Uniform laws among states	36
2. Increased weight limits	28
3. Lower taxes, fees, licenses	16
4. Increase speed limits	13
5. Less regulation and I.C.C. licensing	8
6. Increase length limits	3
7. Miscellaneous	18

were fairly well satisfied with the regulations of and controls over private trucking. Of the 359 firms interviewed, 250 or almost 70 percent said that they were satisfied with present conditions and could make no suggestions for improvement. The other 109 firms offered a total of 122 suggestions for making private truck operations more useful.

The most frequently offered suggestion was one that was also offered for commercial trucking; that is, to establish a system of uniform trucking laws between states. A large number of firms feel very strongly about the situation that has developed over the years between various states. Not only do the maximum permissible gross weight limits vary from one state to another, but there are also variations in factors such as the maximum weight allowed per wheel or axle over-all length, and speed. In addition, more and more states are initiating or enforcing special licensing and tax regulations. These different regulations increase the direct cost of interstate shipping through increasing the payments for additional registrations, taxes, and fees. They may also increase the indirect costs by delaying shipments at check stations and spot weighing points within the state.

It is the contention of many firms that not all states are entirely honest in the enforcement of their laws. These firms feel that some states use their regulations as punitive measures and as methods of obtaining revenue through fines. Whether this contention has merit or not, there can be no question but that a system of uniform and equitable regulations between all states would greatly bene-

fit all firms depending on trucks to move their goods in interstate commerce.

Most of the other suggestions for improving the effectiveness of private trucking were concerned with changing some aspect of the restrictive legislation within the state of Texas. Of these, suggestions to increase weight limits were offered most frequently. These suggestions were usually made by the larger firms who would like to ship in large quantities and were based on economic load considerations. Table 21 shows all of the suggestions offered grouped into homogeneous categories.

A large number of the firms gave some surprising answers when asked to comment on regulations governing their trucking operation. Many expressed a personal desire for certain changes that would benefit their business, but recognized that to initiate such changes would be detrimental to the trucking industry in the long run. Comments such as—"Naturally we would like to have lower taxes and licenses, but we would rather pay at the present rates and continue building better roads than to have our taxes cut and have the kinds of roads we used to have," were offered quite frequently. Similar comments were made regarding speed limits and weight and length regulations. The majority of the firms realized that most of the regulations, while certainly restrictive and at times economically painful, were necessary to the long term successful operation and regulation of their business.

In summary, several broad conclusions can be drawn regarding recommendations for improving the three types of transportation. Users of rail transportation are most concerned with improving the speed and general service offered by the railroads. They feel that significant improvements could be made in this general area. There also appears to be a definite need for improvement in public relations between the rail carriers and the people they serve,

particularly at the local level. Users of commercial truck transportation are more concerned with freight rates. They feel that commercial truck rates are often excessive, particularly in those areas in which competition by rail is reduced through locational or type-of-shipment factors. Users of privately-owned trucks,

on the other hand, are more concerned with uniform laws and regulations between states, and with various aspects of state regulations regarding maximum weights, lengths, and speeds. These regulations were considered more restrictive to their operation than were the operating taxes and licenses that are required.

TRUCK WEIGHTS AND LOAD LIMITS

The adequacy of load limitations under Texas law has long been debated within the trucking industry. Appeals for increases in weight limits are frequently heard and proposals for either minor changes or complete revisions of regulations are often proposed by various segments of the industry. A proposal to increase the over-all maximum weight limit was narrowly defeated by the 1957 session of the Texas Legislature. It is almost a certainty, however, that either this proposal or others similar to it will continue to be advanced by the trucking industry.

For obvious economic reasons, increased load limits would be considered desirable by almost all commercial trucking firms. Their income is affected by the size of the loads they are permitted to carry. The reason for limiting loads, however, is based upon the relationship between gross loads carried by type of vehicle and damage to highways. Since this is largely an engineering problem, it is outside the scope of this study.

The question that is considered of primary importance here is—how well

do the load limits that are in effect meet the transportation requirements of the individual firms served? Do firms normally want to move goods by truck in larger single-shipment quantities than they are now allowed? The answers to these questions should be considered in any proposal for load limit revisions. If present load limits are considered adequate by the shipping firms, then it may be assumed that the argument is one of operational efficiencies between the truck owners and the regulating agencies. If they are not adequate, then these needs should be given consideration in policy formulation.

An effort was made in this study to determine the extent to which present regulations were considered satisfactory by firms in the food industry. To do this, the normal maximum weights of truck loads was determined for each firm. These maximum loads could apply to the firm's own or hired trucks or to buyers' or sellers' trucks. The major objective was to determine the size of the largest normal truck shipments. Each firm was then asked if present load limits were adequate for its operation. Those that answered "No" were then asked for suggested revisions of the weight laws.

WEIGHTS

The maximum loads normally handled by food industry firms are shown in Table 22. For convenience, these data have been grouped into 6 weight classifications. The 19 different industries are shown individually so that their distribution of maximum loads within the various weight categories may be easily seen.

One observation that is immediately apparent from this table is that individual firms within the same four-digit industry group have widely divergent maximum load requirements. The great majority of industries have some firms with maximum

MAXIMUM TRUCK LOADS CARRIED BY FOOD INDUSTRY

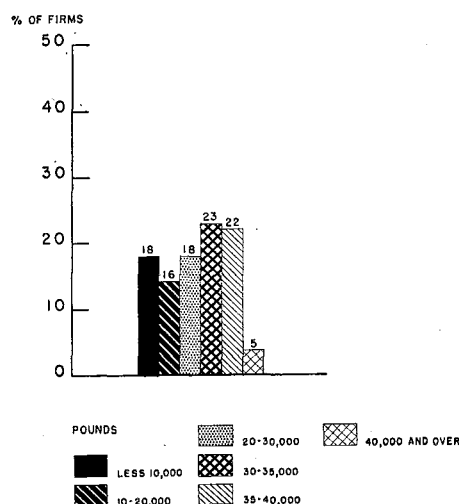


Figure 27.

loads of less than 10,000 pounds and others with loads of over 35,000 pounds. In only the case of ice cream manufacturers, Industry 2044, were more than half the firms concentrated in a single weight range. Here 9 of the 17 firms interviewed had maximum loads of less than 10,000 pounds. Some industries will, of course, have a greater proportion of firms in certain weight categories than others, but over-all, the industries are well spread between the various weight groups.

It would seem logical, then, that maximum loads are influenced by other factors in addition to the type of industry. In order to isolate those factors which may be most influential, all firms were grouped by strata

(Table 23). In this way, the differences due to location within the state, size of the city and size of firm become recognizable. The total number of firms within each strata is shown, and the number of firms falling within each weight category is expressed as a percentage of the strata total.

The extent to which the individual stratum conforms to or diverges from the average distribution for all firms combined can be determined by comparing the percentage of firms within each weight group with the industry totals shown in Figure 27. Almost exactly half of all the firms interviewed had maximum truck loads over 30,000 pounds. The comparisons by area and city size show

TABLE 22—MAXIMUM TRUCK WEIGHTS CARRIED BY FIRMS IN THE TEXAS FOOD INDUSTRY

INDUSTRY NUMBER	Total Number Firms	Number of Firms in Each Weight Range					
		Under 10,000 Pounds	10,000 to 20,000 Pounds	20- 30,000 Pounds	30- 35,000 Pounds	35- 40,000 Pounds	Over 40,000 Pounds
2011	32	5	7	10	8	2	0
2015	13	2	3	2	3	1	2
2024	17	9	1	1	3	1	2
2033	17	0	1	2	6	6	2
2035	10	2	1	0	3	4	0
2037	4	0	0	2	0	2	0
2041	15	0	0	2	0	11	2
2044	4	1	0	1	1	0	1
2051	46	19	7	8	9	2	1
2071	14	5	1	4	2	2	0
2081	58	2	5	17	16	16	2
2082	6	0	1	0	1	3	1
2082	6	0	1	1	0	1	1
2094	3	0	0	2	3	2	1
2097	34	10	16	2	3	2	1
2099	21	7	3	0	4	5	2
Sub-Total	294	62	46	52	59	60	15
5041	71	15	8	14	22	11	1
5042	35	6	3	2	8	15	1
5051	50	5	7	15	11	10	2
5141	32	1	3	3	10	11	4
Sub-Total:	188	27	21	34	51	47	8
Grand Total:	482	89	67	86	110	107	23

TABLE 23—DISTRIBUTION OF MAXIMUM TRUCK WEIGHTS CARRIED BY FIRMS IN THE TEXAS FOOD INDUSTRY

Breakdown of Sample		Number of Firms by Strata	Weight Ranges of Loads					
			0-10 000 lbs. % Firms	10-20 000 lbs. % Firms	20-30 000 lbs. % Firms	30-35 000 lbs. % Firms	35-40 000 lbs. % Firms	Over 40 000 lbs. % Firms
Area	1	151	21.9	16.6	23.8	21.8	12.6	3.3
	2	221	16.8	11.3	15.4	24.4	29.4	2.7
	3	110	17.3	15.5	14.5	20.9	20.9	10.9
City Size	Totals	482	18.5	13.9	17.8	22.8	22.2	4.8
	1	243	20.6	11.1	16.5	25.9	21.8	4.1
	2	127	13.4	17.3	18.9	22.1	23.6	4.7
Firm Size	3	112	19.6	16.1	19.6	17.0	21.4	6.3
	Totals	482	18.5	13.9	17.8	22.8	22.2	4.8
	1	118	5.9	5.1	11.9	30.5	36.4	10.2
Firm Size	2	263	17.5	15.6	21.3	21.7	21.3	2.6
	3	101	35.7	19.8	15.8	16.8	7.9	4.0
	Totals	482	18.5	13.9	17.8	22.8	22.2	4.8

MAXIMUM TRUCK LOADS CARRIED BY FIRM SIZE

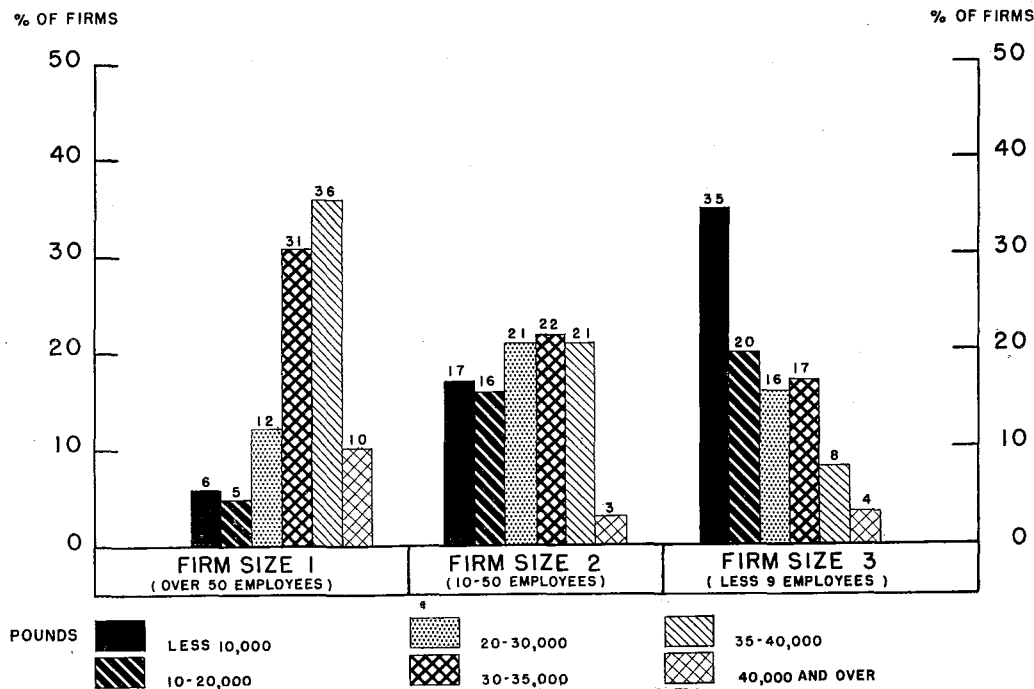


Figure 28.

that each stratum in the classification diverge from the industry average to a certain extent.

When the firms are classified according to size, on the other hand, a definite pattern is readily apparent. There are sharp differences between the size of loads carried by firms of different sizes see Figure 28). Over 77 percent of the larger firms, Firm Size 1, handle truck loads in excess of 30,000 pounds, and only 6 percent have maximum loads of less than 10,000 pounds. The medium size category, Firm Size 2, have 46 percent of the firms with loads in excess of 30,000 pounds and 10 percent carrying loads of less than 10,000 pounds. The smaller size firms, Firm Size 3, handle much lighter loads. Only 29 percent of these firms carry loads over 30,000 pounds while 35 percent carry less than 10,000 pounds as a normal maximum.

It appears evident from these data that the size of the firms is a major

factor in determining the maximum size of truck loads that will normally be handled by a firm. As the size of the firms is increased, the size of the loads that are carried will also generally increase. This is, of course, in accordance with other general operational characteristics of firms of different sizes. The larger firms have certain economic advantages of size, including the ability to buy and sell in large quantities, that are less readily available to the smaller firms.

SUGGESTED CHANGES IN LOAD LIMITS

Texas load limits are imposed on all types of trucks. These limits are established on the basis of gross weight per tire, per axle, and over-all gross weight for the particular vehicle. This "weight limit" is actually a schedule of maximum permissible gross weights for each type of vehicle as well as a series of regulations governing the distribution of weight between the axles of each type. What

TABLE 24—CHANGES SUGGESTED IN LOAD LIMITS

Suggested Changes				No. of Requesting Firms
A. Over-all Weight Increases				
1.	Increase gross load limits by unspecified amount			24
2.	" " " " " 1,000 pounds			1
3.	" " " " " 3,000 "			2
4.	" " " " " 3-5,000 "			1
5.	" " " " " 4,000 "			3
6.	" " " " " 5,000 "			5
7.	" " " " " 5,840 "			1
8.	" " " " " 6,000 "			1
9.	" " " " " 8,000 "			1
10.	" " " " " 8,760 "			2
11.	" " " " " 10-000 "			3
12.	" " " " " 10-14,000 "			1
13.	" " " " " 12,000 "			1
14.	" " " " " 14,500 "			2
15.	Increase load limits to 45,000 net weight			3
16.	" " " " " 62-63,000 gross			1
17.	" " " " " 65,000 "			2
18.	" " " " " 70,000 "			1
19.	" " " " " 74,000 "			1
20.	Increase gross load limits to California level			2
21.	" " " " " level of other western states			1
B. Axle Increases				
1.	Raise axle limits unspecified amount			2
2.	Increase axle limits by 2,000 pounds per axle			1
3.	" " " " " 2,500 "			2
4.	" " " " " to 22,000 " " " with a 65,000 lb. gross limit			1
5.	" " " " " 24,000 " " "			1
6.	Increase tandem axle limits to 32,000 lbs. per tandem axle			1
C. Special Changes				
1.	Increase 2 axle straight truck load limits by 2,000 pounds on rear axle			1
2.	Increase 2 & 3 axle straight truck gross load limits by 5-6,000 pounds			1
3.	Raise truck gross limits to a point where they are competitive with railroads			2
4.	Establish gross load limits by formula which includes tractor horsepower, brake rating and tire-load rating rather than present system			1
5.	Allow tractor-trailer to pull a full trailer			2
6.	Disregard individual axle weights and use gross weights only			1
7.	Increase over-all permitted lengths			1
8.	Increase straight truck limits by 10,000 pounds			1
9.	Allow gross weight of 60,000 pounds on 4 axle trucks			1

is usually considered as the weight limit, 58,420 pounds, actually applies only to the largest trucks. Each type and size truck has its own gross load limit.

This is the reason that suggestions for revising weight limit regulations are made by firms using the smaller size trucks. Some firms felt that the regulations governing the smaller trucks are unduly restrictive. As would be expected, however, by far the most frequent complaint against the present system of weight limitations was made by users of the large vehicles. Most users of small trucks have the option of using larger vehicles if the smaller size is too small to accommodate their normal operations.

About half of the firms interviewed in this study handle, as a part of their normal operations, truck shipments that weigh in excess of 30,000 pounds. Since, with most of the trucking equipment used to serve the

Food Industry, it is difficult to carry loads in excess of 30-35,000 pounds without exceeding some part of the load limit, it is obvious that many firms are presently operating near or in excess of the legal limits. This is particularly true of those firms handling loads in excess of 40,000 pounds. These are the firms who most want increases in the load limits.

Table 24 presents the changes suggested by 78 food industry firms. These suggestions are divided into over-all weight increases, axle increases and special changes so that the general type of change requested can be better visualized. There appears to be little uniformity or agreement between the firms as to just how the regulations should be changed. Most of them, however, feel that the over-all or gross limit should be increased by amounts ranging from 1,000 pounds to over 15,000 pounds. Almost a third of the firms desiring increases (24) thought that

TABLE 25—SUGGESTED LOAD LIMIT CHANGES

Area	Total No. of Firms	No. Firms Wanting Higher Limits	% of Firms Wanting Higher Limits	City Size	Total No. of Firms	No. Firms Wanting Higher Limits	% of Firms Wanting Higher Limits	Firm Size	Total No. of Firms	No. Firms Wanting Higher Limits	% of Firms Wanting Higher Limits
I	151	17	11.3	1	343	43	16.7	1	118	42	35.6
II	221	38	17.2	2	127	17	13.4	2	263	31	11.8
III	110	23	20.9	3	112	18	16.1	3	101	5	5.0
TOTAL	482	78	16.2		482	78	16.2		482	78	16.2

the gross limit should be increased, but did not feel that they were in a position to suggest exact limits. The general feeling of this group was that new limits should be established in accordance with the over-all needs of all the firms.

Several of the firms thought that weight revisions should be concentrated on revising the limits placed on individual axles. One of the most frequent complaints against load limitations was concerned with the limits on axle loads. Many firms, and particularly those that ship across other states, felt that axle load limit regulations were unduly restrictive and too strictly enforced. They reported that most violations were caused by poor load distribution between axles rather than by exceeding the gross load limits for the vehicle. It was claimed that this was often caused by the load shifting en-route and was extremely difficult to control short of underloading.

Special changes were advocated by 11 of the firms. These changes were grouped separately since they are usually applicable to specific situations rather than to the regulations as a whole. Most of the firms listing these suggestions were concerned with particular phases of their own operation.

In the discussion of weights it was concluded that the size of the firm

rather than location within the state or size of the city in which the firm is located was the major factor in determining the size of truck loads handled. As can be seen by Table 25 and Figure 29, the size of the firm is also instrumental in determining if load limits are satisfactory. The larger firms ship and receive in large quantities, and are most concerned with the regulations governing the size of loads. Over 35 percent of the large firms in the food industry feel that present load limits are inadequate for their operation. This is compared to less than 12 percent of the middle size firms and only 5 percent of the smaller ones.

PERCENTAGE OF FIRMS WITHIN EACH AREA, CITY SIZE AND FIRM SIZE THAT DESIRE INCREASED LOAD LIMITS

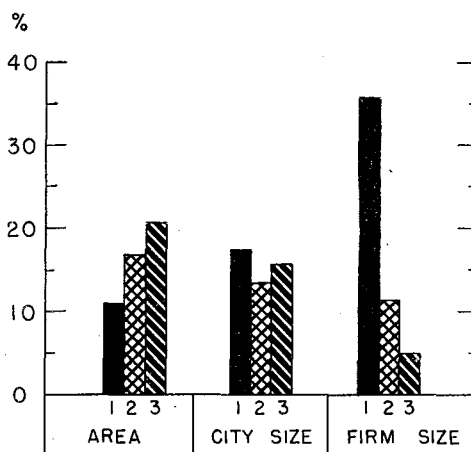


Figure 29.

ADDITIONAL STATISTICAL INFORMATION AVAILABLE

More detailed statistical information is being released in a statistical supplement to this bulletin. A copy of this supplement (Bulletin No. 9 "A Statistical Presentation of Transportation Uses and Preferences in the Texas Food Industry" by Hugo G. Meuth) may be obtained by writing to the Texas Transportation Institute, College Station, Texas.

