A Study of the Highway Distribution of Gasoline

By

DAN R. DAVIS

Associate Research Economist
Texas Transportation Institute

BULLETIN NO. 7

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

THD and TTI Research Project 2

October, 1957

TEXAS TRANSPORTATION INSTITUTE

(A part of the Texas A. & M. College System)

College Station, Texas

FOREWORD

This is one of several studies that have been designed to determine the transportation patterns and extent of traffic generated by the extensive movement of specific commodities on the highways of Texas, such as cotton, groceries, livestock, grain, lumber, gasoline, etc.

The use of heavy-duty motor transports in moving gasoline in Texas from the pipeline and waterway terminals of four major oil companies was surveyed. The information on the weight, distance, and frequency of hauls of gasoline thereby derived is now a part of the cumulative data that contribute to the functional and economical planning of the state highways of the future.

CONTENTS

A STUDY OF THE HIGHWAY DISTRIBUTION OF GASOLINE

DIGEST

Petroleum refining is the largest industry in Texas as measured by value of products.

Expanding markets for gasoline, competitive enterprise, and new innovations stimulated revolutionary transportation changes and resulted in a major shift from the railway tank car distribution of gasoline from refineries to distribution by pipeline. Economies in transportation have resulted from distribution at area terminals with extensive tank fields, bypassing with direct delivery from terminals to service stations, permissive legislation for large capacity motor transports, and the larger storage facilities at multi-pump service stations.

Although the sales volume of gasoline has increased immensely, the combined use of large capacity trucks and the increased capacity of storage facilities at service stations have reduced the number of hauls that would have been required previously. Consequently, the relative hazard of transporting gasoline on the highways has been lessened.

A considerable amount of traffic by heavy-duty gasoline transports is created by the geographic location of gasoline terminals. The location of terminals is determined principally on an engineering basis, often without regard to the nature of the highway system in the vicinitiy of a specific terminal.

Some 10,974,086 tons of gasoline were moved by heavy-duty transports on the public roads of Texas from the terminals and refineries of all oil companies operating in Texas in 1955.

Over one-half million truck hauls with an average weight of 17 tons are required to transport this amount of gasoline. The number of hauls was

Figure 1. Gasoline bulk plant located by railway facilities in 1924.

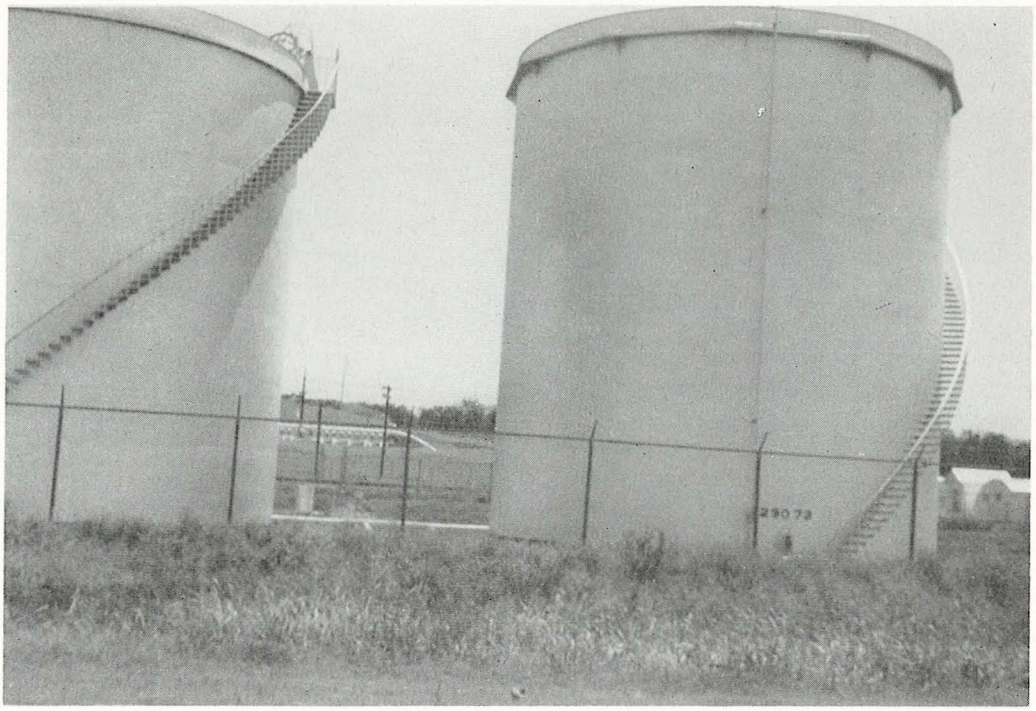


Figure 2. Tank-field storage of gasoline at a modern pipeline terminal.

determined by expanding the sample study transportation pattern (range in capacities of trucks and the frequencies of hauls by capacities) to include the entire state.

The sample study for 1955 included the highway distribution of over four million tons of gasoline from the terminals of four major oil companies to 508 bulk plants and 1297 distant service stations in 152 counties. The transports had a 1500- to 6700-gallon range in capacity.

The study did not include the hauls by trucks of small capacity that make frequent short distance hauls from bulk plants to service stations.

The maps that show the traffic patterns and counties having the greatest concentration of heavy transport traffic plus the summaries of the characteristics of the traffic that are given in the text for each area may provide direct or indirect contributions to the design, safety, construction criteria, and maintenance of future highways in Texas.

INTRODUCTION

Petroleum refining is the largest industry in Texas as measured by value of products. Seventy-four refineries produced 4,970,868,000 gallons of gasoline or 53.4 per cent of the total production for the United States in 1952. This enormous production creates heavy demands on a variety of transportation facilities for moving gasoline from the point of production to the ultimate customer.

The vastness of Texas alone, with its 48,678 miles of paved roads in 1955 and 3,781,235 motor vehicle registrations, presents no meager challenge to transportation to supply gasoline to more than 12,000 service stations at a low cost. The old pattern of transportation prior to 1935, utilized railway tank cars for conveying gasoline from the refineries to bulk plant storage facilities alongside the railways. A fleet of small trucks, with capacities up to 600 gallons, made deliveries of gasoline to small single-pump service stations that had storage facilities for about 500 gallons.

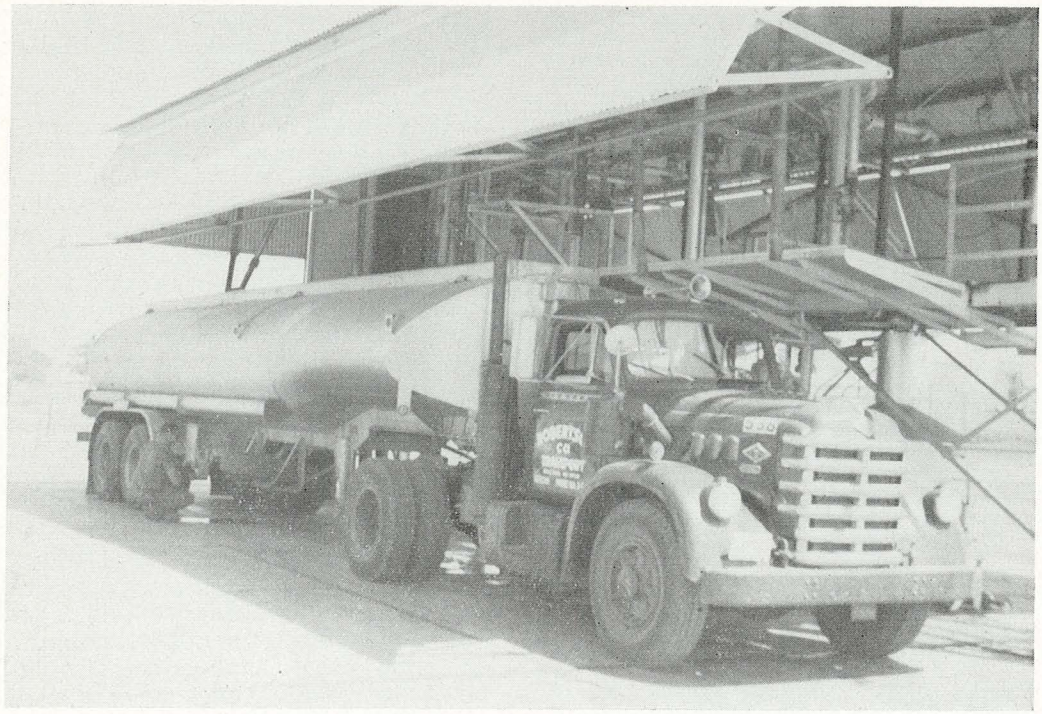


Figure 3. Loading a 6700-gallon truck at a pipeline terminal—the largest capacity used.

A revolutionary cost saving in transportation occurred when the oil companies discovered that refined products as well as crude oil could be transported by pipeline.

Trends in the Transportation of Gasoline in the U.S.A. — The transportation of gasoline by pipeline, under proper circumstances, can make very substantial cost savings over other forms of transportation. Cost comparisons among the various means for transportation are not realistic, however, except with respect to specific situations. For illustration, short hauls of small quantities of gasoline over rough terrain may be cheaper by truck than by railway or pipeline. Conversely, long hauls of large quantities of gasoline by highway may be prohibitive from a cost standpoint. It is generally necessary to rely upon a combination of modes of transportation to move the product at a low cost from its base of origin to the ultimate customer.

Although gasoline was first transported by pipeline in 1930, the major shift away from rail transportation did not begin until the early 1940's. The wartime restriction on the use of rail tank cars for shipments of under 200 miles and the federal support for construction of big inch pipelines both contributed to the drastic decline in railway transportation of gasoline. The laying of pipeline products systems and the introduction of large diameter pipes have both served to reduce the cost of transporting gasoline in the postwar period. An example of the comparative costs embraces the transportation of gasoline from Philadelphia to Pittsburgh between 1935 and 1949. The railway rate increased to $1.52 a barrel and the pipeline tariff declined to 22 cents for transporting a barrel of gasoline between the two cities. One is reminded, however, that this comparison is based on a specific situation.

Although pipelines are associated with cost savings in transportation, their position in the transportation pattern is not one of absolute security because of several factors. Pipelines

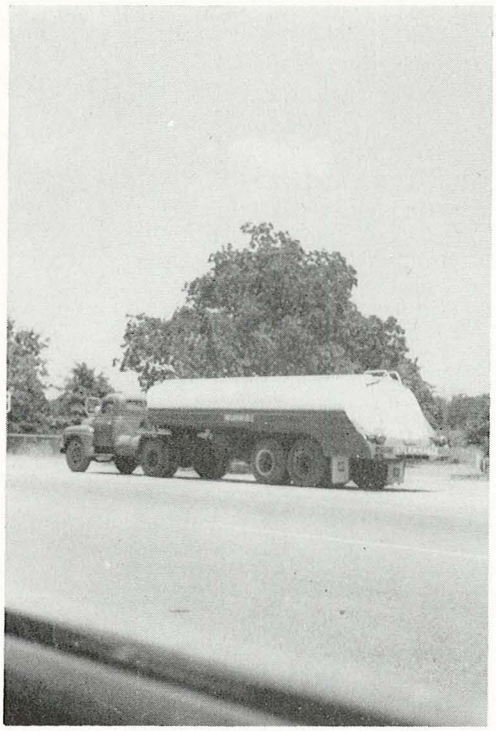


Figure 4. The average capacity truck transports 5295 gallons of gasoline.

for transporting gasoline are most specialized in character; they are fixed geographically and cannot move about from area to area as can trucks when demands are altered or shifted. Furthermore, the volume of gasoline transported may be dependent on a relatively few refineries at the point of origin in a single geographic area. Additional hazards hinge on the fact that oil fields are subject to depletion and pipelines cannot draw business from a variety of goods as may trucks and railways. The discovery of an oil field and the establishment of a refinery near an area of population concentration may cause a decline in the traffic of gasoline that is transported to the area from a more distant point of origin.

Pipelines do, however, provide some unexpected opportunities for the flexibility of company operations. For example, following World War II numerous companies found it more profitable to discontinue the operation of their smaller refineries and to extend their gasoline distributing lines from their major refineries instead of installing the expensive equipment to produce high-octane gasoline at the small refineries. This trend is still under way in Texas.

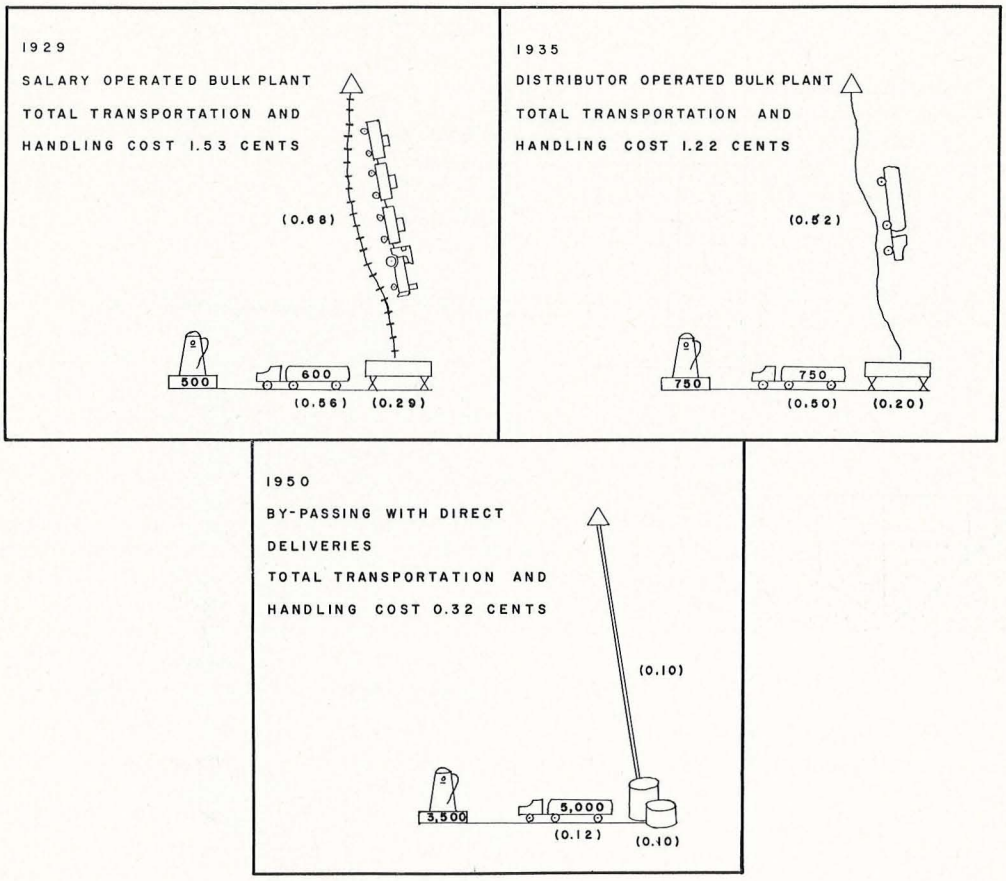
In addition to a shift in the transportation of gasoline from the railways to pipelines previous to World War II, the postwar era exerted pressures upon management to alter company policy for further integration to lower transportation costs. The change in company policy resulted in a practice among some major oil companies of by-passing the traditional wholesale bulk plant in favor of direct delivery of gasoline from pipeline terminals or refineries to service stations. This altered pattern of transportation usually yields savings because the wholesaling costs of storage and shipments at small bulk plants are eliminated. Savings are also derived by eliminating the costs of transporting gasoline by frequent hauls from bulk plants to service stations with a fleet of small trucks.

The extent to which this new trend in by-passing has developed varies considerably among the major oil companies and among counties and states. Cost studies of this altering transportation pattern indicate that the savings in transportation costs usually exceed the savings in storage and handling costs.

The practice of by-passing the bulk plants has been made possible by the development of three factors: (1) the expanding markets, (2) the cumulation of new technical facilities, and (3) the legislative developments in the field of highway transportation. Pipelines and terminals have been extended into market areas that were previously served solely by bulk plants located alongside railway facilities to accommodate railway tank car deliveries. Gasoline storage costs at the extensive tank fields located at pipeway terminals are less per gallon than are the storage costs per gallon at numerous small bulk plants.

ILLUSTRATIVE DISTRIBUTION COSTS FOR MOTOR GASOLINE: 1929-1950

(CENTS PER GALLON)



SOURCE: STANDARD OIL COMPANY (OHIO)

Figure 5.

In Texas transportation costs have been reduced by cooperation in instances where more than one oil company uses the same pipeline. In these instances, the gasolines of the respective companies are properly identified while in transit and tapped at terminals for storage at the respective company tank fields to await distribution by heavy-duty motor transports.

Improvements in highway construction have led to permissive legislation for the operation of heavier trucks for hauling up to six and eight

COUNTIES THAT RECEIVED GASOLINE FROM THIRTY-SIX TERMINALS OF FOUR MAJOR OIL COMPANIES IN TEXAS

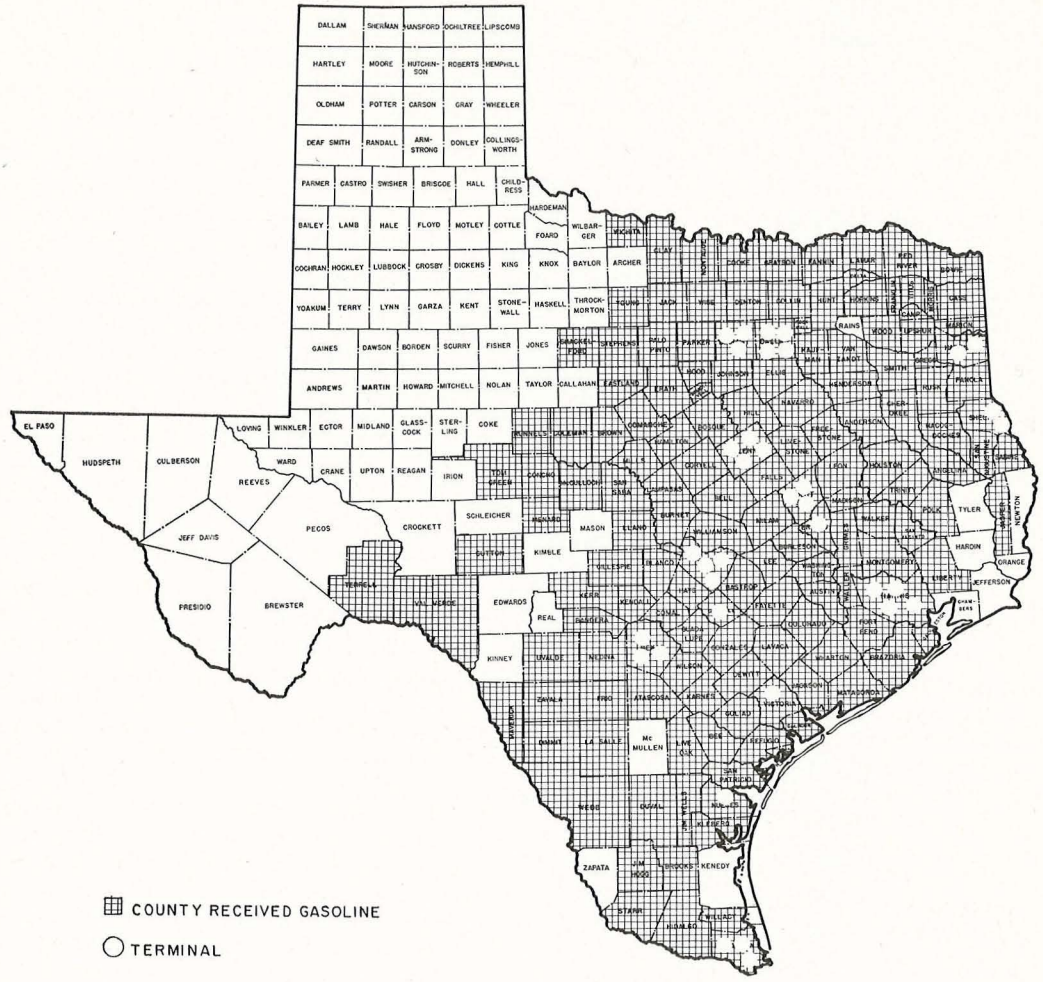


Figure 6.

thousand gallons of gasoline in many states. The use of larger trucks lowered the cost per gallon of gasoline hauled in comparison to the cost of hauls by small delivery vehicles. The expanded sales volume of gasoline and the practice of by-passing have also led to an increase in the storage facilities at service stations. The multi-pump service station commonly accommodates several thousand gallons of gasoline at a single delivery. Although the sales volume of gasoline has increased immensely, the combined use of larger capacity trucks and the increased capacity of storage facilities at service stations have reduced the number of hauls that would have been required previously. In previous years, eleven hauls were required to move 6600 gallons of gasoline by the 600-gallon truck. Today, only one haul is required to move this volume of gasoline on the highways by a modern transport. Consequently, the relative hazard of transporting

gasoline on highways has been lessened.

Figure 5 exemplifies those changes in the transportation pattern that have been reviewed above. The respective costs that are given for the distribution of gasoline at this specific situation in Ohio, also demonstrate the economic significance of altered transportation patterns.

THE STUDY METHOD

The field work for this study was conducted during the June 1 to September 1, 1955, period for the purpose of determining the terminal area transportation patterns and the extent of area highway traffic that is generated by the movement of gasoline from pipeline and waterway terminals in Texas. Attention was focused on the highway traffic that originated at 36 terminals* that are used by four major oil companies for the distribution of gasoline in the state (Figure 6).

There were 152 different counties that received gasoline from the 36 terminals. Some slight overlapping of gasoline deliveries occurred among designated terminal areas. The specific geographic locality served by each company's terminal was delineated; however, to protect a company's operation from simple identification, detailed information in only the perimeter traffic area of the combined counties that contain three or more terminals is revealed. This procedure necessitated an altered treatment of information in the text for four areas that contain less than three terminals. Complete data on the traffic patterns of these four areas is included in the summary.

Although there were 74 refineries in Texas in 1954, the four major oil companies that were studied had 42 per cent of the total maximum capacity for the production of gasoline in the State. The capacities of gasoline delivery trucks operating from terminals, the frequency of deliveries according to truck capacities, the average number of gallons hauled per trip, and the average number of trips per month were determined in each area. No consideration was given to the local delivery of gasoline from bulk plants by trucks of small capacities (800 to 1500 gallons) within cities.

The four oil companies operate some refineries in the State from which direct deliveries of gasoline are made. These particular deliveries of gasoline were not considered (except for purposes of expanding the sample) because the study was restricted to pipeline and waterway terminals. It is estimated that the direct deliveries of gasoline from the refineries would approach 10 per cent of the total terminal deliveries of the four companies.

Consideration was given to the larger company owned trucks and the common carriers that are conventionally used on the highways. Whether deliveries were made to bulk plants or to service stations was determined, because the delivery of gasoline from a terminal directly to service stations (by-passing) at distant points usually involves the use of a truck of large capacity. Direct deliveries of gasoline from a terminal to service stations in a nearby city were not considered, because there is involved little or no use of the state highways, and small capacity trucks are used in these short haul deliveries.

A questionnaire was completed for each field interview at a pipeline or waterway terminal and interviews were made at several of the district offices of the four major oil companies. The letters, A, Y, C, Z, B, and X have been used indiscriminately to designate the terminals in each area and in a manner to prevent the identification of a specific company's operations among the areas. The major items of the transportation pattern for each area are given in the text.

*Terminal has a particular meaning to the gasoline trade; it does not necessarily mean the end of a pipeline, but more commonly indicates the location of one of several points of distribution at intervals along a pipeline.

MOTOR VEHICLE REGISTRATIONS BY COUNTIES IN TEXAS, 1954

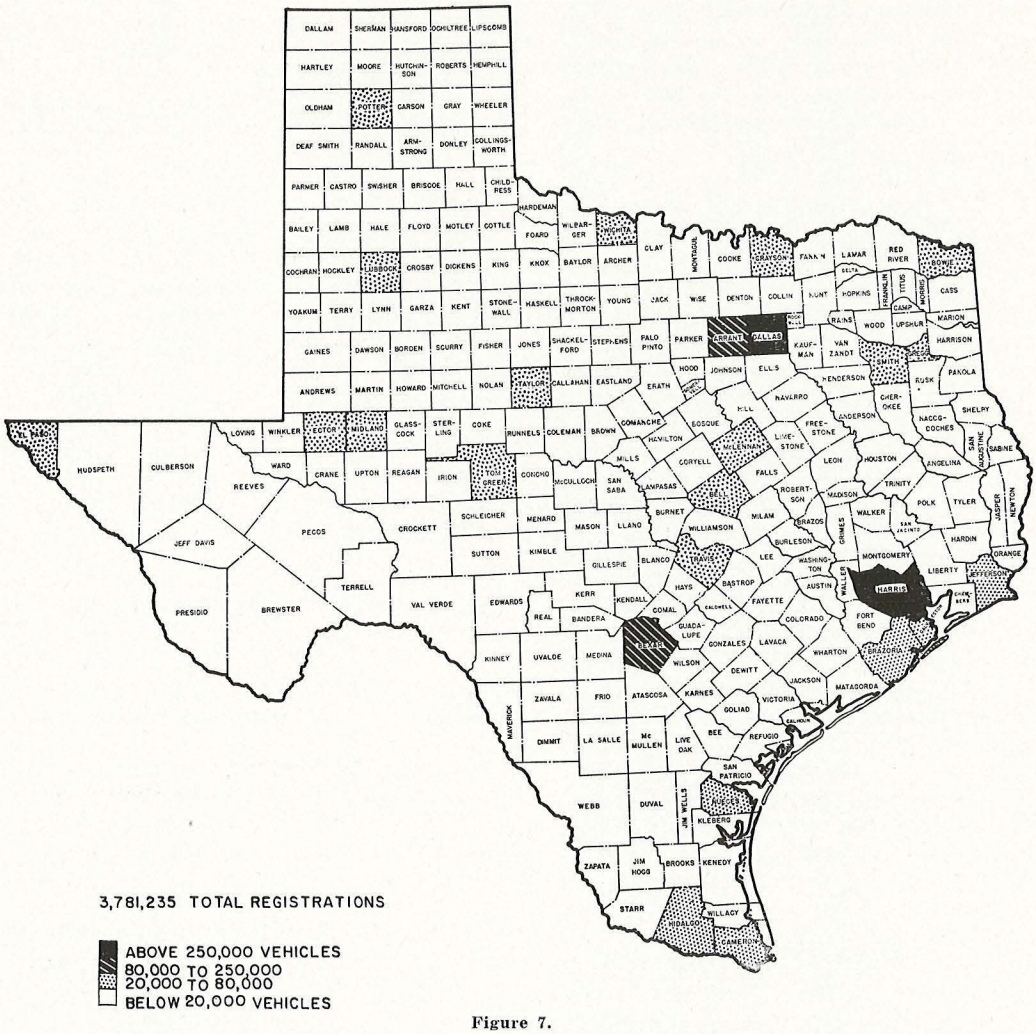


Figure 7.

The writer was granted permission on occasions to ride in the cab of several gasoline transports of large capacity. The perspective of bridge and highway widths, curves, and grades is considerably altered for those accustomed only to passenger-car travel. The conditions of elevation, weight, and size of the truck and the knowledge of an accompanying highly inflammable cargo combine to give the newly initiated rider a feeling of uneasiness. This common customer of the highways, the gasoline transport driver, is at a unique point of vantage to give practical and constructive suggestions for highway improvements that may otherwise go unnoticed by the ordinary highway traveler.

As a general rule gasoline terminals are located near areas of high potential consumption. A comparison of Figures 6 and 7 shows the relationship between the locations of terminals and the extent of motor vehicle registrations for the state.

AREA I

TRANSPORTATION PATTERN FOR THE DISTRIBUTION OF GASOLINE FROM PIPE LINE TERMINALS IN THE HOUSTON AREA

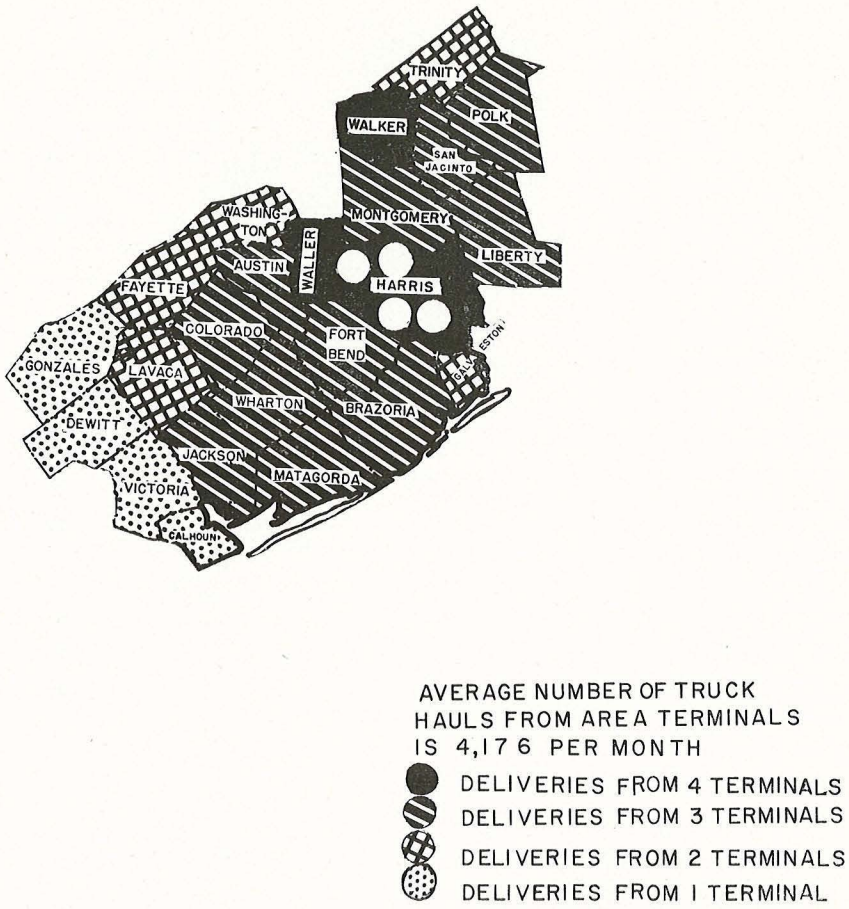


Figure 8.

TERMINAL AREA I (Houston)

Area I includes Harris County which has the largest registration of motor vehicles in the State and the largest city in the South (Figure 8). All four of the major oil companies studied operate terminals in this 23 county area.

The Traffic Pattern Generated in Area I—A summary of the total traffic of trucks that has originated at the four pipeline terminals in the area is given in Table 1.

All four of the terminals that were studied in Area I use both company owned trucks and common carriers for the distribution of gasoline. The deliveries of gasoline to 77 bulk plants and 532 service stations indicate that considerable by-passing is practiced in the area; however, one of the terminals makes no by-pass deliveries to service stations. The average number of gasoline hauls originating at the terminals is 4176 per month. This average number of hauls is exceeded only by that of the Dallas-Fort Worth

TABLE 1

HIGHWAY TRAFFIC GENERATED BY THE MOVEMENT OF GASOLINE FROM TERMINALS IN AREA I

Company Terminal	Deliveries From Terminal		Deliveries Made		Average Number of Trips Per Day	Range in Capacities of Trucks Used (gals.)	Most Frequent Size of Trucks Used (gals.)
	By Company Trucks	By Common Carrier	To Bulk Plants	To Service Stations			
"X"	Yes	Yes	28	173	100	5700-6040	6040
"C"	Yes	Yes	18	0	12	4570-6000	5077
"Z"	Yes	Yes	3	95	4	5255-5700	5275
"A"	Yes	Yes	28	266	58	1500-5800	5450
Area 1 TOTALS	4	4	77	534	174	1500-6040	5275-6040

area. The average size of the trucks that are most frequently used at the Area I terminals is 5460 gallons.

TERMINAL AREA II (Hearne-Bryan)

The locations of gasoline pipeline terminals is determined principally on an engineering basis and often without regard to the nature of the highway system in the vicinity of a particular terminal. The Hearne to Bryan highway is not one of modern design, but the recent location of three terminals near the highway and a fourth terminal at Bryan, Texas, has generated a considerable amount of traffic by heavy trucks from the terminal focal point in the distribution of gasoline to 19 counties (Figure 9). The transportation pattern that has been generated by the location of gasoline terminals in the area was not anticipated when the Hearne to Bryan highway was designed.

The Traffic Pattern Generated in Area II—Table 2 gives a brief summary of the total traffic of trucks that has originated at the four pipeline terminals in the area.

Two of the four pipeline terminals that were studied in Area II use common carriers for all deliveries of gasoline, one terminal depends entirely on company trucks for deliveries, and the fourth terminal uses both common carriers and company trucks. The deliveries of gasoline to 46 bulk plants and 36 service stations indicate that considerable less by-passing is practiced in this area in comparison to several of the other terminal areas that were studied.

The average number of gasoline hauls originating at the four terminals is 888 per month. The average size of the trucks that are most frequently used at the terminals is 5420

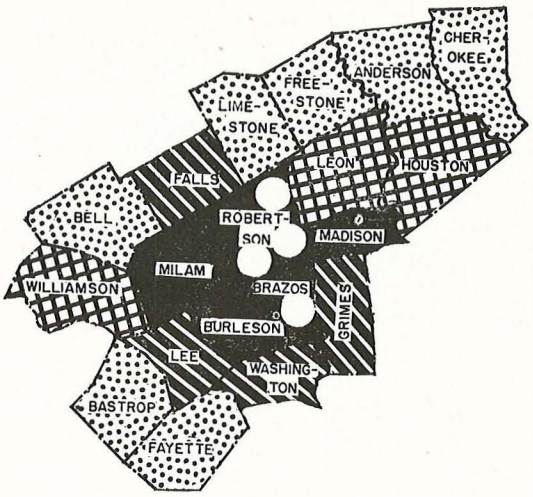
TABLE 2

HIGHWAY TRAFFIC GENERATED BY THE MOVEMENT OF GASOLINE FROM TERMINALS IN AREA II

Company Terminal	Deliveries From Terminal				Deliveries Made		Average Number of Trips Per Day	Range in Capacities of Trucks Used (gals.)	Most Frequent Size of Trucks Used (gals.)
	By Company Trucks		By Common Carrier		To Bulk Plants	To Service Stations			
"C"		No	Yes		8	17	10	5640-6075	Same Frequency
"X"	Yes			No	15	0	7	4570-4605	Same Frequency
"B"		No	Yes		8	0	8	5710-6020	5710
"Z"	Yes		Yes		15	19	12	1500-6020	5155
Area 2 TOTALS	2	2	3	1	46	36	37	1500-6075	5155-6075

AREA II

TRANSPORTATION PATTERN FOR THE DISTRIBUTION OF GASOLINE FROM PIPE LINE TERMINALS IN THE HEARNE-BRYAN AREA



AVERAGE NUMBER OF TRUCK HAULS FROM AREA TERMINALS PER MONTH IS 888

- DELIVERIES FROM 4 TERMINALS
- DELIVERIES FROM 3 TERMINALS
- DELIVERIES FROM 2 TERMINALS
- DELIVERIES FROM 1 TERMINAL

Figure 9.

gallons. The same frequency of trips by truck size is maintained at one terminal that depends on common carriers and salaried drivers. "X" company uses two company trucks that alternate trips in the movement of gasoline from the terminal.

TERMINAL AREA III (Waco, Texas)

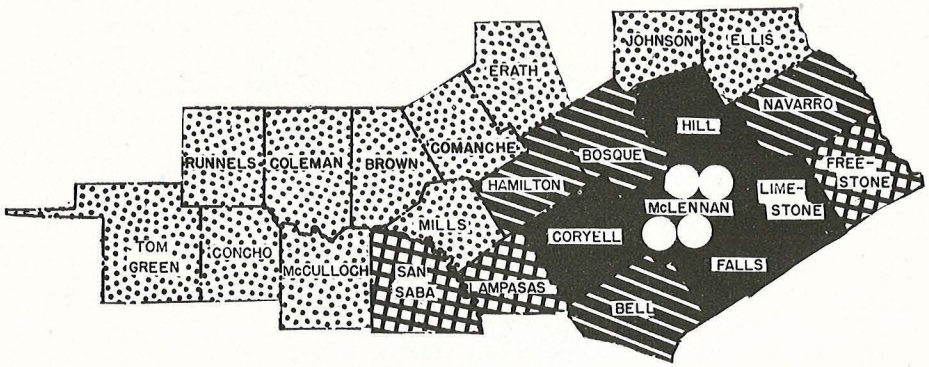
The four major companies operate pipeline terminals in McLennan County (Figure 10). Waco is the largest city in this Central Texas area. Twenty-three counties are served from the terminals.

The Traffic Pattern Generated in Area III — A summary of the total traffic of trucks that has originated at the four pipeline terminals in the area is given in Table 3.

The four pipeline terminals in Area III use company trucks and common carriers for the distribution of gasoline. Deliveries are made to more bulk plants than to service stations. One of the terminals made no by-pass deliveries. The average number of hauls originating at the terminals is 2208 per month and the average size

AREA III

TRANSPORTATION PATTERN FOR THE DISTRIBUTION OF GASOLINE FROM PIPE LINE TERMINALS IN THE WACO AREA



AVERAGE NUMBER OF TRUCK HAULS FROM AREA TERMINALS PER MONTH IS 2,208

- DELIVERIES FROM 4 TERMINALS
- DELIVERIES FROM 3 TERMINALS
- DELIVERIES FROM 2 TERMINALS
- DELIVERIES FROM 1 TERMINAL

Figure 10.

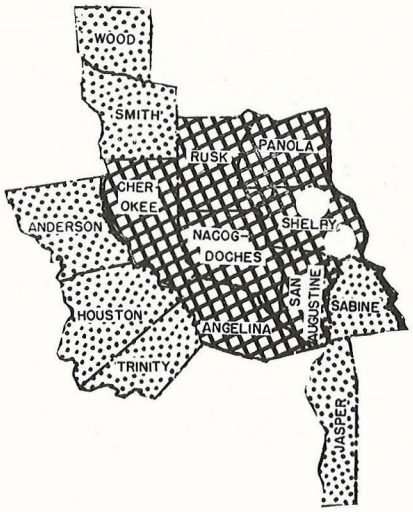
TABLE 3

HIGHWAY TRAFFIC GENERATED BY THE MOVEMENT OF GASOLINE FROM TERMINALS IN AREA III

Company Terminal	Deliveries From Terminal		Deliveries Made		Average Number of Trips Per Day	Range in Capacities of Trucks Used (gals.)	Most Frequent Size of Trucks Used (gals.)
	By Company Trucks	By Common Carrier	To Bulk Plants	To Service Stations			
"X"	Yes	Yes	18	37	25	1648-6010	6010
"B"	Yes	Yes	25	16	18	3000-6217	5660
"Z"	Yes	Yes	14	16	24	3800-5800	5800
"C"	Yes	Yes	25	0	25	4800-6039	5055
Area 3 TOTALS	4	4	82	69	92	1648-6217	5055-6010

AREA IV

TRANSPORTATION PATTERN FOR THE DISTRIBUTION OF GASOLINE FROM PIPE LINE TERMINALS IN THE CENTER AREA



AVERAGE NUMBER OF TRUCK HAULS FROM AREA TERMINALS PER MONTH IS 336

DELIVERIES FROM 2 TERMINALS

DELIVERIES FROM 1 TERMINAL

Figure 11.

of the trucks that are most frequently used at the terminals is 5631 gallons.

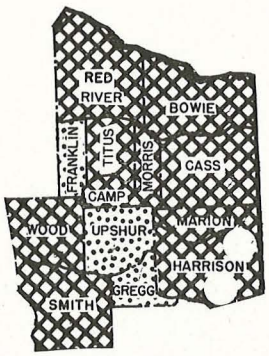
The study of all of the terminal areas revealed that the practice of by-passing varied from company to company, from area to area, and within areas; e.g. in some areas a company made no by-pass deliveries to some counties, but in adjoining counties it made deliveries to both bulk plants and service stations. There is some evidence to indicate that the practice of by-passing may displace all bulk plant deliveries in the future. However, this transition has not been completed by any one of the companies in any of the areas that were studied.

TERMINAL AREA IV (Center, Texas)

The pipeline terminals of two companies are located at Center in Shelby County (Figure 11). This area is the heart of Central-East Texas and it borders on the Louisiana state line. One of the terminals has been in operation for only a few months. Although this area borders the Louisiana state line, the information that follows concerns only the use of Texas highways. Thirteen Texas counties are served by the terminals in this area.

AREA V

TRANSPORTATION PATTERN FOR THE DISTRIBUTION OF GASOLINE FROM PIPE LINE TERMINALS IN THE WASKOM AREA



AVERAGE NUMBER OF TRUCK HAULS FROM AREA TERMINALS PER MONTH IS 1,032

DELIVERIES FROM 2 TERMINALS

DELIVERIES FROM 1 TERMINAL

Figure 12.

The Traffic Pattern Generated in Area IV—Since there are fewer than three terminals in Area IV, the detailed information on each specific terminal is not presented in a table. This procedure is followed to prevent identification of the companies operations. However, information on the transportation patterns that have been generated by the terminals in the area is included in the summary.

Some brief comments on the area are as follows: The average number of gasoline hauls originating at the two terminals is 336 per month and the range in capacities of trucks operating from the terminals in the area is 5400 to 6000 gallons. The average size of the trucks that are most frequently used at the terminals is 5700 gallons.

TERMINAL AREA V (Waskom, Texas)

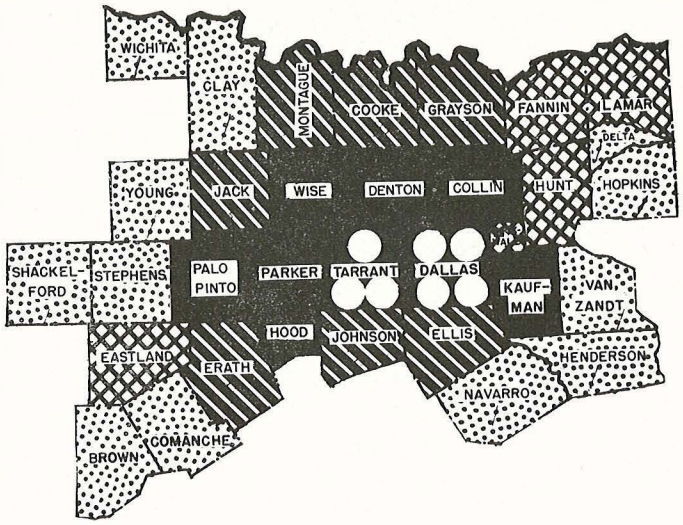
Northeast Texas, and parts of Arkansas and Louisiana are served by two terminals at Waskom, Texas, Harrison County (Figure 12). Since Waskom is located on the Texas-Louisiana line, the hauls to Louisiana have been deleted. The hauls to Arkansas are considered because the Texas highways are traveled considerably enroute. One of the terminals has been in operation for only a few months. There are 13 counties in Texas that are served by the two terminals.

The Traffic Pattern Generated in Area V—Detailed information on each specific terminal is not presented in a table because there are fewer than three terminals in Area V. This procedure is followed to prevent identification of the companies operations. However, information on the transportation patterns that have been generated by the two terminals in the area is included in the summary.

A few comments on the area terminals are as follows: The average

AREA VI

TRANSPORTATION PATTERN FOR THE DISTRIBUTION OF GASOLINE FROM PIPE LINE TERMINALS IN THE DALLAS-FORT WORTH AREA



AVERAGE NUMBER OF TRUCK HAULS FROM AREA TERMINALS PER MONTH IS 5,112

- DELIVERIES FROM 4 TERMINALS
- DELIVERIES FROM 3 TERMINALS
- DELIVERIES FROM 2 TERMINALS
- DELIVERIES FROM 1 TERMINAL

Figure 13.

number of gasoline hauls originating at the terminals is 1032 per month (corrected for Texas). The range in capacities of trucks operating from the terminals in the area is 4575 to 6100 gallons. The average size of the trucks that are most frequently used at the terminals is 5455 gallons.

TERMINAL AREA VI (Dallas-Fort Worth)

The four major oil companies operate seven pipeline terminals in the heavily populated Dallas-Fort Worth Area (Figure 13). Both Dallas and Tarrant Counties have high motor vehicle registrations (Figure 7) and they constitute the focal point for the distribution of gasoline in the 33-county area. The data on traffic patterns have been consolidated in the instances where companies operate more than one terminal in the area.

The Traffic Pattern Generated in Area VI—The total traffic of trucks that has originated at the seven terminals in the area is given in Table 4.

TABLE 4

HIGHWAY TRAFFIC GENERATED BY THE MOVEMENT OF GASOLINE FROM TERMINALS IN AREA VI

Company Terminal	Deliveries From Terminal: By Company Trucks	Deliveries From Terminal: By Common Carrier	Deliveries Made: To Bulk Plants	Deliveries Made: To Service Stations	Average Number of Trips Per Day	Range in Capacities of Trucks Used (gals.)	Most Frequent Size of Trucks Used (gals.)
"B"	Yes	Yes	12	175	54	4700-6000	6000
"A"	Yes	Yes	35	0	28	4500-6000	5000
"Y"	Yes	Yes	29	31	46	5500-5800	5800
"C"	Yes	Yes	30	350	85	1500-6000	5050
Area 6							
TOTALS	4	4	106	556	213	1500-6000	5000-6000

The seven pipeline terminals in Area VI use company trucks and common carriers for the deliveries of gasoline. Deliveries are made to 106 bulk plants and 556 service stations. The latter figure indicates that by-passing is very commonly practiced in the area; however, company "A" made no by-pass deliveries to service stations. The average number of hauls originating at the terminals is 5112 per month. This is the largest average number of hauls among all of the areas studied. The area also contains the largest number of terminals and counties. The average size of the trucks that are most frequently used at the terminals is 5462 gallons.

TERMINAL AREA VII (Austin, Texas)

Each of the four companies operate pipeline terminals in Travis County at Austin, the site of the State Capitol (Figure 14). There are 15 counties in the area that receive gasoline from the terminals.

The Traffic Pattern Generated in Area VII — A summary of the total traffic of trucks that has originated at the four pipeline terminals in the area is given in Table 5.

Three of the terminals in Area VII use company trucks and common carriers for the deliveries of gasoline. The fourth terminal uses company trucks only. Deliveries are made to 26 bulk plants and 21 service stations; however, two terminals do not make by-pass deliveries of gasoline. The average number of gasoline hauls originating at the terminals is 936 per month. The average size of the trucks that are most frequently used at the terminals is 5079 gallons.

TABLE 5

HIGHWAY TRAFFIC GENERATED BY THE MOVEMENT OF GASOLINE FROM TERMINALS IN AREA VII

Company Terminal	Deliveries From Terminal: By Company Trucks	Deliveries From Terminal: By Common Carrier	Deliveries Made: To Bulk Plants	Deliveries Made: To Service Stations	Average Number of Trips Per Day	Range in Capacities of Trucks Used (gals.)	Most Frequent Size of Trucks Used (gals.)
"Z"	Yes	Yes	3	8	10	5500-6100	5785
"X"	Yes	No	14	0	12	4432-4600	4432
"C"	Yes	Yes	6	0	6	5500-5800	5800
"B"	Yes	Yes	3	13	11	1500-4400	4400
Area 7							
TOTALS	4	3 1	26	21	39	1500-6100	4400-5800

AREA VII

TRANSPORTATION PATTERN FOR THE DISTRIBUTION OF GASOLINE FROM PIPE LINE TERMINALS IN THE AUSTIN AREA

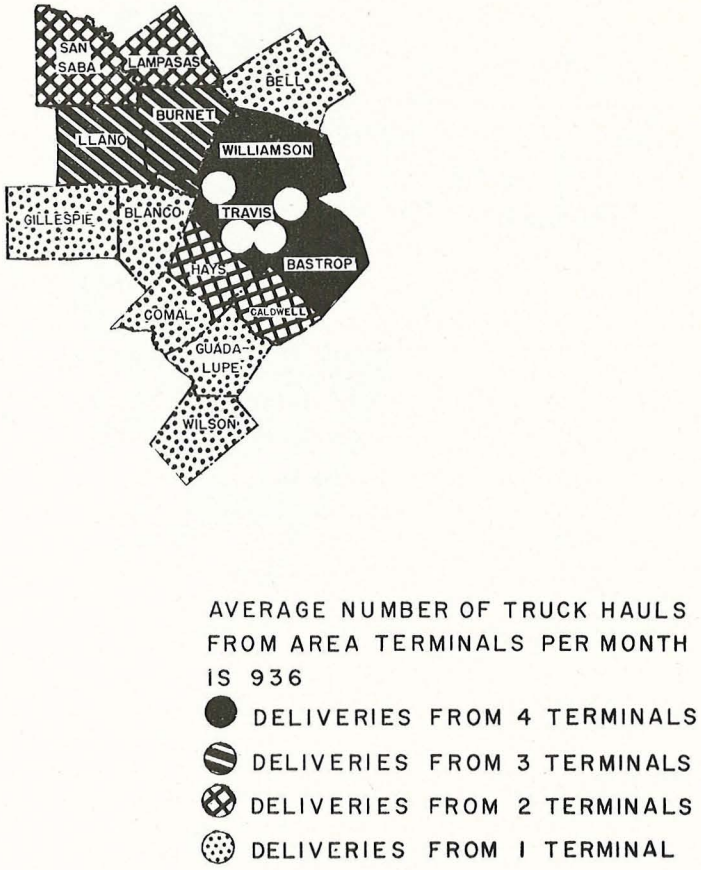


Figure 14.

TERMINAL AREA VIII (San Antonio, Texas)

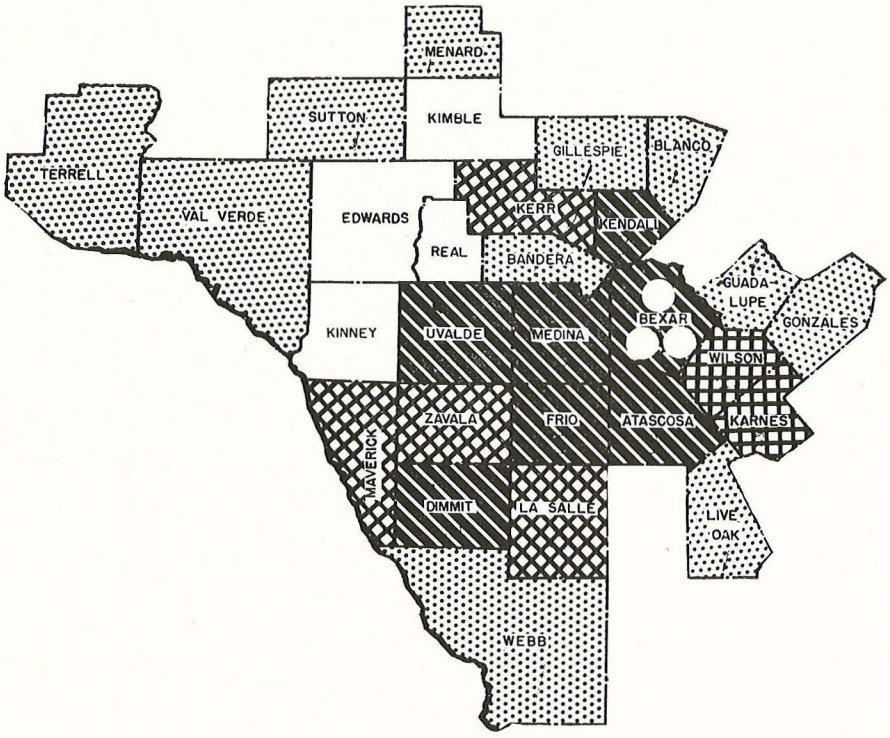
Although all four of the oil companies operate terminals in Bexar County, information was acquired at only three (Figure 15). The long hauls from San Antonio to Valverde, Sutton, Menard, and Terrell Counties are made by trucks of 6700 gallon capacity. The area contains 24 counties.

The Traffic Pattern Generated in Area VIII — A summary of the total traffic of trucks that has originated at the three pipeline terminals that were studied is given in Table 6.

The three terminals that were studied in Area VIII use both company trucks and common carriers for the distribution of gasoline. Deliveries are made to 43 bulk plants and 37 service stations. Some by-pass deliveries of gasoline are made from all of the terminals. The average number of gasoline hauls originating at the terminals is 1320 per month. The average size of the trucks that are most frequently used by the three

AREA VIII

TRANSPORTATION PATTERN FOR THE DISTRIBUTION OF GASOLINE FROM PIPE LINE TERMINALS IN THE SAN ANTONIO AREA



AVERAGE NUMBER OF TRUCK HAULS FROM AREA TERMINALS PER MONTH IS 1,320

DELIVERIES FROM 3 TERMINALS

DELIVERIES FROM 2 TERMINALS

DELIVERIES FROM 1 TERMINAL

(3 OF 4 AREA TERMINALS WERE STUDIED)

Figure 15.

terminals is 5888 gallons. This is the largest average size of trucks that are most frequently used among all of the areas that were studied.

TERMINAL AREA IX (Luling-Victoria)

Although two pipeline terminals are located in the nine counties that compose the Luling-Victoria Area, only one county is served by one of the area terminals (Figure 16). This area has considerable overlapping of deliveries of gasoline from adjoining designated terminal areas.

The Traffic Pattern Generated in Area IX — Detailed information on

TABLE 6

HIGHWAY TRAFFIC GENERATED BY THE MOVEMENT OF GASOLINE FROM TERMINALS IN AREA VIII

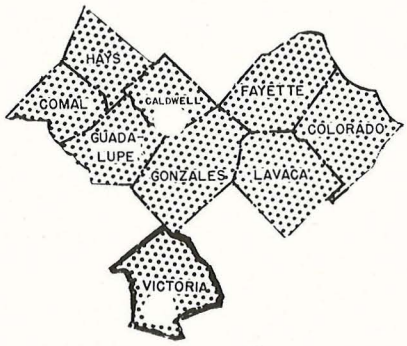
Company Terminal	Deliveries From Terminal		Deliveries Made		Average Number of Trips Per Day	Range in Capacities of Trucks Used (gals.)	Most Frequent Size of Trucks Used (gals.)
	By Company Trucks	By Common Carrier	To Bulk Plants	Stations To Service			
"Y"	Yes	Yes	10	3	15	1500-6700	5800
"A"	Yes	Yes	13	6	15	5500-5800	5800
"B"	Yes	Yes	20	18	25	1500-6700	6000
Area 8 TOTALS	3	3	43	37	55	1500-6700	5800-6000

each specific terminal is not presented in a table because there are fewer than three terminals in Area IX. This procedure is followed to prevent identification of the companies' operations. However, information on the transportation patterns that have been generated by the two terminals in the area is included in the summary.

Brief comments on the area terminals are as follows: The average number of gasoline hauls originating at the terminals is 336 per month. The range in capacities of trucks operating from the terminals in the area is 5500 to 5800 gallons.

AREA IX

TRANSPORTATION PATTERN FOR THE DISTRIBUTION OF GASOLINE FROM PIPE LINE TERMINALS IN THE LULING-VICTORIA AREA



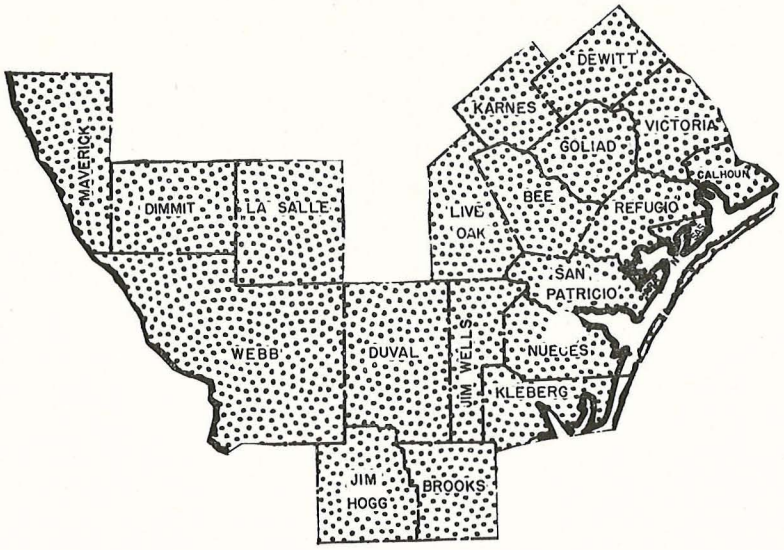
AVERAGE NUMBER OF TRUCK HAULS FROM AREA TERMINALS PER MONTH IS 336

DELIVERIES FROM 1 TERMINAL

Figure 16.

AREA X

TRANSPORTATION PATTERN FOR THE DISTRIBUTION OF GASOLINE FROM A WATERWAY TERMINAL IN THE CORPUS CHRISTI AREA



AVERAGE NUMBER OF TRUCK HAULS FROM AREA TERMINAL PER MONTH IS 672

DELIVERIES FROM 1 TERMINAL

Figure 17.

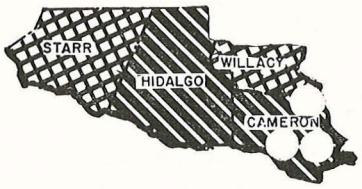
TERMINAL AREA X (Corpus Christi, Texas)

A waterway terminal, operated by one of the four companies, is located at Corpus Christi in Nueces County (Figure 17). The gasoline that is distributed is produced at the company's refinery and transported by barge to the Corpus Christi Area. An average of 672 truck deliveries of gasoline are made per month to twenty counties from the waterway terminal. Trucks of 6700 gallon capacity are used for the distant hauls.

The Traffic Pattern Generated in Area X—Since only one of the four major oil companies operates a terminal in the Corpus Christi Area, specific information on the traffic that is generated by the waterway terminal is omitted. This procedure is followed to prevent the identification of the company's operations. Information on the transportation pattern that has been generated by the terminal is included in the summary.

AREA XI

TRANSPORTATION PATTERN FOR THE DISTRIBUTION OF GASOLINE FROM PIPE LINE AND WATERWAY TERMINALS IN THE RIO HONDO-HARLINGEN-BROWNSVILLE AREA



AVERAGE NUMBER OF TRUCK HAULS FROM AREA TERMINALS PER MONTH IS 888

DELIVERIES FROM 3 TERMINALS

DELIVERIES FROM 2 TERMINALS

Figure 18.

TERMINAL AREA XI (Rio Hondo-Harlingen-Brownsville)

Three of the four companies operate terminals in this southmost area of Texas (Figure 18). One of the terminals is a waterway terminal. Gasoline is transported by barge from the company's refinery to the terminal in Brownsville. There are only four counties served by the terminals, however the area is thickly populated and it is commonly referred to as "The Valley".

The Traffic Pattern Generated in Area XI — A summary of the total traffic of trucks that has originated at the three terminals in the area is given in Table 7.

All three of the terminals that were studied in Area XI use company

TABLE 7
HIGHWAY TRAFFIC GENERATED BY THE MOVEMENT OF GASOLINE FROM TERMINALS IN AREA XI

Company Terminal	Deliveries From Terminal		Deliveries Made		Average Number of Trips Per Day	Range in Capacities of Trucks Used (gals.)	Most Frequent Size of Trucks Used (gals.)
	By Company Trucks	By Common Carrier	To Bulk Plants	To Service Stations			
"Y"	Yes	Yes	12	0	20	4600-5800	4600
"B"	Yes	Yes	3	7	5	3800-5800	5800
"A"	Yes	Yes	11	12	12	3400-6000	5800
Area 11 TOTALS	3	3	26	19	37	3400-6000	4600-5800

trucks and common carriers for the distribution of gasoline. Deliveries are made to 26 bulk plants and 19 service stations. No by-pass deliveries are made from one of the terminals. The average number of gasoline hauls originating at the terminals is 888 per month. The average size of the trucks that are most frequently used by the three terminals is 5400 gallons.

COMMENTS

The writer received excellent cooperation from the personnel of the four major oil companies in spite of the fact that the nature of the information that was required to determine the traffic patterns is ordinarily considered strictly confidential by the companies. It is for this reason that careful steps have been taken to prevent the simple identification of a company's business operations.

The study concerned the extent and nature of highway traffic that is generated by the delivery of gasoline from the terminals of four major oil companies that operate in Texas. The delivery of gasoline by trucks directly from the refineries that are operated by the companies was consequently excluded. Attention was focused on the use of the large trucks (1500 to 6700 gallons) that conventionally frequent the highways in the delivery of gasoline to bulk plants or directly to service stations at distant points (by-passing). The deliveries of gasoline to service stations in the city by which a terminal was located and the deliveries of gasoline to service stations from bulk plants were ignored because little highway travel was involved and smaller trucks were used (usually under 1500-gallon capacity).

There is some evidence to indicate that the practice of by-passing may eventually displace all bulk plant deliveries in the future. However, this transition had not been completed by any one of the companies in any of the areas that were studied.

The traffic patterns of each area that show the counties with the greatest concentration of heavy transport traffic and the summaries of the characteristics of the traffic in each area may provide direct or indirect contributions to the functional and economical planning of the state highways in the future. The trends that have occurred in the past ten years in the traffic of this commodity alone are important to the design, safety, construction criteria, and maintenance of future highways.

SUMMARY

The following is a brief summary of the characteristics of the traffic patterns that were generated by the highway distribution of gasoline from the pipeline and waterway terminals of the four major oil companies that were studied:

1. Information was obtained from 36 terminals located in 11 primary areas. One hundred and fifty-two different counties received gasoline from the terminals. Some slight overlapping of gasoline deliveries occurred among designated terminal areas. Five hundred and eight bulk plants and 1297 (distant) service stations received gasoline directly from the 36 terminals. The Dallas-Fort Worth area of 33 counties was the largest geographic area studied and the Rio Hondo - Harlingen - Brownsville area of four counties was the smallest area studied.

2. All but two terminals depended heavily or completely on the use of common carriers to move gasoline from the terminals. The oil companies most frequently assigned only two to four company-owned trucks at a terminal. The largest assignment of company-owned trucks at a terminal was 14; common carriers were used in addition. The company-owned trucks were usually of considerably less capacity than the common carriers. Common carriers were used extensively for two principle reasons: (1) the demand for the delivery of gasoline fluctuates, and (2) adverse public sentiment towards a specific oil company is less likely to develop

when few company-owned trucks frequent the highways.

3. The frequency of hauls in descending order and the average number of gallons of gasoline hauled per trip for all trucks (company-owned trucks and common carriers, but excluding trucks of less than 1500-gallon capacity) from all of the terminals was as follows: 1st—5524 gal.; 2nd—5205 gal.; 3rd—5218 gal.; and 4th—4947 gal.

4. By-passing, the direct delivery of gasoline from a terminal to service stations, is commonly practiced in Texas by the four oil companies. There were 13 terminals that provided deliveries of gasoline only to bulk plants. Trucks at all of the terminals, except these 13, made some by-pass deliveries of gasoline. Each company usually made both by-pass and bulk plant deliveries in the same area.

5. The largest average number of truck hauls in an area per month, 5112, originated in the Dallas-Fort Worth area. The second largest average number of area hauls, 4176, originated at the terminals in the Houston area. The total of the average number of heavy-duty transport hauls on highways, originating at all of the terminals, was 17,904 per month. This was an average of 746 hauls per day on the basis of a six-day work week.

6. The San Antonio area had the largest average size of trucks (5888 gallons) that are most frequently used among all of the areas that were studied. The Austin area had the smallest average size of trucks (5079 gallons) that are most frequently used among the areas. The average capacity for all of the trucks, operating on highways from all of the terminals, was 5295 gallons. The average weight of gasoline hauled per highway trip was approximately 17.2 tons, and the range in weights was from 4.9 tons to 21.8 tons. An average of 304,726 tons of gasoline is hauled on Texas' highways each month from the 36 terminals.

7. It has been estimated that the direct highway-truck deliveries of gasoline from the refineries of the four companies amount to 10 per cent of the similar hauls that are generated at the terminals. Consequently, the average over-all total weight of hauls on the State's highways amount to 335,198 tons of gasoline per month, or 4,022,376 tons per year, when the weight of the highway gasoline deliveries that are made directly from the refineries of the four companies is added to the weight of hauls from the 36 terminals. Some 236,332 hauls by heavy-duty transports per year are required to move the 4,022,376 tons of gasoline from the terminals and refineries of the four major oil companies.

8. According to information obtained from the State Comptroller's Office, 3,376,642,000 gallons of gasoline were consumed in the State in 1955. This means that over 10,974,000 tons of gasoline were transported on the public roads of Texas from all of the terminals and refineries operating in the State during the year.

9. In 1955, more than one-half million truck hauls with an average capacity of 17 tons were required to transport this grand total weight of gasoline when the pattern for the range in capacities of trucks and the frequencies of truck hauls by capacities as determined by the sample study is expanded to include the entire State. On the basis of a six-day work week, this means that more than 2000 heavy-duty truck hauls per day are required to handle the distribution of the State's gasoline.