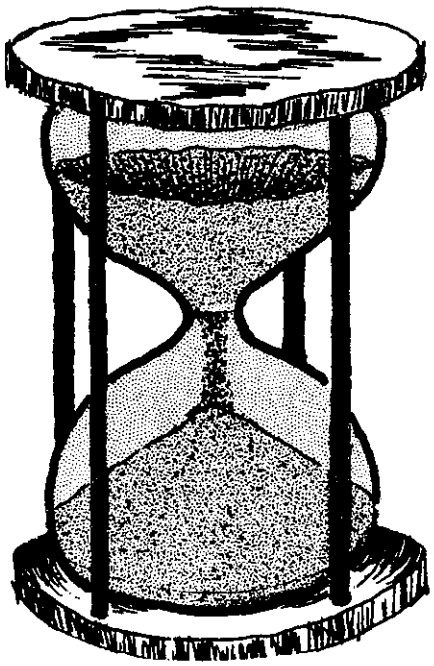
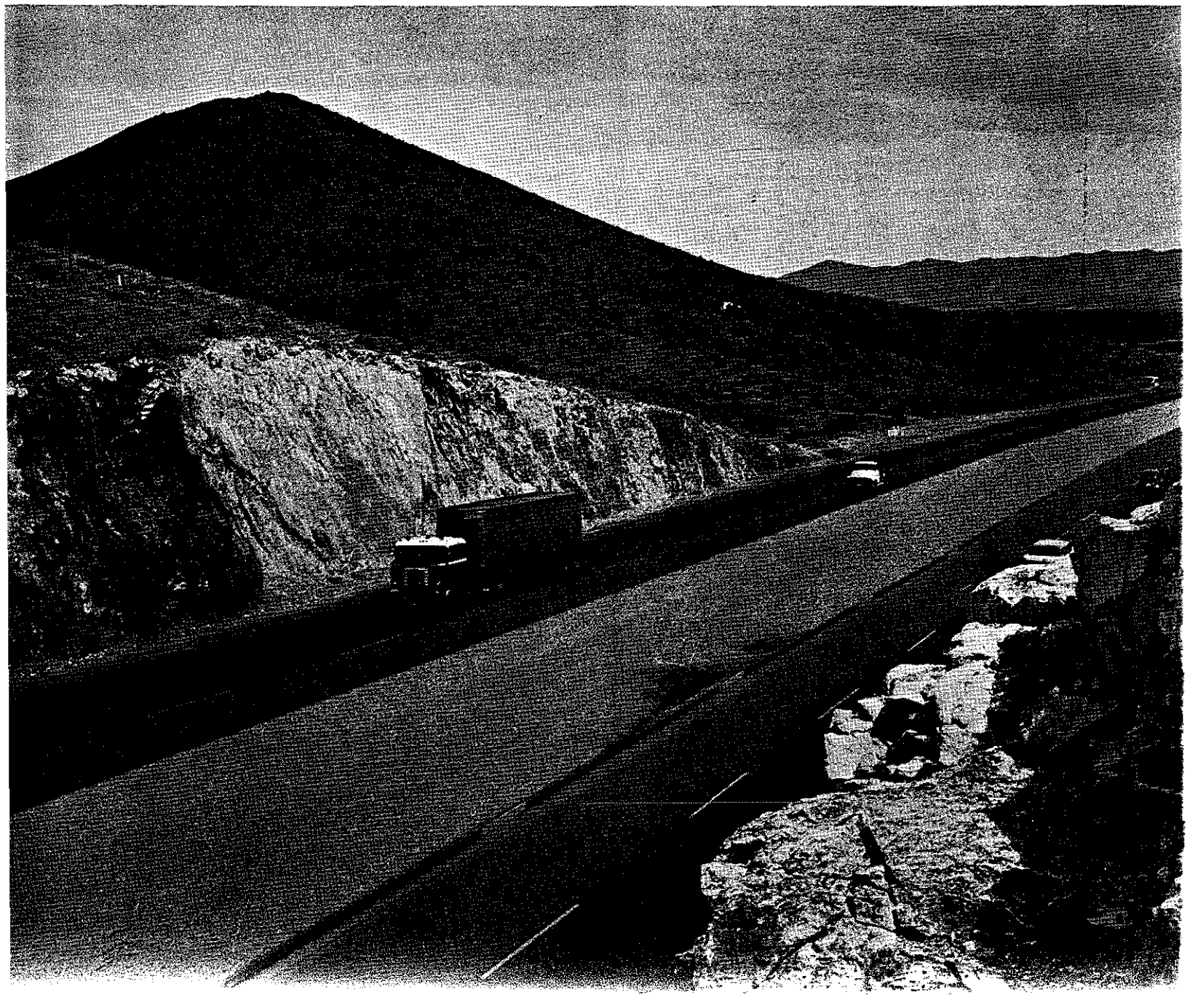
VALUE OF TIME SAVED

TO COMMERCIAL MOTOR VEHICLES THROUGH USE OF

IMPROVED HIGHWAYS





VALUE OF TIME SAVED TO COMMERCIAL MOTOR VEHICLES THROUGH USE OF IMPROVED HIGHWAYS

by

Charles R. Haning

and

William F. McFarland

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Texas Transportation Institute
Texas A&M University System
College Station, Texas

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Summary

Time is a scarce or limited commodity. Since there is a demand for this commodity, it logically follows that time has a value, in terms of our economic framework.

The purpose of this report is to present the findings of a study, the purpose of which was to explore the possibilities of determining reliable estimates of the dollar value that could be assigned to time savings that accrued to commercial truck and motor bus operators through their use of improved highways. The study was concentrated upon the intercity operations of those commercial carriers situated within the Southwestern Region of the United States.

Five general methods of approaching the value of time problem were evaluated. The net operating profit approach was selected for use in this study. The general hypothesis of this method is that as time is saved, the commercial operators will absorb these savings through productive use of the equipment and manpower. This added productive use will create a proportionate increase in gross operating revenues as well as a similar increase in variable vehicle expenses. However, certain vehicle and labor expenses that have a time function will remain constant. Therefore, the value of time savings may be estimated from the marginal net income producing potential.

For the time savings to have value to the commercial highway users, they must be put to productive use. There are numerous impediments that restrict the full utilization of the time saved. These impediments, such as route restrictions, area of service restrictions, method of computing drivers' compensation, fixed terminal locations, rigidity of scheduling, existing equipment interchange agreements and others, must be evaluated in order to arrive at a reasonable estimate of the short-term value of time saved for each type of carrier. Through an evaluation of these factors, certain ranges of probable utilization were estimated for each carrier group. These ranges vary from a low of forty to sixty percent for the general freight carriers, to a high of eighty to one hundred percent for the private carriers and contract carriers

Using the net operating profit approach, the value of time was estimated for the common carriers of general freight, common carriers of commodities other than general freight, contract and private carriers, common carriers of passengers, and for a composite commercial freight vehicle.

The estimated probable range of value was the highest for the contract and private carriers and the lowest for the common carriers of general freight. The range of estimated values for the composite freight vehicle was $3.16-$4.11 per hour of time saved. This is greater than the average for the general freight and specialized carriers and lower than the contract and private carrier estimate.

Since the value of time is also influenced by vehicle size, it seemed desirable to segregate the value of time saved between the most common axle-class vehicle groupings. Therefore, it became necessary to develop certain ratios to be used in apportioning these values between the different axle-classes. The three major axle-classes encountered in the line-haul operations in the Southwestern region are the three-axle, four-axle, and five-axle tractor semitrailer combinations. The ratios were developed through the use of certain known cost relationships that exist between the different axle-classes. These relationships and the resulting ratios were developed for each axle-class within each carrier group.

The ratios and selected expenses for each axle-class were utilized in estimating the value of time saved by axle-classes. The value per hour of added time was estimated for classes 2-S1, 2-S2, and 3-S2 within each carrier group and for the same classifications for a derived composite vehicle which is comprised of all carrier groups. For the composite vehicle, axle-class 2-S2 had the highest range of probable values. These values are based upon the composition of axle-classes being used by the different carrier groups operating in the Southwestern Region. Since the use of this vehicle in total operation is unknown, there is no implication that these estimates of value would be applicable on a national scale.

In order to test the feasibility and potential of the market area approach to the determination of the value of time saved through use of improved highways, a model was established to represent the operations of a general merchandising distribution center. The model operation utilizes both private and for-hire carriage in the distribution of its products within a four-state area. Estimates of the probable value of time savings were derived for this operation. Maps are presented which indicate the radius of operation under present driving conditions and the potential radius assuming an increased average operating speed. The area between these two radii indicate the area of influence that could be covered within the same operating period, assuming improved highways and resultant increases in average operating speeds.

In general, the results of this report confirm those values of time that were included in the Final Report of the Highway Cost Allocation Study. The ratios between the various carrier groups and between axle-classes are generally in accord between the two studies. However, the need for a more extensive inquiry into the various utilization percentages and more precise estimates of the time lag (before "full" utilization is effective) are suggested by this study. If average values are needed to facilitate planners, then the low utilization values presented in this report represent the best estimates of such average values. More precise estimates of an average value do not immediately result from the report. More meaningful average values can be reached only through a more extensive investigation into the time period after which "full" utilization becomes operative.

The value of time, as developed in this study, is not purported to be the complete value accruing to the commercial users of improved highways. There are various intangible benefits from time savings that have not been included in this study. Better customer service, reduced inventories, more marketable products (e. g., fresh fruits and vegetables), and better employee relations are but a few of the intangible benefits. No attempt has been made to quantify or include these intangibles in this analysis.

Introduction

General

Time is a basic concept in our present economy. It is difficult to conceive the hypothetical elimination of this time concept from the production and marketing phases of our industrial complex. Although time is an intangible, it is a necessary and integral part of our lives.

Therefore, if time is such an important concept in our way of life, it must have some assignable value. The value, as measured in monetary terms, varies greatly between individuals and groups of individuals. In certain circumstances, it is quite simple to determine the monetary value of time, whereas, in other circumstances this value is more difficult to calculate. Perhaps the most logical method of determining the value of a unit of time is to use the alternative income or alternative cost approach. For instance, an individual places value upon his leisure hours anytime he chooses the leisure over possible working hours. If a person chooses to work only forty hours per week, he forfeits the additional income that could be derived by working fifty or even sixty hours per week. Some people decide to work at more than one job and utilize more than forty hours of each week in an income producing capacity. Some of these individuals may feel that this is necessary, for monetary or other reasons, but others simply do not value their leisure time highly enough to forfeit the additional income that is derived from this "extra" work.

There is a difference between the value of time to an individual and the value of time to a business concern. An individual can exercise his right to use his time productively or for leisure purposes. However, a going business concern has the profit motive as its reason for existence. Therefore, the business should have no choice except to use any time available for productive purposes if the use of the time will aid in maximizing net returns. Management has the responsibility and duty to adjust the business operations so as to take advantage of any and all profit potential that arises within the normal operating realm of the business enterprise.

Purpose and Scope

The purpose of this study was to explore the possibilities of determining reliable estimates of the dollar value that would accrue to commercial motor vehicle operators as a result of time savings occurring through use of improved highway facilities.

The estimates of the value of time developed in this report may possibly be compared and contrasted with the estimates of the value of time that were included in the final report of the Highway Cost Allocation Study. It was believed that a study of alternative approaches to the general problem and the development of estimates of the value of time saved to commercial truck operators in the Southwest would either (1) lend more credence to those values included in the cost allocation study; or (2) perhaps furnish evidence that more detailed studies would be desirable.

[1]See Bibliography.

Any information developed by this study will supplement the several previous studies[1] of vehicular travel time and fuel consumption rates under various operating conditions. The main purpose of these studies has been to provide reliable information for use in determining the benefits accruing to the users of the Federal Aid Highway System.

During the early stage of this study, the decision was made to concentrate the efforts toward determination of the value of time saved by commercial truck and bus operators in their intercity and over-the-road operations. It was felt that the local pick-up and delivery operations of the commercial freight carriers were seldom benefited to any great extent by the urban freeway systems. Undoubtedly there are specific instances where urban arterial improvements are beneficial to the local carriers; however, the very nature of the pick-up and delivery operations precludes any large usage of the urban freeways.

For similar reasons, only the intercity motor bus operations were included in this study. There was no attempt to determine either the amount or the value of any time saved by the local carriers.

The study included a group of commercial truck and motor bus companies that are home based within the Southwestern Region of the United States. This region includes the states of Arkansas, Louisiana, Oklahoma and Texas.

The Class I and Class II ICC regulated interstate carriers were distributed among the four states. The smaller intrastate carriers and the private trucking fleets were all domiciled within the state of Texas. Table 1 shows the number of each classification and type of carrier included in this study.

Records of the ICC regulated motor common carrier expenses and operating statistics were obtained for the years 1959 and 1960. These data were obtained from the report, "Transport Statistics in the United States, Part 7, Motor Carriers," which is compiled by the Interstate Commerce Commission from the annual reports of individual carriers and from an analysis of Class I and Class II motor carriers' reports, as published by Trinc Associates, Ltd. These combined sources of data permitted a detailed analysis of the operations for the two-year period.

The data relating to the operating expenses and statistics of the intrastate carriers were obtained from the records on file at the Texas Railroad Commission. These records were verified, on a test basis, by mail questionnaires. The expense information for this group of carriers was for the year 1960. A limited check indicated that there were no significant differences in the expense relationships between the years 1959, 1960, and 1961.

Similar operating expenses and statistics were obtained from several private concerns that operate their own trucking fleets. However, due to the inconsistency in their manner of accounting for and recording the transportation expenses, it was deemed advisable to discontinue the collection of these data in lieu of esti-

TABLE 1. NUMBER OF CARRIERS INCLUDED IN STUDY BY CARRIER GROUPS AND CLASSES

Carrier Group	Class I	Class II	Class III
Common Carriers of General Freight	35	25	19
Common Carriers of Passengers	23	—	7
Common Carriers of Commodities Other Than General Freight	32	69	88
Contract Carriers	3	7	29

mated figures derived from the operating expenses of contract carriers. Normally, contract carriage is utilized as a substitute for private carriage and as such has many of the features of private trucking. Therefore, the expenses incurred by the contract carriers should approximate those incurred by private carriers.

Methodology

As mentioned previously, one of the objectives of this study was to evaluate different methods of estimating the value of time to the commercial operators. Pursuant to the fulfillment of this objective several alternative approaches were considered and their respective merits and disadvantages compared. The general methods that received the most attention are listed below:

1. Toll Road Approach.
2. Specific Point-to-Point Movement Approach.
3. Area of Influence or Market Area Approach.
4. Case Study Approach.
5. Net Operating Profit Approach.

Perhaps a brief description of each method's merits and disadvantages as they apply to the operations in the Southwestern Region will serve to clarify each.

Toll Road Approach—This method is predicated upon the assumption that the value of time savings can be estimated from the amount toll road users are willing to pay for use of the facility. The estimate is derived through the process of elimination. The accepted elements of user benefit which may result from highway improvements are: lower vehicle operating costs, reduction in accident costs, reduced driving strain and savings of time. The first two of these benefits may be measured fairly accurately to yield tangible cost savings to the toll road users. The latter two benefits are more intangible in nature, and therefore, are more difficult to assign a direct dollar value. However, by eliminating the sum of the values assigned to vehicle operating costs and reduced accident costs from the toll road charge to the motorist, the remainder becomes the implied value of time savings and driver comfort. This brief description is certainly an oversimplification of the toll road approach. However, Dr. Paul J. Claffey of the United States Bureau of Public Roads conducted a toll road, free road study[2] in 1959 utilizing this approach. The excellent report on this study outlines in detail the methods involved in such a study.

The major merit of this approach, as applied to commercial truck traffic, is that it provides a minimum-maximum dollar value that the carriers are willing to pay for the benefits received.

Among the disadvantages of applying the toll road approach to commercial truck users is that it assumes perfect knowledge of the alternative costs and benefits. Whether the decisions to use the toll road are rational and based upon a knowledge of benefit values is questionable. For instance, why do two firms of similar operations and costs differ in their use of toll road facilities? Investigations have revealed that the decisions are mainly based upon managerial opinion of the value of certain benefits. These opinions are widely divergent and are seldom based upon adequate knowledge of the dollar value of specific benefits but rather upon the individual manager's conceptions of such values. Until these managers become informed of the specific values of toll road versus free road travel, the estimates of the value of time savings derived by this method may be somewhat distorted.

The lack of adequate toll road facilities in the Southwestern Region was also a hindrance to the use of this method in the present study. However, the new interstate system in the Southwestern Region does present an opportunity to use the "full control of access" method of analysis.

Specific Point-to-Point Movement Approach—This method is basically the comparative method utilizing the "before and after" technique in a study of operating costs. The out-of-pocket trucking expenses incurred before specific highway improvements are completed are compared with those same expenses after the improvements of the highway facility. Various operating statistics are also compared using the same "before-after" technique. Certain of these operating statistics, such as time required to complete the specific trip or ton-miles per hour, are utilized in the apportionment of the fixed vehicular expenses.

One of the chief merits of the point-to-point movement approach is the relative control that is obtainable. The specific movements may be selected in such a manner that it is possible to control the type of equipment, topography, distance of runs, general traffic conditions, and other variable operating conditions. Under these circumstances, the variation in operating expenses, driving time and total trip time can be determined with some degree of accuracy. The delays due to scheduling may also be analyzed in their proper perspective when specific movements are viewed in a detailed manner. This latter information is very critical in the process of estimating the value of time. Of the five general approaches described herein, only the point-to-point movement and the case study approaches offer any detailed data regarding the utilization of time.

The control that is offered by use of the specific movement study permits the application of statistical test and measurements much more readily than some of the other described methods. These tests are very desirable for determining the reliability of the estimates of the value of time.

The disadvantages of this method center around the availability of adequate data. Only a few firms in the Southwestern Region keep records in detail for specific point-to-point shipments. Those firms that analyzed their operations in this manner normally did not

[2]See Bibliography.

have sufficient information available for a "before-after" study. Studies of this nature are usually conducted for a specific purpose and the data collected are not kept as permanent records.

Therefore, under the time limitations of the current project, it did not appear feasible to initiate procedures to accumulate this type of data. However, under different circumstances, the potential of this approach would demand serious consideration of its application.

Case Study Approach—The case study method is very similar to the above described method. They differ in that the specific movement method relies upon data from several carriers whereas the case study approach is based upon a detailed operational study of a small number of firms. Both methods yield detailed data regarding operating costs and scheduling. However, the case study provides a better insight into the over-all scheduling operations. This method also pinpoints other utilization problems such as restricted routings and the inflexibility of existing terminal facilities. The significance of these and other utilization problems will be discussed in a subsequent section of this report.

Case studies provide control, detailed analyses and the flexibility of varying certain conditions to determine the effect of specific changes. The major disadvantage of this method at the present is its limited scope. That is, only a few firms' operations would be analyzed. Under these circumstances, it would be extremely difficult to expand any findings to apply to the broad field of commercial truck users.

Currently the desire is for estimates of the value of time based upon broad-range research projects. However, it seems apparent that such broad-based studies need to be supplemented by the more detailed case studies if the estimates of time savings are to acquire a reasonable degree of accuracy. Perhaps subsequent research endeavors into the area of value of time will utilize both types of general approaches, the broad-based and case study, to add sophistication and reliability to the estimates.

Area of Influence or Market Area Approach—The market area technique borrows from the field of location theory. The basic concept of this theory is that business locations can be determined rather scientifically by measuring each major locational factor and weighting each according to its relative importance to each specific business. Different businesses vary markedly in the extent to which they are transportation oriented. Therefore, costs of transportation and time requirements become decisive factors in the plant site selection.

Using certain facets of the plant location theory, it is possible to adapt the market area technique to the problem of determining the value of time savings. This concept may be utilized as an alternative process. Since it relies heavily upon hypothetical assumptions, the measure of check that it provides is perhaps its most important potential. Since private trucking cost figures are rather difficult to obtain, the market area approach was tested using a large general merchandising firm that operates a private fleet of trucks in its distribution process.

Listed below are some of the basic hypotheses that were tested:

A. If a firm is operating with privately owned equipment, then time savings will enable the firm to expand its operations by an amount equal to the time savings.

   1. If the transportation in question is used in supplying raw materials to the manufacturing sector, then the potential amount of raw materials carried will increase by an amount proportionate to the time savings. (The capacity of the manufacturing sector may be a limiting factor, however.)

   2. If the transportation in question is used in the supplying of marketing centers, then the firm may either:

      (a) increase the supply to existing centers by an amount proportionate to the time savings, or

      (b) extend the radius of their distribution area thereby increasing their area of market influence.

B. Under certain circumstances, particularly when transportation costs represent a significant proportion of total costs, time savings may result in decreased costs which would enable the firm to benefit from existing operations or to expand into new areas that were previously unprofitable.

This general approach appears to be of most value in analyzing an individual firm's operations as opposed to an industry-wide study. For a single firm, this method would tend to provide insight into the value of time saved in relation to inventory costs, driver layover expenses, warehouse costs, flexibility of operations and customer service.

It appears to be of limited value when considering the regulated for-hire carrier operations. This is due mainly to the inflexibility created by regulatory restrictions. These restrictions affect both routes traveled and areas served in many cases. Under these conditions, the short-run opportunities for expanding the service area are rather limited for these carriers.

Net Operating Profit Approach—The net operating profit approach is based upon the reasonable assumption that if time savings accruing through the use of improved highways have an assignable value, this value will be reflected through the net operating profits of the commercial highway users. A further assumption is that time savings will be utilized when feasible to maximize profits.

This method is similar to the approach employed by Mr. Forest Green of the United States Bureau of Public Roads in his report of June, 1960.[3] Green included the local delivery operations in his study, whereas the current study was based upon only the intercity operations. As stated previously, it was felt that the time savings occurring in the intercity operations were the most significant. And, since there are very few similarities between the intercity and local operations, it was decided that the analysis would be directed to over-the-road trips only.

[3]See Bibliography.

The general hypothesis of this method is that as time is saved, the commercial operators will gain an advantage in these savings through productive use of the equipment and manpower. This added productive use will create a proportionate increase in gross operating revenues as well as a similar increase in variable vehicle expenses. For conservative purposes, it is assumed that other carrier expenses such as terminal, insurance and safety, and administrative expenses will also increase in proportion to the increased revenues. However, the vehicle and labor expenses that have a time function will remain constant under the theory that hours of service will be unchanged. The productive potential will be increased only as a result of increased average operating speeds.

Another possibility is that the total volume of freight handled would not increase as time savings became available. Under these conditions, the carriers should be able to transport the same volume with fewer units of line-haul operating equipment. The potential savings under these circumstances are evident. The reduction of driver expenses, fixed vehicular expenses and the capitalization of the cost of the eliminated operating units are perhaps the most important.

However, since the total tonnage and ton-miles of intercity freight moved by motor trucks has been increasing each year, it seems more logical to assume that any additional equipment time (capacity) would be utilized by increased demand for truck transport services. For this reason, the computations presented in this report are based upon the assumption that the availability of additional freight is not a limiting factor.

The application of this general approach to the determination of the value of time savings required the following procedures: (1) collection of operating cost and statistical data; (2) segregation of specific line-haul expenses; (3) collection and application of mileage and frequency of occurrence data for commercial trucks (axle and gross weight groups); and (4) analysis of the impediments to the utilization of time savings. These procedures will be covered in more detail in the following sections of this report.

Collection of Operating Costs and Statistical Data

For purposes of cost collection and distribution, the firms were grouped into several classifications. The common carriers of general freight were grouped according to the ICC classification of Class I and Class II with each of these subgrouped into those operating principally with owned equipment, and those operating with owned and leased or purchased transportation. The third major group of common carriers is the smaller intrastate carriers domiciled within the state of Texas.

Included in this study were thirty-five Class I carriers, twenty-five Class II, and nineteen intrastate common carriers of general freight. The contract carrier group included only three Class I, seven Class II, and twenty-nine intrastate firms.

There were thirty-two Class I, sixty-nine Class II and eighty-eight intrastate specialized carriers included in the study.

The motor carriers of passengers were divided into two classes—interstate and intrastate. There were twenty-three interstate and seven intrastate motor bus lines.

Detailed operating costs and revenues were obtained for all of the study firms. These data were derived from both primary and secondary sources.

Segregation of Line-Haul Expenses

Since this study is based upon the line-haul segment of the trucking operation, it was necessary to allocate certain costs between the line-haul and the local operations. This was necessary only for specific costs that were considered applicable to the study of the value of time savings. Specifically, these costs are: (1) drivers' and helpers' wages (ICC Uniform System of Accounts No. 182.4230); (2) employees' welfare (Account No. 182.4245); (3) workmen's compensation (Account No. 182.4540); (4) Social Security Taxes (Account No. 182.5240); (5) license and registration fees (Account No. 182.5220); and (6) real estate and personal property taxes (Account No. 182.5230).

There are other expenses, often considered fixed expenses, that were not included in this study. For example, vehicle depreciation expenses are normally considered a fixed charge. This concept is not in error since depreciation per se is merely a rational allocation of the cost of an asset over the expected useful life of that asset. However, useful life need not be measured in time increments exclusively. Under assumptions of the "going concern" concept, it appears more logical to base depreciation charges on units of production than solely on time. In the case of line-haul equipment, the ideal basis might be a combination of time and productive units. It was decided, however, for purposes of this study that depreciation and other similar expenses would be considered as variable or semivariable and therefore not subject to time savings value. This is a conservative measure.

The wage expense as used in this report includes not only the base salary but also the payments for vacations, holidays, call-in time, lay-over time, breakdown and dead-heading time.

The line-haul drivers' wages were segregated on the basis of actual payroll records or on the basis of relative time spent performing various duties. Accurate records of this expense were maintained by most all of the carriers.

The employee welfare expense account was prorated using the ratio of line-haul drivers to total employees covered under the welfare agreement. Since the welfare payments by the employer are designated to be paid on a per employee basis, the variation in the employee wages is of little consequence in this allocation. This account includes both health and welfare payments as well as payments into the drivers' pension fund.

The employer Social Security expense was prorated to the line-haul operations on the basis of the number of line-haul drivers. The average annual salary for these drivers was in excess of the maximum salary subject to the Social Security program. Therefore, assuming that the average line-haul driver had been employed for the major portion of the year by one employer, the maximum expense per driver would be $144. This tax, therefore, assumes the guise of a fixed expense. There is a possibility that the total payments made by the employer might be greater than an average of $144 per driver. This could be caused by the labor turnover during the year. Any error resulting from this discrepancy would not be significant.

The expense for workmen's compensation insurance coverage was prorated on the basis of line-haul drivers' wages as a percent of total salaries and wages of all employees except clerical office employees and salesmen. This approach yields only an approximation of the line-haul portion of this expense. However, it is believed to be an acceptable approximation for purposes of this study.

The payroll limitation rules that existed during the period were not consistent among the southwestern states. The states of Oklahoma, Louisiana, and Arkansas had payroll limitations of $100 per week. Texas had a limitation of $200 per week. Any salary or wages in excess of these weekly averages were not subject to the insurance rate. There were other stipulations, such as the exemption for excess overtime pay, that posed problems in determining the specific charge to the line-haul operations. Therefore, the estimates as derived in the Appendices of this report will be utilized in computing the estimate of the value of time saved.

Real estate and personal property taxes were apportioned using the ratio of the investment in line-haul equipment to the investment in total plant and equipment. It is assumed that a portion of the personal property which is taxable is related to and kept for the facilitation of the line-haul operation, even though line-haul equipment is not classed as personal property in most states. This report does not purport a direct relationship between personal property taxes and investment in line-haul equipment.

The line-haul license and registration fees were obtained from the records of the individual carriers. The Interstate Commerce Commission's standard system of accounts requires a segregation of these expenses between the line-haul and local delivery operations. The intrastate carriers also keep accurate records of the license and registration fees for the intercity fleet.

Mileage and Frequency of Occurrence of Commercial Trucks

The distribution of vehicle mileage by axle-classes and carrier groups was derived from data included in the unpublished study entitled "Value Characteristics in Motor Truck Transportation." This study was conducted by the Texas Transportation Institute in cooperation with the Bureau of Public Roads. The sample of commercial vehicles included in this study consisted of 13,663 tractor-trailer combinations as observed at various locations in the southwestern area of the United States. The number of observations, average miles per

TABLE 2. DISTRIBUTION OF VEHICLE MILEAGE BY AXLE-CLASS AND CARRIER GROUPS

	No. of Observations	Average One-Way Trip Miles	Total Miles	Percentage Distribution	Percent of Total Miles By Axle-Class	Percent of Total Miles By Carrier Groups
AXLE-CLASS						
2-S1	3,044	504	1,532,834	25.9		
2-S2	9,045	406	3,668,311	61.9		
3-S2	1,574	457	719,845	12.2		
Total	13,663	434	5,920,990	100.0		
COMMON CARRIER						
2-S1	212	731	154,972	17.2	10.1	
2-S2	1,389	311	431,979	47.8	11.8	
3-S2	985	321	316,185	35.0	43.9	
Subtotal	2,586	349	903,136	100.0		15.3
SPECIAL HAULER						
2-S1	704	745	524,480	32.9	34.2	
2-S2	2,176	419	911,744	57.2	24.9	
3-S2	184	855	157,320	9.9	21.9	
Subtotal	3,064	520	1,593,544	100.0		26.9
CONTRACT HAULER						
2-S1	87	472	41,064	45.5	2.7	
2-S2	122	301	36,722	40.6	1.0	
3-S2	55	228	12,540	13.9	1.7	
Subtotal	264	342	90,326	100.0		1.5
PRIVATE						
2-S1	2,041	398	812,318	24.4	53.0	
2-S2	5,358	427	2,287,866	68.6	62.3	
3-S2	350	668	233,800	7.0	32.5	
Subtotal	7,749	430	3,333,984	100.0		56.3
Total			5,920,990			100.0

Source: Slater, J. Nelson, and Ray, Cadwell, L., "Determination of Value Characteristics in Motor Truck Transport," Unpublished report to the United States Bureau of Public Roads, April, 1961.

one-way trip and percentage distribution of each axle-class and each carrier group are shown in Table 2.

The distribution, by relative total mileage for each group, was utilized in the analysis of the mixed fleet costs. It is believed that these data are more reliable than the registration figures for each group. The registration data are sometimes difficult to segregate into either axle-classes or carrier groups. For instance, in Texas the tractor and trailer are registered as separate units and there are no definite records of the registered weight, registration fee or the size of a particular combination.

Therefore, the number and type of units observed in the sample count appear to offer the best description of the units in operation within this area. The total registration fee for each combination unit was also recorded. Then the average for each axle-class was computed. These average fees were used in determining the ratio of registration fees between the three major axle-class groups.

The relationships that exist between the different size units were important to this study in the allocation of composite fleet costs. The cost data that were obtained from the various carriers were applicable to the mixed line-haul fleet being operated by each particular firm. Therefore, to distribute these costs between the axle-classes required an application of weighted ratios of relative costs. The development of the applicable ratios will be covered in a later section of this report.

Impediments to the Utilization of Time Savings

The degree of utilization of time savings is certainly one of the major problem areas in determining the value of time saved to commercial operators. Time is definitely valuable, but the ultimate value cannot be realized unless the time is used productively. It was assumed in this study that all time would be utilized by the commercial carriers, "if the utilization of the added time would maximize profits." The determination of when to utilize the "extra" time is strictly a managerial decision.

The computation of the cost of operating a vehicle for an hour or per mile is basically a mechanical process. There are some differences of opinion as to the specific expenses that would remain constant under conditions of time savings. However, these differences and the resultant value of an hour's saving of time are rather minor when compared to the difference of opinion regarding the percent of time savings that can be profitably utilized. There is no general consensus between vehicle operators or researchers in the field of transportation with respect to the probable effect of the various impediments or barriers to the utilization of time. One barrier may be very significant to a general freight carrier but be of no consequence to a contract carrier and vice-versa.

If there were adequate knowledge whereby each impediment could be assigned a weighting factor for each carrier, then a rather comprehensive and accurate utilization factor could be computed for each firm and for each carrier group. However, until the time that detailed case studies of the utilization of time problem are conducted, the results of this study must rely upon judgement values. Under these conditions, it should be emphasized that any projection of values derived by this study should be considered as estimates and it would be appropriate to express them in terms of a range of probable upper and lower limits.

The utilization of time savings does not normally occur overnight but rather is a gradual process. This makes it difficult to segregate the savings because they tend to become obscured within the routine of business operations. Therefore, to determine the degree of utilization of time savings, it becomes necessary to view the problem from both a short-term and long-term position.

In the short-run, there are numerous barriers to the utilization of time savings. A majority of the intercity drivers are paid on the mileage basis, thereby eliminating any immediate savings through wage adjustments as a result of decreased trip time. Existing ICC and state regulatory agency route and area restrictions are rather rigid and tend to stifle a firm's expansion into new geographic areas. The route restrictions also sometimes hinder a carrier from taking advantage of new highway facilities. Therefore, if a particular group of carriers is being considered with the objective of determining the value of time savings to this group of firms, then the utilization percentages for such firms is lowered due to these restrictions. However, if the value of time savings resulting from operations on a particular facility is the point of consideration, the consequent reduction in utilization percentages would not be the pertinent factor. It should be pointed out, however, that even when the value of time saved on a particular facility is the prime consideration this value will sometimes be affected by a firm's inability to operate on other improved highways, particularly if such operation would facilitate the use of time saved on that particular facility. The utilization hindrances of this nature would be of little consequence in the short-run and of no consequence in the long-run.

The present location of terminal facilities and the existing trip schedules will both require adjustments in many instances before the time can be fully utilized. These obstacles are by no means insurmountable; however, the adjustments will require time.

Therefore, it appears logical that a study such as this should be directed along two avenues. First, there would be the potential value that might accrue to the commercial users, assuming no external interference and a minimum amount of internal problems. This is what shall be referred to as the long-run approach. In the long-run, it is assumed that all of the factors that act as present barriers to the utilization of time savings will have had sufficient time to adjust and be altered to the extent that they no longer operate as impediments to the firms.

The short-run approach will attempt to weigh the effect of the existing impediments and adjust the potential value of time savings accordingly.

Each class of carriers has different problems to cope with in the utilization of time saved. Practically all of the major common carriers of general freight base

their driver wages on a combination of hourly and mileage rates. The hourly rate serves as a guaranteed minimum. However, the mileage pay scale is more prevalent since most trips can be completed within time limits that make the mileage rate basis more advantageous to the driver.

The specialized and contract carriers pay their drivers on either an hourly, mileage, fixed trip fee, or a percentage of revenue basis. The method of computing the pay varies greatly between individual carriers in this major group as well as between the major types of specialized and contract carriers.

There is a belief that wage considerations are fundamentally based upon total "take-home" pay and the mileage basis or percent of revenue basis is only a means of attaining that end. If this premise is acceptable, then it appears logical that, as trip travel time decreases, the fixed rate charges will be adjusted accordingly. This adjustment of per mile rates, etc., does not necessarily mean a downward revision of existing rates. This is highly improbable under current labor conditions. However, it is possible that the future rate increases might be smaller than they would have been if there had been no changes in trip time requirements. There is a psychological element involved that could be very important at the bargaining table.

With the savings of time accruing to the commercial highway users, it is feasible that the individual carriers could add a new service area to existing "runs." However, unless the firm has existing authority to serve that area, the carrier must obtain a certificate of necessity before it can add this area to its service route. Increasing competition within the motor transport industry is making it more difficult to obtain such certificates. Therefore, unless a firm can reschedule the trips, within the existing framework of operating authority, there is a good possibility that much of the potential time savings will not be fully utilized.

The amount of time that can be saved per trip also plays an important role in determining the degree of possible utilization. For instance, a savings of 45-60 minutes on a one-way trip of two hundred miles is not of great significance under normal conditions (although the dispatcher would undoubtedly welcome this leeway in his scheduling.) A similar ratio of time savings to miles driven for a cross-country operation will frequently yield a more than proportionate savings in time as well as dollar savings. On long-distance trips, the time savings are cumulative and are often increased by elimination of layover periods. The ICC safety regulations stipulate that no driver can drive more than ten hours in any period of 24 consecutive hours during, or immediately following the ten hours total driving time and within the period of 24 consecutive hours. This means that on trips that require more than 10 hours of driving time, layovers are required. Each layover period that is thus eliminated will add a minimum of eight hours to the total time saved. This amount of time is significant from both the customer service standpoint and in the area of equipment utilization.

After considering the problems involved in the utilization of incremental savings of time, certain conclusions and estimates have been made. All time that is saved as a result of highway improvements is valuable to the carriers. Even though the time is used only for additional in-the-shop preventative maintenance time or for providing more freedom in the scheduling of trips, it will be useful and will be welcomed by the carriers. Another benefit will be the increased goodwill of the drivers, provided there is no change in their wages. However, it is difficult to assign dollar values to these benefits. The purpose of this study was to estimate the measurable benefits of time savings.

In order to adjust the potential savings to more nearly reflect current or short-term values, it became necessary to establish certain time utilization estimates for each carrier group. During the interviews with the respondent carriers several questions regarding the time utilization problem were discussed. The answers, of course, were expressions of the respondents' informed judgements concerning the problem. The answers, as interpreted by the researchers, were converted to measurement and scaling techniques by use of scaling methods.[4] The value of the scaling technique lies in its transformation of qualitative and noncomparable quantitative information into numerical rankings. Such rankings, moreover, permit the subsequent use of various quantitative techniques.

Based upon the results of the scaling measurement and subjective judgement, the following ranges of probable utilization were established.

The common carriers of general freight, being the most heavily restricted as to the routes traveled and areas served, and operating predominantly with organized labor, received the lowest estimates, a range of forty to sixty percent of potential value.

Within the specialized carrier group there are both regular and irregular route carriers, long and short-haul carriers and carriers that base their driver wages on a mileage, percent of revenue or hourly rate. Normally, these carriers have a greater degree of freedom in their operations than the general freight carriers. Accordingly, the specialized carrier group was estimated to be able to use approximately sixty to eighty percent of any time saved.

The private and contract haulers are less regulated and restricted in their operations than either of the preceding carrier groups. They have much more freedom in their scheduling, routing, and service areas. The major impediments to the complete utilization of time savings center around internal rather than external restrictions and problems. The private and contract carriers were assigned a utilization range of eighty to one hundred percent.

In a similar manner, it was estimated that the motor buses would be able to utilize between eighty and ninety percent of time savings accruing to them through use of improved highways.

[4]For a discussion of scaling techniques, see Torgerson, Warren S., **Theory and Methods of Scaling.** John Wiley and Sons, Inc., 1958.

Development of Value of Time Saved By Carrier Groups

The previous sections have established the general methodology employed in this study. This includes a treatment of the expenses that would most likely be affected by travel-time savings, the rather mechanical process of segregating the appropriate line-haul expenses and the problems faced by the commercial highway users in their productive use of time saved. The information and data reported in the previous sections will be merged in this section in order to develop an estimate of the value of time saved.

The estimates of value for each group of commercial carriers are founded upon several assumptions. It is assumed that, as additional time (equipment capacity) becomes available, the added capacity will be utilized through additional freight or passenger volume. This incremental volume will produce a proportionate increase in gross operating revenues as well as a similar increase in the variable and semivariable expenses. Therefore, the value accruing through this added capacity is the difference between the incremental gross revenues and the incremental expenses. The savings are thus an amount equal to the selected expenses (as described previously) which are not incurred in the incremental shipment plus the average net profit per unit of measure. The unit of measure employed in the tables and computations in this section is the "intercity mile." The revenue, expenses and potential value added are all expressed in terms of "per intercity miles." The potential value added per mile is expanded to the value per hour by multiplying by the average line-haul speed, expressed in miles per hour.

The average line-haul operating speed of 38 miles per hour was used for all of the commercial freight carriers. The value of an hour of time saved by the commercial motor carriers of passengers was derived by using an estimated average operating speed of 45 miles per hour. These average speeds were determined by sampling trip records and driver log sheets and were confirmed through conferences with dispatchers and other carrier officials.

The major variation in operating speeds appeared to be between specific routes and between different types of specialized and contract carriers. For instance, the heavy equipment haulers' average operating speed is not as high as the grain haulers'. However, the average for each group of carriers appears to be comparable for the general freight, specialized, contract and private carriers.

The revenues and variable expenses, that is, total expenses less the selected expenses, of each class of carriers were weighted according to the relative mileage of each class to the total mileage of the group. This weighting has the effect, of course, of giving prime importance to the revenues and expenses of the carrier class that has the greatest utilization of the highways in the Southwestern Region. The weighting factors were developed from sample loadometer data and the average miles per firm information for each study carrier.

The carriers are subgrouped in the various tables and computations into Class I, Class II and Class III carriers. These classifications conform to the Interstate Commerce Commission's designations. However, the Class III subgroup also includes intrastate carriers that are not included under the jurisdiction of the ICC. The terms "Intrastate" and "Class III" carriers may, at times, be interchanged in this report since they are both used to refer to the group of smaller carriers included in the study. These smaller carriers may be either intrastate or interstate in character.

Common Carriers of General Freight

Table 3 shows the total revenue and expenses as well as the line haul portion of the certain selected expenses for each class of general freight common carriers. The development of the listed expenses is shown in more detail in Tables 1 and 2 of Appendix A. A summary of the revenues and selected expenses per mile is presented in Table 4. It is quite apparent, from a review of these data, that the major expense involved in determining the potential value of time saved is that of driver wages. It should be remembered that, under current

TABLE 3. SUMMARY OF REVENUE AND SELECTED LINE HAUL EXPENSES INTERSTATE CLASS I AND CLASS II AND INTRASTATE COMMON CARRIERS OF GENERAL FREIGHT ENGAGED IN INTERCITY OPERATIONS, SOUTHWESTERN REGION AND TEXAS, FOR THE YEAR ENDED DECEMBER 31, 1959

	Class I			Class II			
	A*	B**	Total	A*	B**	Total	Class III
Operating Revenue—Total	$155,958,891	$112,618,790	$268,577,681	$10,193,768	$3,498,617	$13,692,385	$1,401,204
Expenses—Total	$146,512,236	$103,513,407	$250,025,643	$ 9,838,114	$3,513,073	$13,351,187	$1,378,305
Drivers' Wages—Line Haul	$ 21,564,528	$ 15,025,778	$ 36,590,306	$ 1,185,638	$ 324,492	$ 1,510,130	$ 164,558
Employees' Welfare—Line Haul	$ 582,254	$ 373,612	$ 954,936	$ ——	$ ——	$ ——	$ ——
Workmen's Compensation—Line Haul	$ 344,294	$ 246,879	$ 591,019	$ 33,260	$ 9,154	$ 42,411	$ 3,556
Vehicle License & Registration Fees—Line Haul	$ 2,127,519	$ 1,409,549	$ 3,537,000	$ 141,962	$ 65,519	$ 207,482	$ 27,136
Real Estate & Personal Property Taxes—Line Haul	$ 476,797	$ 249,052	$ 735,247	$ 18,511	$ 1,841	$ 20,546	$ 3,827
Social Security Taxes—Line Haul	$ 378,576	$ 284,112	$ 662,688	$ 30,672	$ 9,504	$ 40,176	$ 4,421
Total Intercity Miles	212,928,816	143,797,764	356,726,580	11,097,349	3,643,323	14,740,672	4,550,994

*Operating principally with owned equipment.
**Operating with owned and leased or purchased transportation.

TABLE 4. SUMMARY OF REVENUE AND SELECTED LINE HAUL EXPENSES PER MILE INTERSTATE CLASS I AND CLASS II AND INTRASTATE COMMON CARRIERS OF GENERAL FREIGHT ENGAGED IN INTERCITY OPERATIONS, SOUTHWESTERN REGION AND TEXAS FOR THE YEAR ENDED DECEMBER 31, 1959

Statistics Per Mile	Class I			Class II			Class III
	A*	B**	Total	A*	B**	Total	
Operating Revenue	$.73244	$.78317	$.75289	$.91857	$.96028	$.92888	$.30788
Total Expenses	$.68808	$.71985	$.70088	$.88652	$.96424	$.90573	$.30285
Drivers' Wages	$.10127	$.10449	$.10257	$.10683	$.08906	$.10244	$.03615
Employees' Welfare	.00273	.00259	.00267	——	——	——	——
Workmen's Compensation	.00161	.00171	.00165	.00299	.00251	.00287	.00078
Vehicle License and Registration Fees	.00999	.00980	.00991	.01279	.01798	.01407	.00596
Real Estate and Personal Property Taxes	.00223	.00173	.00206	.00166	.00050	.00139	.00084
Social Security Taxes	.00177	.00197	.00185	.00276	.00260	.00272	.00097
Total Selected Line Haul Expenses Per Mile	$.11960	$.12229	$.12071	$.12703	$.11265	$.12349	$.04470

*Operating principally with owned equipment.
**Operating with owned and leased or purchased transportation.

conditions, this expense is primarily variable for this group of carriers.

The derivation of the potential value added per mile (as a result of time savings) for the common carriers of general freight is shown in Table 5. The Class I carriers had the greatest influence on this group since they accounted for approximately eighty-eight percent of the total mileage.

When the value added per mile is converted to an hourly basis, the potential value of $6.17 per hour is obtained. Application of the probable utilization percentages yields a range of probable values of $2.47-$3.70 per hour of time saved. These data are summarized in Table 15.

Although the potential value that might be derived by a savings of time is greater for this group than for any of the other freight haulers, the estimated time utilization factor causes the range of probable values to be slightly lower than for any of the other carrier groups.

TABLE 5. DERIVATION OF POTENTIAL VALUE ADDED PER MILE COMMON CARRIERS OF GENERAL FREIGHT

	Revenue Per Intercity Mile	Ratio of Class Mileage to Total Mileage	Weighted Revenue Per Mile
Class I	$.75289	.88328	$.66501
Class II	.92888	.04123	.03830
Class III	.30788	.07548	.02324
Weighted revenue per intercity mile			$.72655

	Total Expenses Less Selected Expenses per Intercity Mile	Ratio of Class Mileage to Total Mileage	Weighted Variable Expenses per Mile
Class I	$.58017	.88328	$.51245
Class II	.78224	.04123	.03225
Class III	.25815	.07548	.01949
Weighted total expenses less selected line-haul expenses			$.56419
Potential value added per mile for common carriers of general freight			$.16236

Common Carriers of Commodities Other Than General Freight

The group of common carriers of commodities other than general freight, are generally considered as specialized carriers. They include the haulers of petroleum products, household goods, heavy machinery, automobiles, exempt agricultural products and various other specific commodities. It is within this group of carriers that the greatest variation in both physical operations and the cost of operation occurs.

Tables 6 and 7 present the pertinent revenue and expense data for the three classes of specialized carriers. More detailed data are presented in Tables 3-11, inclusive, of Appendix A. The derivation of the potential value added per mile is shown in Table 8.

Class I and III accounted for almost 86 percent of the total estimated mileage by the specialized group of carriers. This is apparent in the calculations of the

TABLE 6. SUMMARY OF REVENUE AND SELECTED LINE HAUL EXPENSES,* INTERSTATE CLASS I AND CLASS II AND INTRASTATE COMMON CARRIERS OF COMMODITIES OTHER THAN GENERAL FREIGHT, SOUTHWESTERN REGION, FOR THE YEAR ENDED DECEMBER 31, 1959**

	Interstate		
	Class I	Class II	Class III
Intercity Miles—Total	307,213	87,036	15,056
Operating Revenue—Total	$107,350	$37,041	$ 8,542
Expenses—Total	101,993	35,458	7,848
Drivers' Wages—Line Haul	17,560	6,987	1,647
Employees' Welfare—Line Haul	439	——	——
Workmen's Compensation—Line Haul	758	508	111
Vehicle License & Registration Fees—Line Haul	2,560	881	190
Real Estate & Personal Property Taxes—Line Haul	213	50	31
Social Security Taxes—Line Haul	158	82	30

*All dollars and miles in thousands—add (000).
**All intrastate information for year ended December 31, 1960.

TABLE 7. SUMMARY OF REVENUE AND SELECTED LINE HAUL EXPENSES PER MILE, INTERSTATE CLASS I AND CLASS II AND INTRASTATE COMMON CARRIERS OF COMMODITIES OTHER THAN GENERAL FREIGHT, SOUTHWESTERN REGION, FOR THE YEAR ENDED DECEMBER 31, 1959*

	Interstate		
	Class I	Class II	Class III
Statistics Per Mile			
Operating Revenue	$.34942	$.42558	$.56734
Total Expenses	$.33199	$.40739	$.52125
Drivers' Wages—Line Haul	$.05715	$.08027	$.10939
Employees' Welfare—Line Haul	.00142		
Workmen's Compensation—Line Haul	.00246	.00583	.00737
Vehicle License & Registration Fees—Line Haul	.00833	.01012	.01261
Real Estate & Personal Property Taxes—Line Haul	.00069	.00057	.00205
Social Security Taxes	.00051	.00094	.00199
Total Selected Line Haul Expenses	$.07056	$.09773	$.13341

*All intrastate information for year ended December 31, 1960.

weighted revenues per mile and the weighted variable expenses per mile as presented in Table 8.

The potential value added for the common carriers of commodities other than general freight is estimated to be slightly less than thirteen cents per mile. This is approximately 20 percent lower than the estimate for the common carriers of general freight. However, the probable value added is greater than for the general freight haulers because of the level of probable utilization is higher.

The potential value per hour of time saved for this group is estimated at $4.86. The low value of the probable range is $2.91 and the high value is $3.89. This range is based upon the estimated utilization of 60-80 percent.

TABLE 8. DERIVATION OF POTENTIAL VALUE ADDED PER MILE COMMON CARRIERS OF COMMODITIES OTHER THAN GENERAL FREIGHT

	Revenue Per Intercity Mile	Ratio of Class Mileage to Total Mileage	Weighted Revenue Per Mile
Class I	$.34942	.46555	$.16267
Class II	.42558	.14253	.06066
Class III	.56734	.39192	.22235
Weighted revenue per intercity mile			$.44568

	Total Expenses Less Selected Expenses Per Intercity Mile	Ratio of Class Mileage to Total Mileage	Weighted Variable Expenses Per Mile
Class I	$.26143	.46555	$.12171
Class II	.30966	.14253	.04414
Class III	.38784	.39192	.15200
Weighted total expenses less selected line haul expenses			$.31785
Potential value added per mile for common carriers of commodities other than general freight			$.12783

TABLE 9. SUMMARY OF REVENUE AND SELECTED LINE HAUL EXPENSES,* INTERSTATE CLASS I AND CLASS II AND INTRASTATE CONTRACT CARRIERS, SOUTHWESTERN REGION, FOR THE YEAR ENDED DECEMBER 31, 1959**

	Interstate		
	Class I	Class II	Class III
Intercity Miles—Total	26,673	10,450	7,382
Operating Revenue—Total	$ 8,556	$ 4,036	$2,474
Expenses—Total	7,432	3,854	2,384
Drivers' Wages—Line Haul	2,485	819	521
Employees' Welfare—Line Haul	35		
Workmen's Compensation—Line Haul	17	22	21
Vehicle License & Registration Fees—Line Haul	207	124	69
Real Estate & Personal Property Taxes—Line Haul	27	5	12
Social Security Taxes—Line Haul	20	7	11

*All dollars and miles in thousands—add (000).
**All intrastate information for year ended December 31, 1960.

Contract and Private Carriers

The contract and private carriers' costs are assumed to be comparable for purposes of this study. Therefore, this subsection includes the derivation of estimated values of time savings for both groups.

The selected expenses and revenues for the three classes of contract carriers are listed in Tables 9 and 10. The derivation of the potential value added per mile in Table 11 applies to both carrier groups and is weighted accordingly. Additional data for the contract carrier group are shown in Table 12 of Appendix A.

The smallest class of carriers in this group accounted for the highest percentage of total mileage. Therefore, their revenues and expenses were weighted the heaviest.

The potential value added per mile for the contract and private carriers was estimated to be approximately

TABLE 10. SUMMARY OF REVENUE AND SELECTED LINE HAUL EXPENSES, PER MILE, INTERSTATE CLASS I AND CLASS II AND INTRASTATE CONTRACT CARRIERS, SOUTHWESTERN REGION, FOR THE YEAR ENDED DECEMBER 31, 1959.*

	Interstate		
	Class I	Class II	Class III
Statistics Per Mile			
Operating Revenue	$.32077	$.38622	$.33513
Total Expenses	$.27863	$.36880	$.32294
Drivers' Wage—Line Haul	$.09316	$.07837	$.07057
Employees' Welfare—Line Haul	.00131		
Workmen's Compensation—Line Haul	.00063	.00210	.00284
Vehicle License & Registration Fees—Line Haul	.00776	.01186	.00934
Real Estate & Personal Property Taxes—Line Haul	.00101	.00047	.00162
Social Security Taxes—Line Haul	.00074	.00066	.00149
Total Selected Line Haul Expenses Per Mile	$.10461	$.09346	$.08586

*All intrastate information for year ended December 31, 1960.

TABLE 11. DERIVATION OF POTENTIAL VALUE ADDED PER MILE, CONTRACT CARRIERS AND PRIVATE CARRIERS

	Revenue Per Intercity Mile	Ratio of Class Mileage to Total Mileage	Weighted Revenue Per Mile
Class I	$.32077	.28060	$.09001
Class II	.38622	.15705	.06066
Class III	.33513	.56235	.18846
Weighted revenue per intercity mile			$.33913

	Total Expenses Less Selected Expenses per Intercity Mile	Ratio of Class Mileage to Total Mileage	Weighted Variable Expenses per Mile
Class I	$.17402	.28060	$.04883
Class II	.27534	.15705	.04324
Class III	.23708	.56235	.13332
Weighted total expenses less selected line haul expenses			$.22539
Potential value added per mile for contract and private carriers			$.11374

11 cents per mile. Converted to an hourly figure through use of the 38 miles-per-hour average speed, the potential time savings are estimated to be valued at $4.32 per hour. Application of the utilization range of 80-100 percent yields a low value of $3.46 per hour and a high value of $4.32 per hour.

The estimated probable values accruing to these carriers are the highest of any of the commercial freight haulers. The validity of these figures is dependent upon the accuracy of the judgment values employed in determining the probable extent of time utilization by each carrier class.

Composite Commercial Freight Vehicle

This subsection deals with the derivation of the values of time for a composite commercial freight vehicle. The composite vehicle is defined as an average vehicle, composed of the four freight carrier groups, operating in the Southwestern Region.

The value added per hour for a composite vehicle is derived through employment of the values developed in Tables 5, 8, and 11, together with the ratios in Table 2, in the following formula:

$$p_1(G) + p_2(S) + p_3(N) + p_4(P) = p_t\ (C_t)$$

where:

p_1, p_2, p_3, and p_4 = the ratio of each of the four carrier groups' miles operated to total miles operated by all carrier groups—respectively, common carriers of general freight, common carriers of commodities other than general freight, contract carriers, and private carriers.

p_t = the ratio of the miles operated by the carrier groups used in a particular equation to the total miles operated by the carrier groups making up the particular costs or revenues solved for — by definition this ratio is equal to one and is added here simply for mathematical clarity.

G, S, N, and P = the value added per hour for, respectively, common carriers of general freight, common carriers of commodities other than general freight, contract carriers and private carriers as computed in Tables 5, 8, and 11.

C_t = the value added per hour for a composite vehicle composed of the four carrier groups.

TABLE 12. SUMMARY OF REVENUES AND SELECTED LINE HAUL EXPENSES, INTERSTATE AND INTRASTATE CARRIERS OF PASSENGERS ENGAGED IN INTERCITY SERVICE, SOUTHWESTERN REGION, FOR THE YEAR ENDED DECEMBER 31, 1959*

	Interstate	Intrastate
Intercity Miles—Total	142,261,673	1,197,736
Operating Revenue—Total	$ 67,248,565	$ 210,231
Expenses—Grand Total	57,050,536	212,573
Drivers—Total Compensation	13,395,675	49,561
Workmen's Compensation—Drivers	123,210	995
Vehicle License & Registration Fees—Total	1,151,419	4,683
Real Estate & Personal Property Tax—Revenue Equipment	393,415	1,811
Social Security Taxes—Drivers	313,920	3,312

*All intrastate information for year ended December 31, 1960.

By using the values in Tables 5, 8, and 11, and in Table 2, three values may be developed for a composite vehicle: (1) potential value, (2) low value and (3) high value:

(1.1) Potential Value (100% for all carriers)
$.153(\$6.16968) + .269(\$4.85754) + .015(\$4.32212) + .563(\$4.32212) = C_t$
C_t = \$4.74803 per hour

(1.2) Low Value
$.153(\$2.46787) + .269(\$2.91452) + .015(\$3.45770) + .563(\$3.45770) = C_t$
C_t = \$3.16054 per hour

(1.3) High Value
$.153(\$3.70181) + .269(\$3.88603) + .015(\$4.32212) + .563(\$4.32212) = C_t$
C_t = \$4.11014 per hour

Therefore, assuming a commercial freight traffic stream consisting of approximately 15 percent general freight carriers, 27 percent specialized carriers, and 58 percent private and contract carriers, the potential value of an hour of time saved would average \$4.74 for all vehicles. The average low-high utilization values would be approximately \$3.16-\$4.11 per hour of time saved.

It is readily apparent from the formula that the composite vehicle values are heavily weighted by the private carriers. Any shift in the composite traffic stream would automatically cause a change in the computed values for the composite vehicle.

It should be noted that the value range of \$3.16 per hour to \$4.11 is derived under assumptions that are based upon the short-run period. However, this does not imply that these conditions and assumptions are currently operative. Therefore, the current values are probably somewhat lower than the value of \$3.16 per hour. This will be true until the adjustments are consummated in regard to driver wage payments since the possible savings that may accrue through this expense are responsible for the major portion of the estimated value of time savings.

TABLE 13. SUMMARY OF REVENUES AND SELECTED LINE HAUL EXPENSES, PER MILE, INTERSTATE AND INTRASTATE CARRIERS OF PASSENGERS ENGAGED IN INTERCITY SERVICE, SOUTHWESTERN REGION, FOR THE YEAR ENDED DECEMBER 31, 1959*

	Interstate	Intrastate
Statistics Per Mile		
Operating Revenue	$.47271	$.17552
Expenses	$.40102	$.17747
Drivers' Wages	$.09416	$.04137
Workmen's Compensation—Drivers	.00086	.00083
Vehicle Licence & Registration Fees	.00809	.00390
Real Estate & Personal Property Taxes—Revenue Equipment	.00276	.00151
Social Security Taxes—Drivers	.00220	.00276
Total Selected Expenses Per Mile	$.10807	$.05037

*All intrastate information for year ended December 31, 1960.

Common Carriers of Passengers

The common carriers of passengers (motor buses) are segregated into two groups—the interstate carriers and the intrastate carriers. As with the commercial carriers of freight, only the carriers engaged primarily in intercity service were included in this study.

A summary of the revenues and selected expenses of the common carriers of passengers are presented in Tables 12 and 13. The derivation of the potential value added per mile is shown in Table 14. Sufficient information was not obtained to allow an expansion of the available data to represent a composite motor bus.

TABLE 14. DERIVATION OF POTENTIAL VALUE ADDED PER MILE, COMMON CARRIERS OF PASSENGERS

	Interstate		Intrastate	
Revenue Per Mile		$.47271		$.17552
Total Expenses Per Mile	$.40102		$.17747	
Less Selected Expenses Per Mile	.10807	.29295	.05037	.12710
Potential Value Added Per Mile for Common Carriers of Passengers		$.17976		$.04842

It is readily apparent that there is a wide spread between the potential value for the interstate and intrastate carriers. Most of this spread can be explained by the differences in driver expense and the profit potential. The intrastate carriers (as a group) were operating at a loss rather than making a profit on their operations.

The expansion of the potential value added per mile to an hourly figure was made by using an estimated average speed of 45 miles per hour. This expansion produced an estimated potential value added per hour of $8.09 for the interstate motor buses. Application of the probable utilization percentage range for this group yields a range of values of $6.47-$7.28 per hour. These values are based upon the estimated time utilization of 80-90 percent.

The range of probable values for the intrastate carriers was $1.74-$1.96 per hour. These data are summarized in Table 15.

Development of Axle-Class Ratios

This section is devoted to the development of certain ratios which will be used in apportioning the value of time savings between the three major axle-classes of vehicles that are used for line-haul operations in the Southwestern Region. The predominant axle-classes are the three-axle, four-axle, and five-axle semi-combinations. These will be referred to as 2-S1, 2-S2, and 3-S2 combinations, respectively.

The ratios are developed in terms of the relative cost per mile for selected expenses by the three axle-classes. These relative expenses together with the percentage distribution of axle-classes within carrier groups, Table 2, are applied to the composite expenses for each carrier group. In this manner, the selected line-haul expenses per mile are estimated for each axle-class within the carrier groups.

The data required for the development of the relative axle-class expenses are shown in Tables 16, 17, 18, and 19. The mileage wage rates applicable to the Southwestern Region carriers are listed in Table 16. The total miles operated by each carrier group are developed in Table 17. The line haul employees' welfare, workmen's compensation insurance, and social security tax expenses are developed and listed as a percentage of the

TABLE 15. SUMMARY OF VALUE ADDED PER HOUR DERIVATIONS BY CARRIER GROUPS AND FOR COMPOSITE VEHICLE

	Value Added Per Mile	Average Speed In M.P.H.	Potential Value Added Per Hour	Percent Range of Utilization	Range of Value Low - High
Common Carriers of General Freight	$.16236	38	$6.16968	40-60	$2.46787 - $3.70181
Common Carriers of Commodities Other Than General Freight	.12783	38	4.85754	60-80	2.91452 - 3.88603
Contract and Private Carriers	.11374	38	4.32212	80-100	3.45770 - 4.32212
Composite Vehicle	.12485	38	4.74803	——	3.16054 - 4.11014
Common Carriers of Passengers					
Interstate	.17976	45	8.08920	80-90	6.47136 - 7.28028
Intrastate	.04842	45	2.17890	80-90	1.74312 - 1.96101

TABLE 16. MILEAGE AND HOURLY WAGE RATES, SOUTHERN CONFERENCE OVER-THE-ROAD MOTOR FREIGHT AGREEMENTS COVERING THE DRIVERS EMPLOYED IN THE OPERATION OF COMMON, CONTRACT AND PRIVATE CARRIERS IN THE STATES OF ARKANSAS, LOUISIANA, OKLAHOMA, AND TEXAS, FROM FEBRUARY 1, 1951, THROUGH JANUARY 31, 1963

	Feb. 1, 1951 thru Jan. 31, 1952	Feb. 1, 1952 thru Jan. 31, 1953	Feb. 1, 1953 thru Jan. 31, 1954	Feb. 1, 1954 thru Jan. 31, 1955	Feb. 1, 1955 thru Jan. 31, 1956	Feb. 1, 1956 thru Aug. 31, 1956	Aug. 1, 1957 thru Jan. 31, 1957
Single Axle Units	$ .05125	$ .05875	$ .0625	$ .06625	$ .06950	$ .07325	$ .07450
Tandem Axle Units	.05375	.06125	.0650	.06875	.07200	.07575	.07700
Tandem 5-Axle Units		.06375	.0675	.07125	.07450	.07825	.07950
Double Bottom Units, Jeeps or a Combination of Vehicle or Units		.06875	.0725	.07625	.07950	.08325	.08450
Hourly Rates	1.46	1.65	1.76	1.87	2.00	2.09	2.11
Two-Man Rate	.06825	.08	.0825	.0850	.0961	.0986	——
Single Man Rate	.034125	.04	.04125	.04125	.04805	.0493	——

	Feb. 1, 1957 thru Aug. 31, 1957	Aug. 1, 1957 thru Jan. 31, 1958	Feb. 1, 1958 thru Jan. 31, 1959	Feb. 1, 1959 thru Jan. 31, 1960	Feb. 1, 1960 thru Jan. 31, 1961	Feb. 1, 1961 thru Jan. 31, 1962	Feb. 1, 1962 thru Jan. 31, 1963
Single Axle Units	$ .07825	$ .07950	$ .08450	$ .08700	$ .08950	$ .09425	$ .09675
Tandem Axle Units	.08075	.08200	.08700	.08950	.09200	.09675	.09925
Tandem 5-Axle Units	.08325	.08450	.08825	.09075	.09325	.09800	.10050
Double Bottom Units, Jeeps or a Combination of Vehicles or Units	.09025	.09350	.09850	.10100	.10350	.10825	.11075
Hourly Rates	2.21	2.23	2.43	2.50	2.57	2.73	2.84
Two-man Rate	.1011	——	.1061	.1086	.1111	.11585	.11835
Single Man Rate	.05055	——	.05305	.05430	.05555	.057925	.059175

drivers' wages in Table 18. The vehicle license and registration fees are shown in Table 19, which is a summary of these expenses as developed in Appendix B of this report. The development of the related real estate and personal property taxes is included in Appendix C. A summary of all of the selected expenses for each axle-class, within carrier groups, is shown in Table 20.

The miles operated by each class of carrier are used to weight the selected expenses in developing their value per mile for each carrier group. These values are shown in Table 21. The values in Table 21, together with the relative expenses by axle-class and the percentage distribution of each axle-class within carrier groups are all included in equations 1.11-1.43 which follow.

Using X to represent the 2-S1 combinations, the other axle-classes may be expressed in relation to X by applying the relative values developed in Table 20.

(1) Selected expenses for axle-classes = dollar value = value relative to 2-S1.

Common Carriers of General Freight

(1.11) 2-S1 = $.101227 = X
(1.12) 2-S2 = $.106530 = 1.0524X
(1.13) 3-S2 = $.108592 = 1.0728X

Common Carriers of Commodities Other Than General Freight

(1.21) 2-S1 = $.103575 = X
(1.22) 2-S2 = $.108956 = 1.0520X
(1.23) 3-S2 = $.110966 = 1.0714X

Contract Haulers

(1.31) 2-S1 = $.099913 = X
(1.32) 2-S2 = $.105461 = 1.0555X
(1.33) 3-S2 = $.106964 = 1.0706X

TABLE 17. DEVELOPMENT OF TOTAL MILES OPERATED BY CARRIER GROUPS AND CLASSES, SOUTHWESTERN REGION, FOR THE YEAR ENDED DECEMBER 31, 1959

	Number of Carriers		Average Total Miles Per Carriers	Miles by Carriers Used in Study	Total Miles by all Carriers
	Total	Used in Study			
Common Carriers of General Freight					
Class I	37	35	10,192,188	356,726,580	375,586,000
Class II	28	25	589,627	14,740,672	17,533,000
Intrastate	134	19	239,526	4,550,994	32,096,484
Contract Carriers					
Class I	3	3	8,891,000	26,673,000	26,673,000
Class II	10	7	1,492,857	10,450,000	14,928,570
Intrastate	210	29	254,552	7,382,000	53,455,920
Common Carriers of Commodities Other than General Freight					
Class I	42	32	9,600,406	307,213,000	403,217,052
Class II	100	71	1,234,437	87,645,000	123,443,700
Intrastate	1,984	88	171,091	15,056,000	339,444,544

TABLE 18. DEVELOPMENT OF SELECTED LINE HAUL EXPENSE RELATIONSHIPS BY CARRIER GROUPS, SOUTHWESTERN REGION, FOR THE YEAR ENDED 1959

	Selected Line Haul Expenses (per mile)				Total Miles Operated Per Year	Selected Total Line Haul Expenses			
	Drivers' Wages	Employees' Welfare	Workmen's Compensation	Social Security Taxes		Drivers' Wages	Employees' Welfare	Workmen's Compensation	Social Security Taxes
Common Carriers of General Freight									
Class I	$.10257	$.00267	$.00165	$.00185	375,586,000	$ 38,523,856	$1,002,815	$ 619,717	$ 694,834
Class II	.10244	——	.00287	.00272	17,533,000	1,796,081	——	50,320	47,690
Intrastate	.03615	——	.00078	.00097	32,096,484	1,160,288	——	25,035	31,134
Sub-total					425,215,484	$ 41,480,225	$1,002,815	$ 695,072	$ 773,658
Contract Carriers									
Class I	$.09316	$.00131	$.00063	$.00074	26,673,000	$ 2,484,857	$ 34,942	$ 16,804	$ 19,738
Class II	.07837	——	.00210	.00066	14,928,570	1,169,952	——	31,350	9,853
Intrastate	.07057	——	.00284	.00149	53,455,920	3,772,384	——	151,815	79,649
Sub-total					95,057,490	$ 7,427,193	$ 34,942	$ 199,969	$ 109,240
Common Carriers of Commodities Other than General Freight									
Class I	$.05715	$.00142	$.00246	$.00051	403,217,052	$ 23,043,855	$ 572,568	$ 991,914	$ 205,641
Class II	.08027	——	.00583	.00094	123,443,700	9,908,826	——	719,677	116,037
Intrastate	.10939	——	.00737	.00199	339,444,544	37,131,839	——	2,501,706	675,495
Sub-total					866,105,296	$ 70,084,520	$ 572,568	$4,213,297	$ 997,173
Total					1,386,378,270	$118,991,928	$1,610,325	$5,108,338	$1,880,071
Other Selected Expenses as Percentage of Drivers Wages									
Common Carriers—General Freight							2.417%	1.675%	1.865%
Contract Carriers							.470	2.692	1.470
Common Carriers—Other							.816	6.011	1.422
Total Weighted Percentage							1.353	4.293	1.579

TABLE 19. VEHICLE LICENSE AND REGISTRATION FEES (PER MILE), BY AXLE-CLASS AND CARRIER GROUP

	Axle-Class		
	2-S1	2-S2	3-S2
Common-General Freight	$.008150	$.010072	$.010188
Contract	.008219	.010570	.010274
Common-Other	.008665	.010708	$.010831
Private	.007879	.009737	.009849

Source: Appendix B.

Private Carriers

(1.41) 2-S1 = $.099516 = X
(1.42) 2-S2 = $.104534 = 1.0504X
(1.43) 3-S2 = $.106412 = 1.0693X

The following equation may be solved for each carrier group to develop the cost of the selected expenses for each axle-class.

$$(2)\quad \frac{s_1}{s_t}(E_1) + \frac{s_2}{s_t}(E_2) + \frac{s_3}{s_t}(E_3) = \frac{s_t}{s_t}(G)$$

where:

s_1 = Mileage of observed axle-class 2-S1 for a particular carrier group,

s_2 = Mileage of observed axle-class 2-S2 for a particular carrier group,

s_3 = Mileage of observed axle-class 3-S2 for a particular carrier group,

s_t = Total mileage observed for all axle-classes in a particular carrier group,

E_1 = The ratio of 2-S1 selected expenses to 2-S1 selected expenses for a particular carrier group, (by definition this will always equal 1),

E_2 = The ratio of 2-S2 selected expenses to 2-S1 selected expenses for a particular carrier group,

E_3 = The ratio of 3-S2 selected expenses to 2-S1 selected expenses for a particular carrier group, and

G = The average selected expenses for a particular carrier group, composed of all axle-classes.

Using X to represent axle-class 2-S1 and inserting the values from Tables 2, 20 and 21 into the following equations, the cost of selected expenses for axle-classes within each carrier group may be determined.

Common Carriers of General Freight

(2.1) .172(X) + .478(1.0524X) + .350(1.0728X) = $.11508 per mile
X = $.10954 per mile

Selected line-haul expenses of 2-S1 = X = $.10954 per mile

Selected line-haul expenses of 2-S2 = 1.0524X = $.11528 per mile

Selected line-haul expenses of 3-S2 = 1.0728X = $.11751 per mile

Common Carriers of Commodities Other Than General Freight

(2.2) .329(X) + .572(1.0520X) + .099(1.0714X) = $.09906 per mile
X = $.09554 per mile

Selected line-haul expenses of 2-S1 = X = $.09554 per mile

TABLE 20. DEVELOPMENT OF RELATIVE EXPENSES FOR VARIOUS AXLE-CLASSES BY CARRIER GROUPS SOUTHWESTERN REGION, FOR YEAR ENDED DECEMBER 31, 1959

	Common Carriers of General Freight			Common Carriers of Commodities Other Than General Freight		
	2-S1	2-S2	3-S2	2-S1	2-S2	3-S2
Line Haul Expenses						
Drivers' Wages—Per Mile	$ .086792	$ .089292	$ .090542	$ .086792	$ .089292	$ .090542
Employees' Welfare—Per Mile	.002098	.002158	.002188	.000708	.000729	.000739
Workmen's Compensation	.001454	.001496	.001517	.005217	.005367	.005442
Vehicle License & Registration Fees—Per Mile	.008150	.010072	.010188	.008665	.010708	.010831
Real Estate & Personal Property Tax—Per Mile	.001114	.001847	.002468	.000959	.001590	.002124
Social Security Taxes—Per Mile	.001619	.001665	.001689	.001234	.001270	.001288
Total Selected Expenses	.101227	.106530	.108592	.103575	.108956	.110966
Each Axle-Class Relative to Axle-Class 2-S1 (Total Selected Expenses)	$1.00	$1.0524	$1.0728	$1.00	$1.0520	$1.0714

	Contract Carriers			Private Carriers		
	2-S1	2-S2	3-S2	2-S1	2-S2	3-S2
Line Haul Expenses						
Drivers' Wages—Per Mile	$ .086792	$ .089292	$ .090542	$ .086792	$ .089292	$ .090542
Employees' Welfare—Per Mile	.000408	.000420	.000426	.000408	.000420	.000426
Workmen's Compensation—Per Mile	.002336	.002404	.002437	.002336	.002404	.002437
Vehicle License & Registration Fees—Per Mile	.008219	.010570	.010274	.007879	.009737	.009849
Real Estate & Personal Property Tax—Per Mile	.000882	.001462	.001954	.000825	.001368	.001827
Social Security Taxes—Per Mile	.001276	.001313	.001331	.001276	.001313	.001331
Total Expenses	.099913	.105461	.106964	.099516	.104534	.106412
Each Axle-Class Relative to Axle-Class 2-S1 (Total Selected Expenses)	$1.00	$1.0555	$1.0706	$1.00	$1.0504	$1.0693

Selected line-haul expenses of 2-S2 = 1.0520X = $.10051 per mile

Selected line-haul expenses of 3-S2 = 1.0714X = $.10236 per mile

Contract Carriers

(2.3) .455(X) + .406(1.0555X) + .139(1.0706X) = $.09231 per mile
X = $.08942 per mile

Selected line-haul expenses of 2-S1 = X = $.08942 per mile

Selected line-haul expenses of 2-S2 = 1.0555X = $.09438 per mile

Selected line-haul expenses of 3-S2 = 1.0706X = $.09573 per mile

Private Carriers

(2.4) .244(X) + .686(1.0504X) + .070(1.0693X) = $.09231 per mile
X = $.08881 per mile

Selected line-haul expenses of 2-S1 = X = $.08881 per mile

Selected line-haul expenses of 2-S2 = 1.0504X = $.09329 per mile

Selected line-haul expenses of 3-S2 = 1.0693X = $.09496 per mile

The cost of selected line-haul expenses per mile for a composite vehicle (average commercial vehicle operating on the highways in the Southwestern Region) may be derived from a similar formula:

$$(3)\quad \frac{A}{T}(G) + \frac{B}{T}(S) + \frac{D}{T}(N) + \frac{F}{T}(P) = \frac{T}{T}(C)$$

where:

A = Mileage of observed common carriers of general freight,

T = Total mileage of observed commercial vehicles,

B = Mileage of observed common carriers of commodities other than general freight,

D = Mileage of observed contract carriers,

F = Mileage of observed private carriers,

G = Cost of selected line-haul expenses per mile for common carriers of general freight,

S = Cost of selected line-haul expenses per mile for common carriers of commodities other than general freight,

N = Cost of selected line-haul expenses per mile for contract carriers,

P = Cost of selected line-haul expenses per mile for private carriers, and,

C = Cost of selected line-haul expenses per mile for composite vehicles observed on highways in Southwestern Region.

By substituting the calculated values from Tables 2 and 21, equation (3) may be solved for C as follows:

(3.1) .153($.11508) + .269($.09906) + .015($.09231) + .563($.09231) = 1.00 (C)
C = $.09760 per mile

The development of selected line-haul expenses per mile of operation may be developed similarly for each axle-class group by use of the following formulas:

$$(4)\quad \frac{A}{T}(R) + \frac{B}{T}(S) + \frac{C}{T}(M) + \frac{D}{T}(L) = \frac{T}{T}(X_1)$$

where:

A = Mileage of 2-S1 axle-class engaged as common carrier of general freight,

B = Mileage of 2-S1 axle-class engaged as common carrier of commodities other than general freight,

C = Mileage of 2-S1 axle-class engaged as contract carriers,

D = Mileage of 2-S1 axle-class engaged as private carriers,

TABLE 21. DEVELOPMENT OF VALUE OF SELECTED LINE HAUL EXPENSES PER MILE BY CARRIER GROUP,* SOUTHWESTERN REGION, FOR THE YEAR ENDED DECEMBER 31, 1959

	Value of Selected Line Haul Expenses Per Mile	Miles Operated by all Carriers	Total Value of Selected Expenses	Value of Selected Expenses Per Mile By Carrier Group
Common Carriers of General Freight				
Class I	$.12071	375,586,000	$ 43,336,986	
Class II	.12349	17,533,000	2,165,150	
Intrastate	.04470	32,096,484	1,434,713	
Sub-total		425,215,484	$ 48,936,849	$.11508
Contract Carriers				
Class I	$.10461	26,673,000	$ 2,790,263	
Class II	.09346	14,928,570	1,395,224	
Intrastate	.08586	53,455,920	4,589,725	
Sub-total		95,057,490	$ 8,775,212	$.09231
Common Carriers of Commodities Other than General Freight				
Class I	$.07056	403,217,052	$ 28,450,995	
Class II	.09773	123,443,700	12,064,153	
Intrastate	.13341	339,444,544	45,285,296	
Sub-total		866,105,296	$ 85,800,444	$.09906
Total		1,386,378,270	$143,512,505	$.10351

*Class Groups weighted by intercity miles operated to develop carrier group costs per mile.

TABLE 22. COST OF SELECTED LINE HAUL EXPENSES PER MILE BY AXLE-CLASS AND CARRIER GROUP

	Common Carriers of General Freight	Common Carriers of Commodities Other Than General Freight	Contract Carriers	Private Carriers	Composite Vehicle
Axle-Class:					
2-S1	$.10954	$.09554	$.08942	$.08881	$.09323
2-S2	.11528	.10051	.09438	.09329	.09772
3-S2	.11751	.10236	.09573	.09496	.10653
Group Averages	$.1151	$.0991	$.0923	$.0923	$.09760

T = Total mileage of 2-S1 axle-class (A + B + C + D),

R = Cost of selected line-haul expenses per mile of operation by common carriers of general freight (2-S1 axle class),

S = Cost of selected line-haul expenses per mile of operation by common carriers of commodities other than general freight (2-S1 axle-class),

M = Cost of selected line-haul expenses per mile of operation by contract carriers (2-S1 axle class),

L = Cost of selected line-haul expenses per mile of operation by private carriers (2-S1 axle-class), and

X_1 = Cost of selected line-haul expenses per mile of operation by composite 2-S1 vehicles.

By substituting 2-S2 for 2-S1 in all of the definitions above, the cost of selected line-haul expenses per mile of operation by a composite 2-S2 axle-type vehicle (X_2) may be obtained. Similarly, the cost of selected line-haul expenses per mile of operation by a composite 3-S2 axle-class vehicle (X_3) may be obtained by using 3-S2 statistics in place of 2-S1 statistics. By using the information in Tables 2 and 22 (developed in equations 2.1-2.4), equation (4) may be solved to obtain values for X_1, X_2, and X_3:

$$(4.1)\quad X_1 = \frac{A}{T}(R) + \frac{B}{T}(S) + \frac{C}{T}(M) + \frac{D}{T}(L)$$

$$X_1 = .101(\$.10954) + .342(\$.09554) + .027(\$.08942) + .530(.08881)$$

$$X_1 = \$.09323 \text{ per mile}$$

$$(4.2)\quad X_2 = \frac{A}{T}(R) + \frac{B}{T}(S) + \frac{C}{T}(M) + \frac{D}{T}(L)$$

$$X_2 = .118(\$.11528) + .249(\$.10051) + .010(\$.09438) + .623(\$.09329)$$

$$X_2 = \$.09772 \text{ per mile}$$

$$(4.3)\quad X_3 = \frac{A}{T}(R) + \frac{B}{T}(S) + \frac{C}{T}(M) + \frac{D}{T}(L)$$

$$X_3 = .439(\$.11751) + .219(\$.10236) + .017(\$.09573) + .325(\$.09496)$$

$$X_3 = \$.10653 \text{ per mile}$$

A summary of the selected expenses as developed in this section is shown in Table 22. These expenses will be used in the following section in developing estimates of the value of time savings by axle-class classifications.

Development of Value of Time Savings By Axle-Classes Within Carrier Groups

The purpose of this section is to develop the potential and probable values of time savings for each of the three major axle-classes of commercial freight vehicles. The estimates are developed for each axle-class within each major carrier group. Estimates of values are also derived for a composite vehicle of each axle-class. The composite vehicles are composed of each carrier group weighted by the proportionate mileage factors as developed for the Southwestern Region.

The value added per mile for the various axle-classes within each carrier group is developed below using the following formula:

$$(1.0)\quad (R - E) + S = V$$

where:

R = total revenue per intercity mile for particular carrier group,

E = total expenses per intercity mile for particular carrier group,

S = selected expenses per intercity mile for particular axle-class within carrier group, and

V = value added per mile for each axle-class.

The values for (R — E) in formula (1.0) are taken from Column 1 of Tables 5, 8 and 11 and the values for S are taken from Table 22.

Common Carriers of General Freight

A. Axle-Class 2-S1

(1.11) $.04728 + $.1107 = V

V = $.15798 per mile

B. Axle-Class 2-S2

(1.12) $.04728 + $.1157 = V

V = $.16298 per mile

C. Axle-Class 3-S2

(1.13) $.04728 + $.1162 = V

V = $.16348 per mile

Common Carriers of Commodities Other Than General Freight

A. Axle-Class 2-S1
(1.21) $.02877 + $.0960 = V
V = $.12477 per mile

B. Axle-Class 2-S2
(1.22) $.02877 + $.1004 = V
V = $.12917 per mile

C. Axle-Class 3-S2
(1.23) $.02877 + $.1008 = V
V = $.12957 per mile

Contract Carriers

A. Axle-Class 2-S1
(1.31) $.02143 + $.0900 = V
V = $.11143 per mile

B. Axle-Class 2-S2
(1.32) $.02143 + $.0941 = V
V = $.11553 per mile

C. Axle-Class 3-S2
(1.33) $.02143 + $.0945 = V
V = $.11593 per mile

Private Carriers

A. Axle-Class 2-S1
(1.41) $.02143 + $.0892 = V
V = $.11063 per mile

B. Axle-Class 2-S2
(1.42) $.02143 + $.0932 = V
V = $.11463 per mile

C. Axle-Class 3-S2
(1.43) $.02143 + $.0936 = V
V = $.11503 per mile

A summary of the potential and probable range of values is shown in Table 23. These hourly values are derived from the mileage values developed above. The average line-haul operating speed of 38 miles per hour was used to determine the potential value per hour and the low-high ranges of probable values were computed, using the previously established estimates of time utilization factors for each carrier group.

The values, as developed in this section, are based on the assumption that each axle-class vehicle within a particular carrier group has an equal net operating profit potential. It is believed that the resultant error occurring as a result of the acceptance of this assumption will not be of major consequence, even though there is undoubtedly some variation. The major variation in net operating profit potential results from differences between carrier groups rather than axle-classes. Since it is impossible to determine from available data the variation between both carrier groups and axle-classes, the groups were segregated by carrier groups, the major source of variation.

Composite Axle-Classes

The value added per hour for composite axle-class groups may be developed from the information in Table 23, together with the values from Table 2, with the use of the following equation:

(2.0) $P_1(G) + P_2(S) + P_3(N) + P_4(P) = P_t(C_a)$

where:

P_1, P_2, P_3, and P_4 = the ratio of the number of miles operated by a particular axle-class within a carrier group to the total miles operated by that axle-class within the four carrier groups, respectively, common carriers of general freight, common carriers of commodities other than general freight, contract carriers, and private carriers,

P_t = the ratio of the miles operated by a particular axle-class in all carrier groups, used in a particular equation, to the total miles operated by that axle-class within the carrier groups making up the costs or revenues solved for (this ratio is equal to one in all the following equations,)

G, S, N, and P = the value added per hour for a particular axle-class within each carrier group; respectively, common carriers of general freight, common carriers of commodities other than general freight, contract carriers, and private carriers, and

C_a = the value added per hour for a composite axle-class vehicle composed of that axle-class within each carrier group.

TABLE 23. SUMMARY OF VALUE ADDED PER HOUR DERIVATIONS BY AXLE-CLASSES WITHIN CARRIER GROUPS

	Value Added Per Hour		
	(1) Potential	(2) Low Utilization	(3) High Utilization
Common Carriers of General Freight			
Axle-Class 2-S1	$6.00	$2.40	$3.60
Axle-Class 2-S2	6.19	2.48	3.72
Axle-Class 3-S2	6.21	2.48	3.73
Common Carriers of Commodities Other Than General Freight			
Axle-Class 2-S1	4.74	2.84	3.79
Axle-Class 2-S2	4.91	2.95	3.93
Axle-Class 3-S2	4.92	2.95	3.94
Contract Carriers			
Axle-Class 2-S1	4.23	3.39	4.23
Axle-Class 2-S2	4.39	3.51	4.39
Axle-Class 3-S2	4.41	3.52	4.41
Private Carriers			
Axle-Class 2-S1	4.20	3.36	4.20
Axle-Class 2-S2	4.36	3.48	4.36
Axle-Class 3-S2	4.37	3.50	4.37

By using the values in Tables 23 and 2, three values may be developed for each composite axle-class: (1) potential value, (2) low value, and (3) high value:

Composite 2-S1 Axle-Class

A. Potential Value
(2.11) .101($6.00324) + .342($4.74126) + .027($4.23434) + .530($4.20394) = $4.57051 per hour

B. Low Value
(2.12) .101($2.40130) + .342($2.84476) + .027($3.38747) + .523($3.36315) = $3.08919 per hour

C. High Value
(2.13) .101($3.60194) + .342($3.79301) + .027($4.23434) + .530($4.20394) = $4.00329 per hour

TABLE 24. SUMMARY OF VALUE ADDED PER HOUR DERIVATIONS BY COMPOSITE AXLE-CLASS

	Value Added Per Hour		
	Potential	Low Utilization	High Utilization
Composite Vehicle:			
Axle-Class 2-S1	$4.57	$3.09	$4.00
Axle-Class 2-S2	4.71	3.23	4.17
Axle-Class 3-S2	5.30	2.93	3.99

Composite 2-S2 Axle-Class

A. Potential Value

(2.21) .118($6.19324) + .249($4.90846) + .010($4.39014) + .624($4.35594) = $4.70997 per hour

B. Low Value

(2.22) .118($2.47730) + .249($2.94508) + .010($3.51211) + .624($3.48475) = $3.23225 per hour

C. High Value

(2.23) .118($3.71594) + .249($3.92677) + .010($4.39014) + .623($4.35594) = $4.17424 per hour

Composite 3-S2 Axle-Class

A. Potential Value

(2.31) .439($6.21224) + .219($4.92366) + .017($4.40534) + .325($4.37114) = $5.30117 per hour

B. Low Value

(2.32) .439($2.48490) + .219($2.95420) + .017($3.52427) + .325($3.49691) = $2.93426 per hour

C. High Value

(2.33) .439($3.72734) + .21855($3.93893) + .017($4.40534) + .325($4.37114) = $3.99449 per hour

A summary of the value added per hour for each composite axle-class commercial vehicle is shown in Table 24. It is interesting to note that the potential value added per hour increases with the number of axles but the probable range of values added per hour does not follow this pattern. The range of probable values for the 3-S2 axle-class is less than for either of the other axle-classes although the potential value is the greatest for the 3-S2 axle-class. A combination of factors enters into the explanation of this apparent incongruity.

The greatest use of the 3-S2 vehicles in the Southwestern Region study was by the common carriers of general freight, accounting for approximately 44 percent of the total mileage. This carrier group had the highest potential value of time savings but the lowest range of probable values. The private carriers accounted for the predominant usage of the 2-S1 and 2-S2 vehicles. These private carriers had the lowest potential values but the highest range of probable utilization. Therefore, the 2-S1 and 2-S2 axle-classes are weighted more heavily by the higher utilization carrier groups, whereas the 3-S2 axle-class is weighted more heavily by the lower utilization carrier groups.

The situation described above serves to illustrate the importance of the relative composure of the composite axle-class vehicles and the importance of the estimated range of probable utilization upon the dollar value estimates of time savings.

Area of Influence or Market Area Approach

This section of the report shows several alternative ways by which a merchandising firm could utilize time savings resulting from increased operating speeds in intercity trucking operations. It gives a more comprehensive description of the method previously outlined in the discussion of the various approaches.

Generally speaking, each industry has three basic needs: (1) to accumulate its required raw materials and services at a manufacturing center, (2) to convert these resources into finished products at the manufacturing center, and (3) to distribute the finished products from the manufacturing center to the various market outlets. Transportation is required in two of these processes—in accumulating the raw materials at the manufacturing center and in distributing the finished products to the market outlets.

In certain cases the distribution process may be carried out in separate stages. In these instances the products are first moved from the manufacturer to wholesalers, jobbers or other distribution centers from which they are then shipped to the retail outlets. Consumers then usually assume the burden of transporting the goods from the retail store to their final place of consumption.

The particular operation under consideration in this section is a merchandising firm with a regional distribution center, located in Dallas, from which its products are distributed to retail outlets. This final movement may be either by way of common carriers of general freight or by the firm's private fleet of trucks.

The following discussion is divided into three parts, each showing a way in which time savings might be of value to such a firm. The first part shows how time savings might be of value to a firm if such savings allowed the firm to supply more of their retail outlets with their private fleet, rather than having to use for-hire carriers. The second part shows how the firm might use time savings to supply increased business to existing retail outlets. The third part shows how time savings might, in certain restricted cases, allow a firm to locate new retail outlets in previously (before time savings occurred) unprofitable locations.

General Value of Time Savings Under Present Operations

Under present operations, time savings would be of value to the private fleet through allowing them (1) to increase the use of their own trucks (instead of for-hire carriers) in hauling products to their retail outlets, and (2) to operate this mileage at reduced costs. It is assumed that the number of miles operated by both for-hire carriers and by the private fleet, in serving the retail outlets, remains constant. That is, the amount of

products carried to the retail outlets is assumed to remain constant, and the number of miles operated in carrying these products is likewise assumed to remain constant. Equation 1 shows the total transportation costs per year paid by the merchandising firm to serve its retail outlets.

$$(1)\quad E_t = r(B) + c(D)$$

where:

E_t = total transportation expenses per year,

r = common carrier rates per mile (although common carrier rates are not given in mileage figures, it is possible to develop such an average figure for known operations over a period of time—to be discussed more fully below),

c = private carrier costs per mile of operation,

B = miles operated by common carriers of general freight for the merchandising firm, and

D = miles operated by private fleet of the merchandising firm.

When the merchandising firm's potential miles operated by its private fleet increases ($\triangle D$) due to time savings (due to increased speeds on the Interstate system) utilized, the miles operated for the firm by common carriers of general freight will decrease by an equal amount ($\triangle B \equiv - \triangle D$, recalling the assumption that total miles operated per year remain constant). Furthermore, these changes in mileage will be accompanied by a change in total transportation expenses ($\triangle E_t$), since r and c, or r and (c-s) below, are not equal:

$$(2)\quad E_t + \triangle E_t = r(B - \triangle D) + c(D + \triangle D)$$

Subtracting equation 1 from equation 2 gives equation 3 which shows the change in total expenses which results from the increase in miles operated by the private fleet and the decrease in miles operated by common carriers for the firm:

$$(3)\quad \triangle E_t = r(-\triangle D) + c(\triangle D)$$

However, since the additional mileage operated by the private fleet is accomplished with the same number of operating hours, the expenses for the private fleet on the additional mileage are not equal to c; rather, they are equal to the private carrier costs per mile before time savings occurred (c) less selected expenses per mile (designated hereafter as s) not occurring on the additional mileage. The reasoning used in the preceding sentence is identical to that used in the sections on commercial haulers, and the reader is referred to these sections for a more complete discussion of the reasoning. Using (c-s) to represent the expenses per mile on the additional private carrier miles operated, equation 4, showing the change in total transportation expenses from both the change-over from common carrier to the private fleet and the reduced expenses on the additional mileage, is obtained:

$$(4)\quad \triangle E_t = r(-\triangle D) + (c-s)(\triangle D)$$

There exist various impediments to changing from common carrier to the private fleet (such as rescheduling, route and load limitations) and other institutional factors prohibiting maximum savings of selected expenses on additional mileage (such as drivers paid on mileage basis, equipment utilization.) Therefore, the total expense change will be less than $\triangle E_t$. The actual change in total expenses ($\triangle E_t'$) will be represented as 50 percent of the potential change ($\triangle E_t$), a percentage lower than that for private carriers in general* due to the particular institutional factors present in this firm's operation:

$$(5)\quad \triangle E_t' = \frac{\triangle E_t}{2} = \frac{r(-\triangle D)}{2} + \frac{(c-s)(\triangle D)}{2}$$

The change in the total miles operated by the private fleet ($\triangle D$) may be derived from the following formula:

$$(6)\quad \triangle D = p(D)/S_o\ (S_1 - S_o)$$

where:

D = total miles operated per year by the private fleet,

p = the ratio of miles operated in 1961 on roads which will be part of the Interstate Highway System to the total miles operated on all roads during 1961,

s_o = the average speed of the private fleet during 1961,

s_1 = the estimated speed of the private trucks while operating on the Interstate System, and

D = the potential increase in total miles operated by the private fleet due to increased speed on the Interstate Highways, assuming the same number of driving hours by the private fleet. Substituting the value for $\triangle D$ from Equation 6 into equation 5 gives:

$$(7)\quad \triangle E_t' = \frac{r\,[(-pD/S_o)\ (S_1-S_o)]}{2} + \frac{(c-s)\ [(pD/S_o)\ (S_1-S_o)]}{2}$$

The total savings per year ($\triangle E_t'$) may be transformed into *value per hour of time saved on Interstate Highways* (H_s) by Equation 8 or into *savings per potential mile saved on Interstate Highways* (M_s) by Equation 9:

$$(8)\quad H_s = \triangle E_t'/(\triangle D/S_1)$$

$$(9)\quad M_s = H_s/S_1$$

The change in total transportation expenses per year due to increased speeds of operation ($\triangle E_t'$) may be obtained by using Equation 7 together with the following information: r = \$.46995; p = .6532; D = 4,517,824 miles; S_o = 38.011 m.p.h.; c = \$.33144; and s = \$.14187.

The common carrier rates per mile (r) is a figure, obtained from the private firm under consideration, which has been developed from past years' operations. The firm has kept records showing the cost of using common carriers instead of the private fleet; the common carrier rates have averaged 1.4179 times as much

*See private carriers in net operating revenue approach, pp. 41.

TABLE 25. SELECTED LINE HAUL EXPENSES* FOR LARGE MERCHANDISING FIRM OPERATING IN TEXAS, LOUISIANA, OKLAHOMA, AND NEW MEXICO, PRIVATE FLEET RECORDS FOR YEAR ENDED DECEMBER 31, 1961

	Selected Expense Per Mile	Line Haul Percentage Allocated	Line Haul Amount
Drivers' Wages	$.131506	100.00	$.131506
Workmen's Compensation	.000027	83.05	.000022
Vehicle License and Registration Fees	.008790	100.0	.008790
Social Security Taxes	.007846	19.72	.001547
Total Selected Line Haul Expenses Per Mile			$.141865

*This firm has no employees' welfare expenses. Also, no figures were attainable for real estate and personal property taxes.

per mile as the cost of hauling the same goods with the private fleet (1.4179 times $.33144 equals $.46995). All other statistics given above are taken from the records of the firm under consideration for the year ended 1961. The p and S_o are taken from a sample of all trips dispatched on twelve days throughout the year 1961. All other statistics cover the entire year's operation. The derivation of cost of selected expenses per mile is shown in Table 25.

Since the operating speed on the Interstate system may not yet be determined accurately, the values of time saved are computed for increased speeds varying from 39 to 45 miles per hour. For each of these speeds, Table 26 shows: (1) total yearly change in transportation expenses, (2) value per hour of time saved on Interstate highways, and (3) savings per potential mile saved on Interstate highways. After the average operating speed on the Interstate system has been ascertained, the value of time savings per year, hour, and mile may

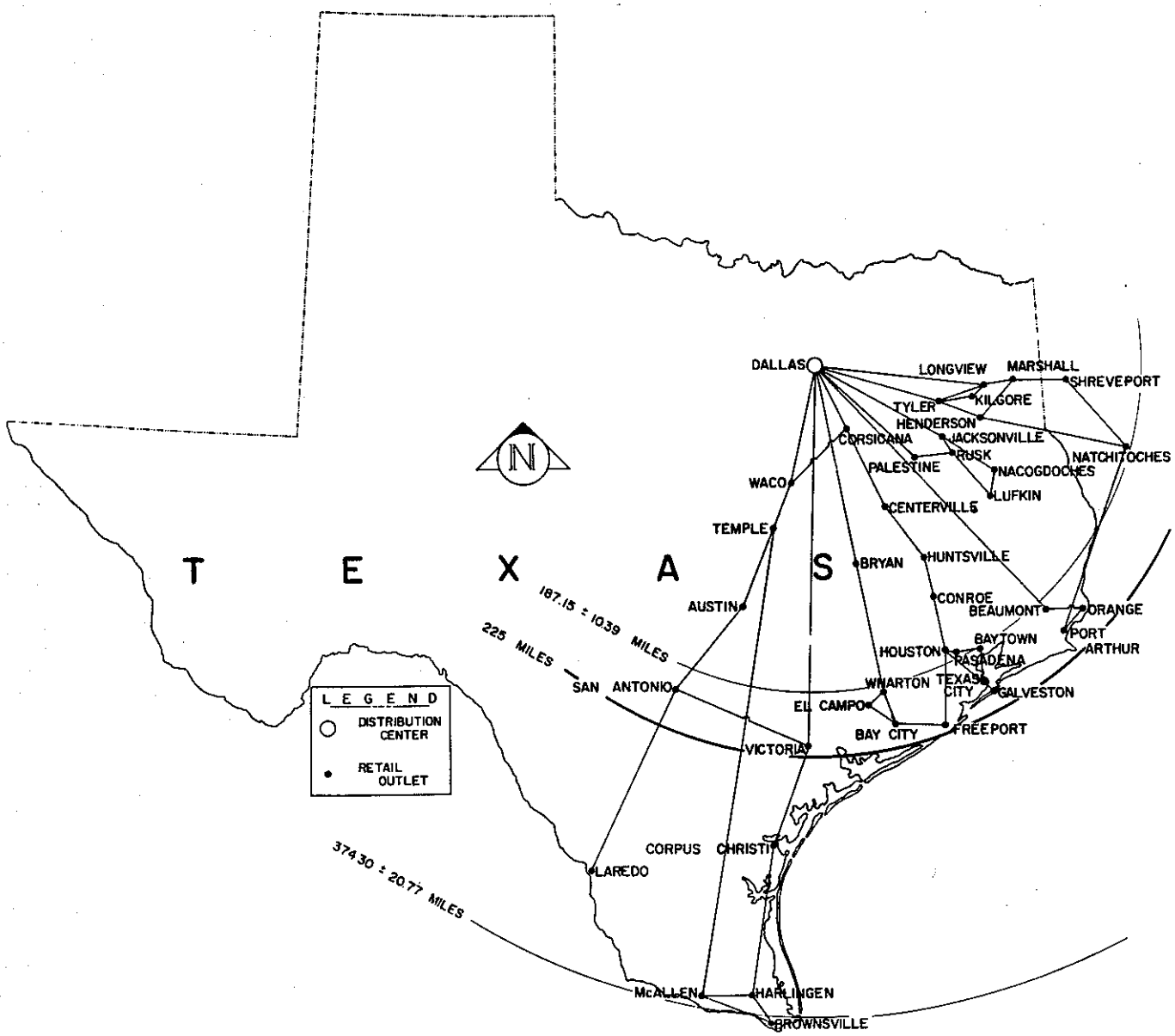

Figure 1. Existing and potential market area radius retail outlets of merchandising firm in East and South Texas.

be approximated by simply referring to the speed in the table. (If the speed differs from the values shown in the table, then other values may be readily computed by use of their given formulas.) For example, the value of one hour of time saved on Interstate highways at an average speed of 42 miles per hour is worth approximately $5.89.

Extension of Market Area.

The merchandising firm under consideration has a central distribution center located in Dallas from which it serves its many retail outlets located in the states of Texas, Louisiana, Oklahoma, and New Mexico. In the previous section it was shown how the firm could utilize time savings and supply more of its retail outlets with its private fleet rather than having to use for-hire transportation. However, the firm does not necessarily have to utilize all of its time savings strictly in this manner since there are other economically feasible means of using time savings.

TABLE 36. VALUE OF TIME SAVINGS TO MERCHANDISING FIRM PER YEAR, HOUR AND MILE, AT DIFFERENT SPEEDS

S_1	$\Delta E'_t$	H_s	M_s
39	$10,764.14	$5.4674	$.1401
40	21,648.00	5.6075	.1401
41	32,531.86	5.7477	.1401
42	43,415.72	5.8879	.1401
43	54,299.58	6.0281	.1401
44	65,183.44	6.1683	.1401
45	76,067.31	6.3085	.1401

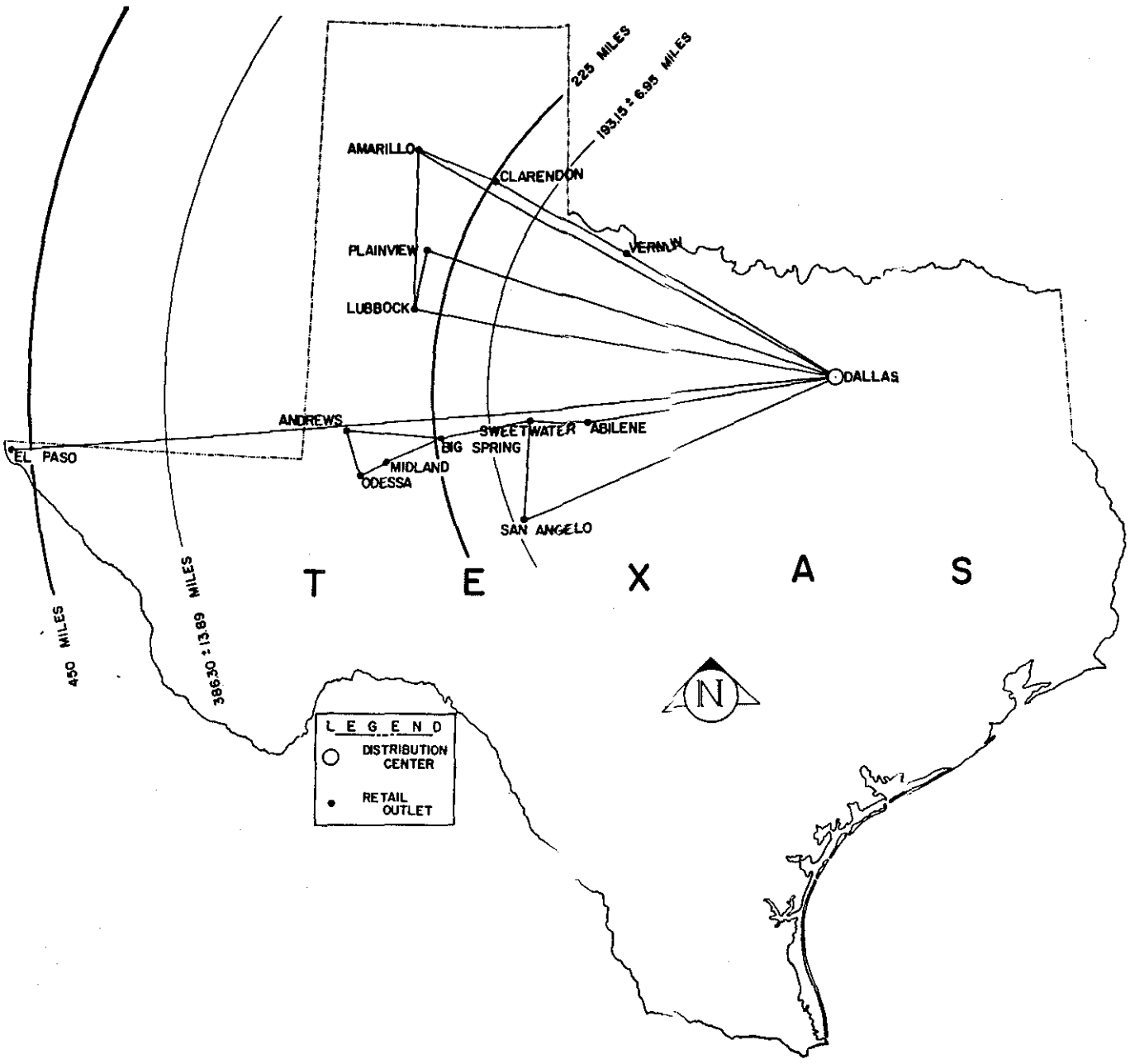

Figure 2. Existing and potential market area radius retail outlets of merchandising firm in North and West Texas.

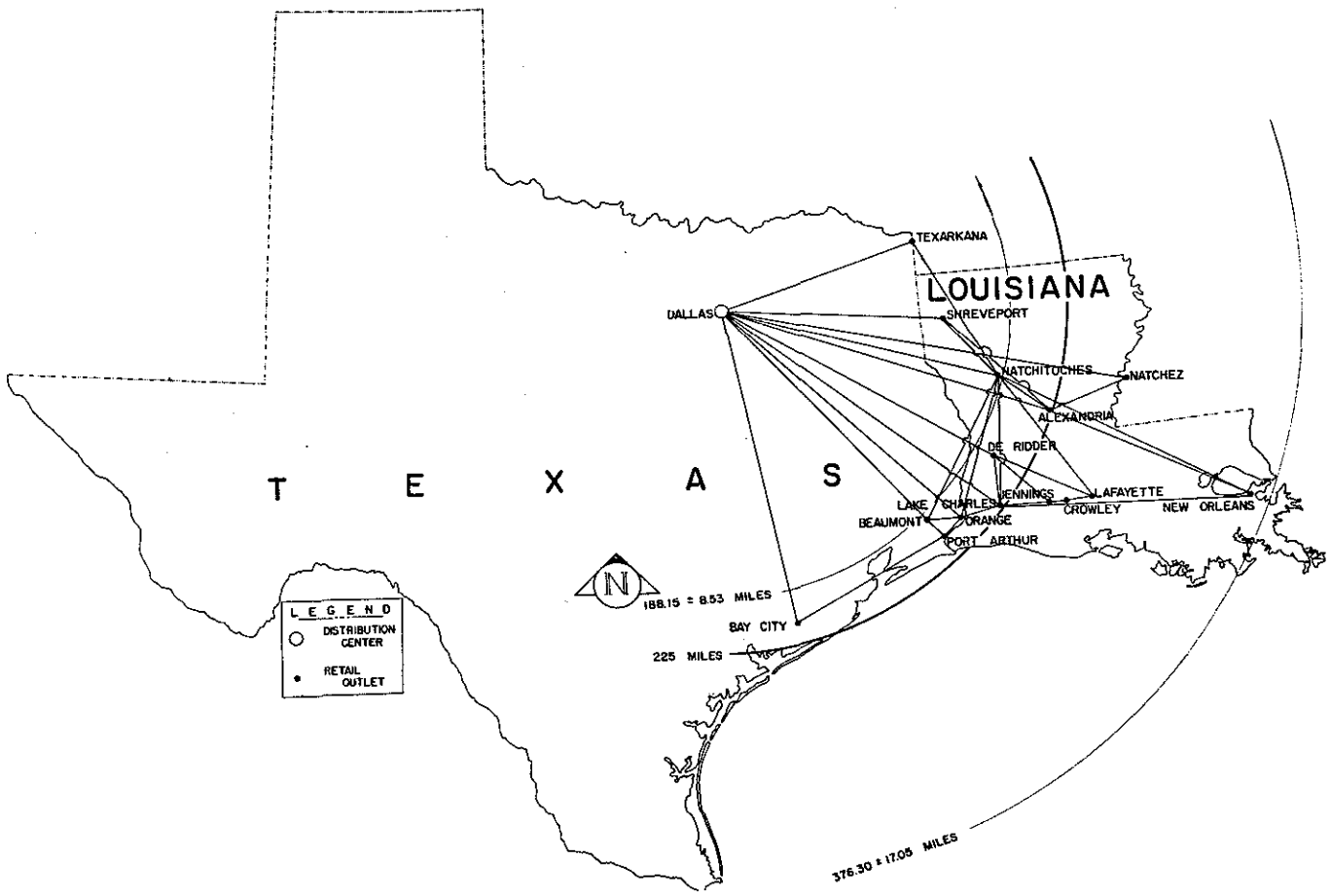

Figure 3. Existing and potential market retail outlets of merchandising firm in Louisiana.

One very significant way in which a private firm may utilize its time savings is through an extension of its area of influence or market area. Using the same amount of equipment, a firm benefiting from time savings may extend its market area by an amount equal to the distance traveled in the same time (which is equal to average speed on the improved highways times the amount of time saved). This extension of market area is possible at reduced costs and, as stated above, with the same amount of operating equipment. Since the firm may supply this extended market area at reduced costs, it may either take these reduced costs strictly in the form of profits, or by reducing prices, sell more products (assuming more will be bought at lower prices) at reduced prices. Clearly, an economical decision would depend upon the elasticity of demand and the economies of scale in any particular case. The firm's profits may be represented by the cost savings (the extra distance operated times the selected expenses not occurring on this additional mileage which is operated in the same amount of driving time with the same amount of equipment) and would also be determined by the demand conditions and economies of scale present in any particular case.

Figures 1 through 5 show the retail outlets of the large merchandising firm under consideration. All of the retail outlet locations shown are now served, at least partially, by the private fleet. Still other locations are served exclusively by common carrier. The light circular lines show the area within which the firm can now operate within designated layover-time distances.* The distance which may be traveled within a no-, one-, or two-layover period is determined by multiplying ten, twenty, or thirty hours** times the average speed for each region. The round-trip distance traveled within any driving period is divided by two to determine the radius of market influence. The area of market extension, which may be served at reduced costs, is the area between the light circular lines and the dark circular lines. The dark circular lines on the five maps are determined in a manner similar to the lighter lines; the dark lines merely represent a higher rate of speed (assumed to be 45 miles per hour on the Interstate Highways), whereas the lighter lines represent the average speed now being experienced in a particular operating region.

The above described relationship shows how a firm might choose to use its time savings in extending its market area and use the increased capacity of its private fleet to serve increased business. The firm may extend this area of influence by increasing the area as described, or it may simply increase the supply to the existing market area at reduced costs.

*Layover-time distances" as used here are defined most simply as the distance that can be driven in ten hours.

**ICC Safety Regulations—Part 195, stipulates that no driver may drive more than ten hours in any period of 24 consecutive hours during, or immediately following, the 10 hours total driving time and within the period of 24 consecutive hours.

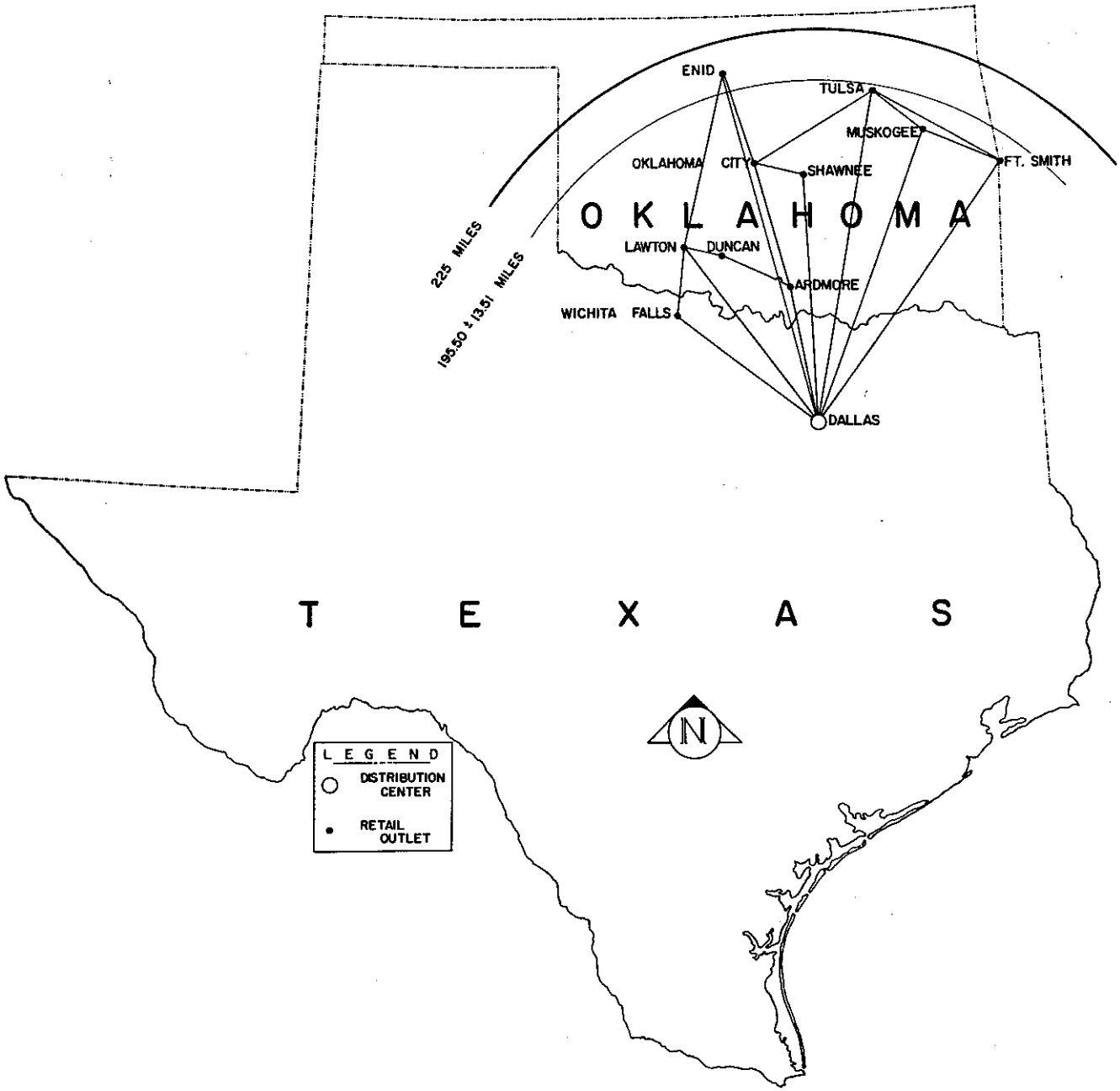

Figure 4. Existing and potential market area radius retail outlets of merchandising firm in Oklahoma.

Under conditions approaching pure competition the former would have to be the more likely alternative, since in the absence of strong monopoly advantages, the firm would attempt to expand its operation to the point where marginal cost became equated with the marginal revenue. This would mean in effect that a firm would continue to expand its area until the additional income derived from operating the last unit would be just equal to the additional costs incurred in its operation.

The preceding discussion, General Value of Time Savings Under Present Operations, showed how a firm might use time savings to supply its retail outlets with its private fleet instead of using common carriers. In that discussion it was assumed that the total volume of business remained constant. The above discussion has differed from the preceding discussion by showing how a firm might use its time savings to increase its volume of business, therefore increasing the volume of products carried by its private fleet while maintaining the same amount carried by for-hire carriers. The firm might choose to use its time savings in either of the two ways, or in a combination of the two, depending upon the particular cost and demand situations prevalent.

Market Area and Plant Location

Just as the market area served by the private fleet might be extended through increasing business in existing market areas, in some cases the market area served by the private fleet may be extended through new plant locations. These locations would be possible when time savings reduced costs to an extent where submarginal outlets became profitable.

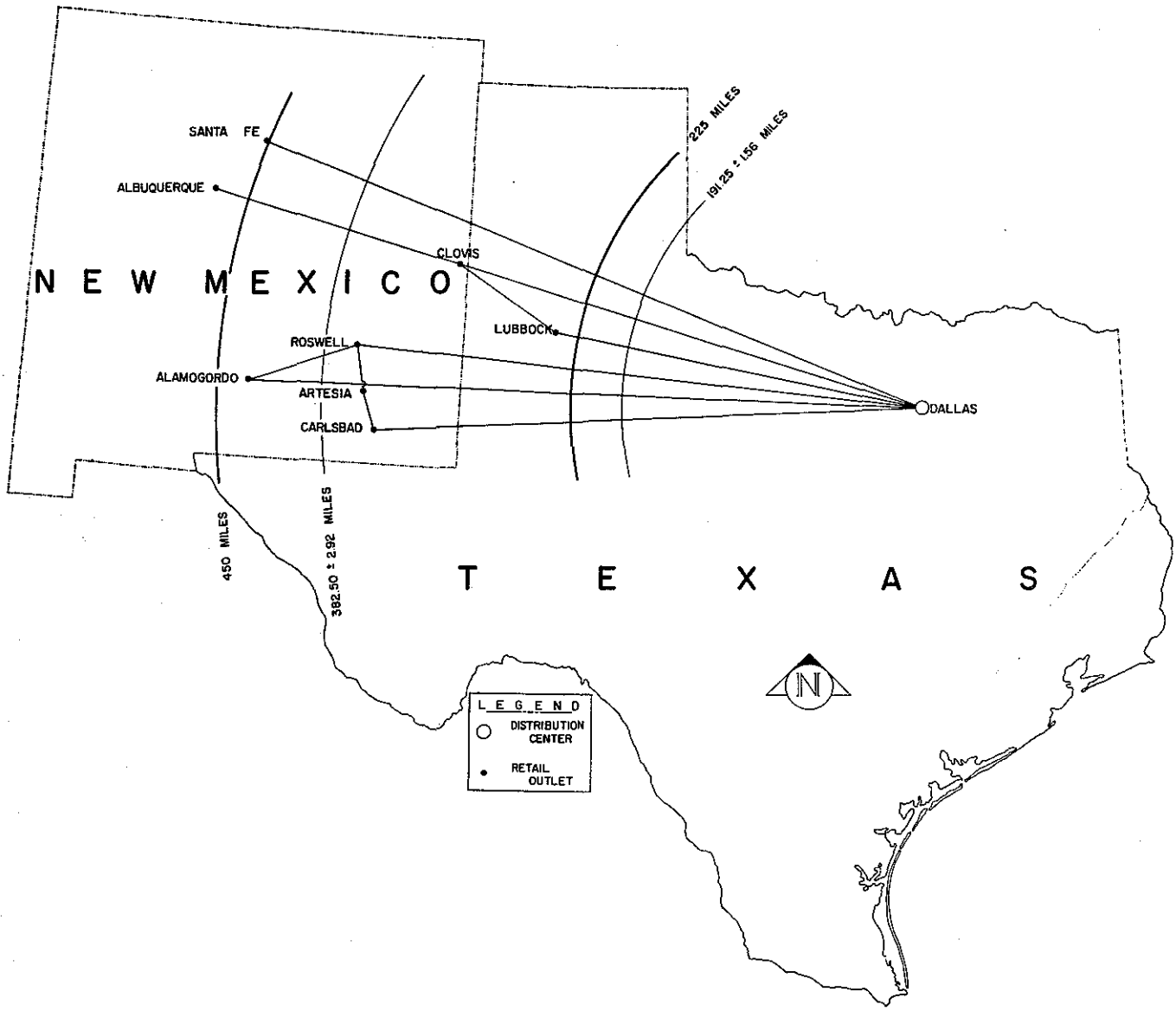

Figure 5. Existing and potential market area radius retail outlets of merchandising firm in New Mexico.

The merchandising firm's marketing division determines the location of new retail outlets by (1) determining the costs to serve a particular area and (2) analyzing those factors which generally represent adequate demand, as shown by competitors, consumer purchasing power, etc. This firm has expanded its operations in the various regions to where all retail outlets now designated as profitable are served. Further expansion will be determined by whether either demand or costs change to an extent which will permit the location of new retail outlets. Such a possible change in costs could come through reduced transportation costs incurred in serving a particular location. In general, the total costs of the firm to supply a given product to a particular retail outlet is comprised of the costs of the product at the distribution center, the cost of transporting the product to the retail outlet (the distance from the distribution center to the retail outlet in miles times the transport costs per mile) and the costs of selling the goods at the retail outlet. If the retail price that can be charged for the product is larger than total costs at a particular location, then this location is considered, from the cost situation, to be a suitable, profit-making location. Stated in more general terms, contemporary location theory states that, if all costs other than transportation costs are constant, then location will be oriented towards points of minimum transport costs.

As was mentioned in the preceding analysis, Figures 1-5 show the various retail outlets served by the private trucking fleet of the firm under consideration. Also, it was shown how the firm might extend its market area served by private carriage through increasing the volume carried to existing stores.

Other than the savings which would come from increasing the volume carried to existing stores, the firm might extend its market area by opening new outlets.

As was shown in the preceding analysis on Extension of Market Area, time savings enable a firm to expand its operations at reduced costs. Whenever these costs are reduced enough to allow new retail outlet loca-

tions to become profitable, it may be said that the time savings take the value of the profits of these new outlets.

Clearly many factors, many of which are somewhat intangible and have no readily assignable dollar value, must be taken into account in any decision on plant location. This report does not attempt to analyze all the various expenses of the potential retail outlets, but rather outlines the conditions under which time savings might permit an extension of the market area of a firm.

Appendix A

TABLE 1. SUMMARY OF SELECTED LINE HAUL AND TOTAL EXPENSES, INTERSTATE CLASS I AND CLASS II AND INTRASTATE COMMON CARRIERS OF GENERAL FREIGHT ENGAGED IN INTERCITY OPERATIONS, SOUTHWESTERN REGION, FOR THE YEAR ENDED DECEMBER 31, 1959

	Class I			Class II			Intrastate
	A*	B**	Total	A*	B**	Total	Operators
Total Number of Firms	21	14	35	19	6	25	19
Operating Revenue	$155,958,891	$112,618,790	$268,577,681	$10,193,768	$3,498,617	$13,692,385	$1,401,204
Total Expenses	146,512,236	103,513,407	250,025,643	9,838,114	3,513,073	13,351,187	1,378,305
Line Haul Drivers Wages	31,564,528	15,025,778	36,590,306	1,185,638	324,492	1,510,130	164,558
Employees' Welfare—Transportation	1,305,210	861,651	2,166,861	——	——	——	——
Workmen's Compensation	977,274	699,375	1,676,649	104,921	32,153	137,074	11,492
Vehicle License and Registration Fees	2,772,951	1,837,168	4,610,119	160,511	74,080	234,591	30,682
Total Real Estate and Personal Property Taxes	659,379	406,815	1,066,194	26,261	2,295	28,556	5,319
Total Social Security Taxes	2,198,562	1,639,711	3,838,273	131,329	42,751	174,080	19,158

*Operating principally with owned equipment.
**Operating with owned and leased equipment or purchased transportation.

TABLE 2. SUMMARY OF SELECTED LINE HAUL AND TOTAL STATISTICS, INTERSTATE CLASS I AND CLASS II AND INTRASTATE COMMON CARRIERS OF GENERAL FREIGHT ENGAGED IN INTERCITY OPERATIONS, SOUTHWESTERN REGION AND TEXAS, FOR THE YEAR ENDED DECEMBER 31, 1959

	Class I			Class II		
	A*	B**	Total	A*	B**	Total
No. Line Haul Drivers	2,629	1,973	4,602	213	66	279
Total No. of Transportation Employees	5,893	4,550	10,443	555	197	752
Investment in Line Haul Equipment	$34,235,294	$12,529,801	$ 46,765,095	$1,677,350	$ 335,787	$2,013,137
Investment in All Equipment and Property	$47,343,987	$20,468,263	$ 67,812,250	$2,379,453	$ 418,543	$2,797,996
Transportation Supervisory Salaries	$ 891,905	$ 723,112	$ 1,615,017	$ 69,032	$ 29,414	$ 98,446
Drivers' and Helpers' Wages—Line Haul	$21,564,528	$15,025,778	$ 36,590,306	$1,185,638	$ 324,492	$1,510,130
Drivers' and Helpers' Wages—Pick-up and Delivery	$19,873,418	$14,418,811	$ 34,292,229	$1,787,604	$ 623,960	$2,411,564
Terminal Supervisory Salaries	$ 2,882,086	$ 2,763,717	$ 5,645,803	$ 222,656	$ 53,394	$ 276,050
Platform Employees—Salaries and Wages	$15,596,832	$ 9,410,524	$ 25,007,356	$ 459,176	$ 99,773	$ 558,949
Other Terminal Employees—Salaries and Wages	$ 410,098	$ 227,421	$ 637,519	$ 16,647	$ 8,804	$ 25,451
Total Salaries and Wages	$61,218,867	$42,569,363	$103,778,230	$3,740,753	$1,139,837	$4,880,590
No. of Line Haul Drivers and Helpers as Percentage of Total Transportation Employees	44.61%	43.36%	44.07%	38.38%	33.50%	37.10%
Line Haul Investment as Percentage of Total Investment	72.31%	61.22%	68.96%	70.49%	80.23%	71.95%
Line Haul Drivers Wages as Percentage of Total Salaries & Wages	35.23%	35.30%	35.25%	31.70%	28.47%	30.94%

*Operating principally with owned equipment.
**Operating with owned and leased equipment or purchased transportation.

TABLE 3. SELECTED STATISTICS*, CLASS I COMMON CARRIERS OF COMMODITIES OTHER THAN GENERAL FREIGHT, BY COMMODITY GROUPS, SOUTHWESTERN REGION, FOR THE YEAR ENDED DECEMBER 31, 1959

	Petroleum Products	Household Goods	Auto Transporters	Heavy Machinery	Refrigerated Solid Products	Agricultural Commodities	Specific Commodities Not Subgrouped	Total Specialized
Number of firms	12	1	2	2	2	1	12	32
Operating Revenue	$38,371	$1,173	$11,316	$10,026	$3,497	$1,713	$41,254	$107,350
Expenses—Grand Total	36,388	1,193	10,825	9,353	3,380	1,591	39,263	101,993
Drivers' Wages—Line Haul	7,085	136	3,357	1,484	35	249	5,214	17,560
Employees' Welfare—Line Haul	124	——	125	53	1	2	134	439
Workmen's Comp.—Total	211	10	35	224	8	1	446	935
Vehicle License & Registration Fees—Line Haul	740	23	231	207	30	63	1,266	2,560
Real Estate and Personal Property Taxes—Total	100	2	51	21	2	2	90	268
Social Security Taxes—Total	358	10	128	77	12	10	323	917

*All dollars and miles in thousands—add (000).

TABLE 4. SELECTED STATISTICS*, CLASS I COMMON CARRIERS OF COMMODITIES OTHER THAN GENERAL FREIGHT, BY COMMODITY GROUPS, SOUTHWESTERN REGION, FOR THE YEAR ENDED DECEMBER 31, 1959

	Petroleum Products	Household Goods	Auto Transporters	Heavy Machinery	Refrigerated Solid Products	Agricultural Commodities	Specific Commodities Not Subgrouped	Total Specialized
Transportation Employees Wages	$7,680	$153	$3,536	$1,762	$80	$249	$7,097	$20,557
Terminal Employees Wages	184	——	137	139	——	——	632	1,092
Total	$7,864	$153	$3,673	$1,901	$80	$249	$7,729	$21,649
Line Haul Drivers' Wages as Percentage of Total Transportation and Terminal Wages	90.09%	88.88%	91.40%	78.06%	43.75%	100.00%	67.46%	81.11%
Investment in Line Haul Equipment	——	——	——	——	——	——	——	$34,373
Investment in All Equipment and Property	——	——	——	——	——	——	——	$41,216
Line Haul Investment as Percentage of Total Investment	——	——	——	——	——	——	——	83.40%
Line Haul Social Security as Percentage of Total	——	——	——	——	——	——	——	17.265%

*All dollars and miles in thousands—add (000.)

TABLE 5. SUMMARY OF SELECTED LINE HAUL STATISTICS*, CLASS I COMMON CARRIERS OF COMMODITIES OTHER THAN GENERAL FREIGHT BY COMMODITY CLASSES, SOUTHWESTERN REGION, FOR THE YEAR ENDED DECEMBER 31, 1959

	Petroleum Products	Household Goods	Auto Transporters	Heavy Machinery	Refrigerated Solid Products	Agricultural Commodities	Specific Commodities Not Subgrouped
Intercity Miles—Total	121,814	1,449	36,866	24,181	7,642	5,217	110,048
Operating Revenue	$38,371	$1,173	$11,316	$10,026	$3,497	$1,713	$ 41,254
Expenses—Total	36,388	1,193	10,825	9,353	3,380	1,591	39,263
Drivers' Wages—Line Haul	7,085	136	3,357	1,484	35	249	5,214
Employees' Welfare—Line Haul	124	——	125	53	1	2	134
Workmen's Compensation—Line Haul	190	9	32	175	4	1	301
Vehicle License & Registration Fees—Line Haul	740	23	231	207	30	63	1,266
Real Estate & Personal Property Taxes—Line Haul	83	3	30	18	3	3	75
Social Security Tax—Line Haul	62	2	22	13	2	2	56

*All dollars and miles in thousands—add (000.)

TABLE 6. SUMMARY OF SELECTED LINE HAUL STATISTICS, (PER MILE), CLASS I COMMON CARRIERS OF COMMODITIES OTHER THAN GENERAL FREIGHT BY COMMODITY CLASSES, SOUTHWESTERN REGION, FOR THE YEAR ENDED DECEMBER 31, 1959

	Petroleum Products	Household Goods	Auto Transporters	Heavy Machinery	Refrigerated Solid Products	Agricultural Commodities	Specific Commodities Not Subgrouped
Operating Revenue	$.31499	$.80952	$.30694	$.41462	$.45760	$.32834	$.37487
Total Expenses	.29871	.82332	.29363	.38679	.44229	.30496	.35678
Drivers' Wages—Line Haul	.05816	.09385	.09105	.06137	.00457	.04772	.04737
Employees' Welfare—Line Haul	.00101	——	.00339	.00219	.00013	.00038	.00121
Workmen's Compensation—Line Haul	.00155	.00621	.00086	.00723	.00052	.00019	.00273
Vehicle License & Registration Fees—Line Haul	.00607	.01587	.00626	.00856	.00392	.012070	.01150
Real Estate & Personal Property Taxes—Line Haul	.00068	.00207	.00081	.00074	.00039	.00057	.00068
Social Security Taxes—Line Haul	.00050	.00138	.00059	.00053	.00026	.00038	.00050
Total Selected Line Haul Expenses Per Mile	.06797	.11938	.10296	.08062	.000979	.06131	.06399

TABLE 7. SELECTED STATISTICS*, CLASS II COMMON CARRIERS OF COMMODITIES OTHER THAN GENERAL FREIGHT BY COMMODITY GROUPS, SOUTHWESTERN REGION, FOR THE YEAR ENDED DECEMBER 31, 1959

	Petroleum Products	Household Goods	Heavy Machinery	Refrigerated Solid Products	Agricultural Commodities	Building Materials	Films and Associated Commodities	Forest Products	Specific Commodities Not Subgrouped	Total Specialized Class II
Number of Firms	6	8	10	2	4	3	3	1	32	69
Operating Revenue	$3,018	$4,397	$5,430	$783	$2,228	$1,402	$1,237	$371	$18,175	$37,041
Expenses—Grand Total	2,856	4,315	5,420	741	2,128	1,358	1,057	373	17,210	35,458
Drivers' Wages—Line Haul	572	551	1,052	57	359	250	264	12	3,870	6,960
Workmen's Compensation—Total	28	24	154	4	16	11	8	4	355	604
Vehicle License & Registration Fees—Line Haul	91	52	144	28	46	19	11	13	477	881
Real Estate & Personal Property Taxes—Total	4	8	10	1	1	2	2	1	31	60
Social Security Taxes—Total	26	41	59	3	8	15	10	3	189	354

*All dollars and miles in thousands—add (000.)

TABLE 8. SELECTED STATISTICS*, CLASS II COMMON CARRIERS OF COMMODITIES OTHER THAN GENERAL FREIGHT BY COMMODITY GROUPS, SOUTHWESTERN REGION, FOR THE YEAR ENDED DECEMBER 31, 1959

	Petroleum Products	Household Goods	Heavy Machinery	Refrigerated Solid Products	Agricultural Commodities	Building Materials	Films and Associated Commodities	Forest Products	Specific Commodities Not Subgrouped	Total Specialized Class II
Transportation Employees—Wages	$609	$644	$1,230	$65	$377	$280	$274	$12	$4,534	$ 8,025
Terminal Employees' Wages—Total	40	127	13	——	6	——	62	——	69	317
Total	$649	$771	$1,243	$65	$383	$280	$336	$12	$4,603	$ 8,342
Investment in Line Haul Equipment	——	——	——	——	——	——	——	——	——	$15,678
Investment in All Equipment and Property	——	——	——	——	——	——	——	——	——	$18,844
Line Haul Drivers' Wages as Percentage of Total Transportation and Terminal Wages	88.14%	71.47%	84.63%	87.69%	93.73%	89.29%	78.57%	100.00%	84.08%	83.43%
Line Haul Investment as Percentage of Total Investment	——	——	——	——	——	——	——	——	——	83.20%
Line Haul Social Security as Percentage of Total Social Security	——	——	——	——	——	——	——	——	——	23.08%

*All dollars and miles in thousands—add (000.)

TABLE 9. SUMMARY OF SELECTED LINE HAUL EXPENSES*, CLASS II COMMON CARRIERS OF COMMODITIES OTHER THAN GENERAL FREIGHT ENGAGED IN INTERCITY OPERATIONS, SOUTHWESTERN REGION, FOR THE YEAR ENDED DECEMBER 31, 1959

	Petroleum Products	Household Goods	Heavy Machinery	Refrigerated Solid Products	Agricultural Commodities	Building Materials	Films and Associated Commodities	Forest Products	Specific Commodities Not Subgrouped
Intercity Miles—Total	11,477	5,436	10,912	2,127	8,525	5,366	4,431	706	38,056
Operating Revenue—Total	$ 3,018	$4,397	$ 5,430	$ 783	$2,228	$1,402	$1,237	$371	$18,175
Expenses—Total	$ 2,856	$4,315	$ 5,420	$ 741	$2,128	$1,358	$1,057	$373	$17,210
Drivers' Wages—Line Haul	$ 572	$ 551	$ 1,052	$ 57	$ 359	$ 250	$ 264	$ 12	$ 3,870
Workmen's Compensation—Line Haul	25	17	130	4	15	10	6	4	298
Vehicle License & Registration Fees—Line Haul	91	52	144	28	46	19	11	13	477
Real Estate & Personal Property Taxes—Line Haul	3	7	8	1	1	2	2	1	26
Social Security Taxes—Line Haul	6	9	14	1	2	3	2	1	44

*All dollars and miles in thousands—add (000.)

TABLE 10. SUMMARY OF SELECTED LINE HAUL EXPENSES, (PER MILE), CLASS II COMMON CARRIERS OF COMMODITIES OTHER THAN GENERAL FREIGHT ENGAGED IN INTERCITY OPERATIONS, SOUTHWESTERN REGION, FOR THE YEAR ENDED DECEMBER 31, 1959

	Petroleum Products	Household Goods	Heavy Machinery	Refrigerated Solid Products	Agricultural Commodities	Building Materials	Films and Associated Commodities	Forest Products	Specific Commodities Not Subgrouped
Operating Revenue	$.26296	$.80886	$.49761	$.36812	$.26134	$.26127	$.27916	$.52549	$.47758
Total Expenses	.24884	.79378	.49670	.34837	.24961	.25307	.23854	.52832	.45222
Drivers' Wages—Line Haul	.04983	.10136	.09640	.02679	.04211	.04658	.05958	.01699	.10169
Workmen's Compensation—Line Haul	.00217	.00312	.01191	.00188	.00175	.00186	.00135	.00566	.00783
Vehicle License & Registartion Fees—Line Haul	.00792	.00956	.01319	.01316	.00539	.00354	.00248	.01841	.01253
Real Estate & Personal Property Taxes—Line Haul	.00026	.00128	.00073	.00047	.00011	.00037	.00045	.00141	.00068
Social Security Taxes—Line Haul	.00052	.00165	.00128	.00047	.00023	.00055	.00045	.00141	.00115
Total Selected Line-Haul Expenses Per Mile	.06070	.11697	.12351	.04277	.04959	.05290	.06431	.04388	.12388

TABLE 11. SELECTED STATISTICS*, INTERSTATE CLASS I AND CLASS II AND INTRASTATE COMMON CARRIERS OF COMMODITIES OTHER THAN GENERAL FREIGHT, SOUTHWESTERN REGION, FOR THE YEAR ENDED DECEMBER 31, 1959**

	Interstate		
	Class I	Class II	Intrastate
Total Number of Firms	32	69	88
Operating Revenue	$107,350	$37,041	$8,542
Total Expenses	101,993	35,458	7,848
Drivers' Wages—Line Haul	17,560	6,960	1,647
Employees' Welfare—Transportation	439		
Workmen's Compensation—Total	935	604	120
Vehicle License & Registration Fees—Line Haul	2,560	881	190
Real Estate & Personal Property Taxes—Total	255	60	37
Social Security Taxes—Total	917	354	132
Transportation Employees' Wages	$ 20,557	$ 8,025	$1,727
Terminal Employees' Wages	1,092	317	53
Total	21,649	8,342	1,780
Investment in Line Haul Equipment	$ 34,373	$15,678	
Investment in All Equipment & Property	41,216	18,844	
Line Haul Drivers' Wages as Percentage of Total Transportation & Term Wages	81.11%	83.43%	92.53%
Line Haul Investment as Percentage of Total Investment	83.40	83.20	83.20
Line Haul Social Security as Percentage of Total Social Security	17.27	23.08	23.08

*All dollars in thousands—add (000.)
**All intrastate information for year ended December 31, 1960.

TABLE 12. SUMMARY OF SELECTED STATISTICS*, INTERSTATE CLASS I AND CLASS II, AND CLASS III CONTRACT CARRIERS, SOUTHWESTERN REGION, FOR THE YEAR ENDED DECEMBER 31, 1959**

	Interstate		
	Class I	Class II	Class III
Total Number of Firms	3	7	29
Operating Revenue	$9,709	$4,036	$2,474
Total Expenses	8,529	3,854	2,384
Drivers' Wages—Line Haul	2,663	819	521
Employees' Welfare—Transportation	94		
Workmen's Compensation—Total	21	28	22
Vehicle License & Registration Fees—Line Haul	227	124	69
Real Estate & Personal Property Taxes—Total	31	5	13
Social Security Taxes—Total	114	31	46
Transportation Employees' Wages	$2,909	$ 915	$ 537
Terminal Employees' Wages	329	140	11
Total	3,238	1,055	548
Investment in Line Haul Equipment	2,609	2,586	
Investment in All Equipment & Property	2,994	2,834	
Line Haul Drivers' Wages as Percentage of Total Transportation & Terminal Wages	82.24%	77.63%	95.07%
Line Haul Investment as Percentage of Total Investment	87.14	91.25	
Line Haul Social Security as Percentage of Total Social Security	17.27	23.08	23.08

*All dollars in thousands—add (000.)
**All Class III information for year ended December 31, 1960.

TABLE 13. SUMMARY OF SELECTED STATISTICS, INTERSTATE AND INTRASTATE CARRIERS OF PASSENGERS ENGAGED IN INTERCITY SERVICE, SOUTHWESTERN REGION, FOR THE YEAR ENDED DECEMBER 31, 1959*

	Interstate	Intrastate
Number of Firms	23	7
Operating Revenue	$67,248,565	$210,231
Expenses—Grand Total	57,050,536	212,573
Drivers—Total Compensation	13,395,675	49,561
Workmen's Compensation—Total	173,072	1,368
Vehicle License & Registration	1,151,419	4,683
Real Estate & Personal Property Taxes	548,390	2,524
Social Security Taxes—Drivers	313,920	3,312
Number of Drivers	2,180	23
Investment in Revenue Equipment*	$18,354,294	
Investment in All Carrier Operating Property*	25,583,070	
Transportation Supervisory—Total Compensation	915,849	3,000
Transportation Drivers—Total Compensation	13,395,675	49,561
Transportation Other Employees—Total Compensation	207,928	1,347
Station—Supervisory—Total Compensation	312,885	1,034
Station—Ticket Office and Travel Bureau Employees—Total Compensation	1,797,922	5,944
Station—Other Employees—Total Compensation	2,186,570	7,229
All Other Transportation and Terminal Employees—Total Compensation	18,816,829	68,115
Investment in Revenue Equipment as Percentage of Investment in Total Carrier Operating Property	71.74%	71.74%
Drivers' Compensation as Percentage of Total Tranportation & Term Compensation	71.19%	72.76%

*All intrastate information for year ended December 31, 1960.

Appendix B

The vehicle license and registration fees (relative and absolute) are shown for the various axle-class sizes in Table B-2. Using X to represent 2-S1 carriers, the relative axle-class sizes may be expressed as follows:

(1) Axle-class (shown in Table B-2) = Average registration and license fees per vehicle—values relative to 2-S1.

(1.1) 2-S1 = $352.00 = X

(1.2) 2-S2 = $435.00 = 1.2358X

(1.3) 3-S2 = $440.00 = 1.25X

The percentage distribution of commercial vehicle mileage on highways in the Southwestern Region is shown in Table B-3 for each carrier group (common, contract, specialized, and private). The following equations may be formulated for the various axle-class groups:

(2) 2-S1 percentage (2-S1 fees) + 2-S2 percentage (2-S2 fees) + 3-S2 percentage (3-S2 fees) = total percentage (average fees for all axle-classes)

(2.1) 17.2% (2-S1) + 47.8% (2-S2) + 35.0% (3-S2)
= 100% (Common Carriers)

(2.2) 45.5% (2-S1) + 40.7% (2-S2) + 13.9% (3-S2)
= 100% (Contract carriers)

(2.3) 32.9% (2-S1) + 57.2% (2-S2) + 9.9% (3-S2)
= 100% (Special Hauler)

(2.4) 24.4% (2-S1) + 68.6% (2-S2) + 7.0% (3-S2)
= 100% (Private Carriers)

By substituting the average registration and license fees per mile (Table B-4) for each type of carrier and by using equations (1) through (1.3), the following equations are derived and solved by substitutions, giving the average registration and license fees per mile for the various axle-classes by carrier group:

(3) 2-S1 ratio $\left(\frac{\text{2-S1 fees}}{\text{2-S1 fees}}\right)$ + 2-S2 ratio $\left(\frac{\text{2-S2 fees}}{\text{2-S1 fees}}\right)$ + 3-S2 ratio $\left(\frac{\text{3-S2 fees}}{\text{2-S1 fees}}\right)$ = Total (Average fees for all axle-classes)

TABLE B-1. DEVELOPMENT OF AVERAGE REGISTRATION FEES BY AXLE-CLASSES

	Observations* Number	Percent	Gross Weight Mean	Error	Average** Registration Fee
Axle-Class 2-S1					
Open Top	224	7.4	33,960	587	$346
Platform	352	11.6	29,830	419	352
Stakes	325	10.7	31,470	411	358
Van	1,393	45.8	27,860	175	334
Refrigerated	95	3.1	31,740	726	358
Tank	104	3.4	33,940	723	346
Auto Carrier	418	13.7	32,070	201	353
Special	131	4.3	28,750	913	338
Total	3,044	100.0	29,870	133	$352
Axle-Class 2-S2					
Open Top	1,008	11.1	49,800	284	$440
Platform	1,160	12.8	44,610	289	430
Stakes	918	10.1	46,410	330	435
Van	2,939	32.5	43,990	193	430
Refrig.	1,176	13.0	47,730	266	365
Tank	1,515	16.7	52,140	192	448
Special	328	3.6	45,420	598	434
Total	9,045	100.0	46,870	106	$435
Axle-Class 3-S2					
Open Top	31	2.0	55,570	2,328	$456
Platform	98	6.2	55,360	1,385	456
Stakes	16	1.0	50,660	3,454	440
Van	1,155	73.4	47,150	327	365
Refrigerated	238	15.1	54,280	577	457
Tank	15	1.0	56,520	2,737	463
Special	21	1.3	62,380	3,180	452
Total	1,574	100.0	49,230	294	$440

*Taken from "Value Characteristics for Loaded Vehicles," as observed at Texas Loadometer Stations in 1957 and 1958, an unpublished report by J. Nelson Slater, 1961.

**Taken from "An Analysis of Texas Cargo Vehicle Registration Taxes," an unpublished report by C. L. Ray, 1961.

Common Carriers of General Freight

(3.1) $172(X) + .478(1.2358X) + .350(1.25X) = 1.00\ (\$.009783)$

$X = \$.008150$ per mile

Registration and License fee of 2-S1 = X = $.008150 per mile

Registration and License fee of 2-S2 = 1.2358X = $.010072

Registration and License fee of 3-S2 = 1.25X = $.010188

TABLE B-2. DEVELOPMENT OF RELATIVE REGISTRATION AND LICENSE FEES BY AXLE-CLASSES

	2-S1	2-S2	3-S2
Average Registration and License Fees Per Vehicle	$352.00	$435.00	$440.00
Average Fees of Vehicle Sizes Relative to 2-S1	1.000	1.2358	1.2500

Contract Carriers

(3.2) $.455(X) + .406(1.2358X) + .139(1.25X) = 1.00(\$.009292)$

$X = \$.008219$ per mile

Registration and License fee of 2-S1 = X = $.008219

Registration and License fee of 2-S2 = 1.2358X = $.010570

Registration and License fee of 3-S2 = 1.25X = $.010274

Common Carriers of Commodities other Than General Freight

(3.3) $.329(X) + .572(1.2358X) + .099(1.25X) = 1.00(\$.010049)$

$X = \$.008665$ per mile

Registration and License fee of 2-S1 = X = $.008665 per mile

Registration and License fee of 2-S2 = 1.2358X = $.010708 per mile

Registration and License fee of 3-S2 = 1.25X = $.010831 per mile

Private Carriers

(3.4) $.244(X) + .686(1.2358X) + .070(1.25X) = 1.00(\$.009292)$*

$X = \$.007879$

Registration and License fee of 2-S1 = X = $.007879

Registration and License Fee of 2-S2 = 1.2358X = $.009737

Registration and License Fee of 3-S2 = 1.25X = $.009849

*Assume private haulers registration and license fees are same as those for contract carriers (when taken as a carrier group statistic.)

TABLE B-3. DISTRIBUTION OF VEHICLE MILEAGE BY AXLE-CLASS AND CARRIER GROUPS

	No. of Observations	Average Trip Miles	Total Miles	Percentage Distribution	Percent of Total Miles By Axle-Class	Percent of Total Miles By Carrier Groups
Axle-Class						
2-S1	3,044	504	1,532,834	25.9		
2-S2	9,045	406	3,668,311	61.9		
3-S2	1,574	457	719,845	12.2		
Total	13,663	434	5,920,990	100.0		
Common Carrier						
2-S1	212	731	154,972	17.2	10.1	
2-S2	1,389	311	431,979	47.8	11.8	
3-S2	985	321	316,185	35.0	43.9	
Subtotal	2,586	349	903,136	100.0		15.3
Special Hauler						
2-S1	704	745	524,480	32.9	34.2	
2-S2	2,176	419	911,744	57.2	24.9	
3-S2	184	855	157,320	9.9	21.9	
Subtotal	3,064	520	1,593,544	100.0		26.9
Contract Hauler						
2-S1	87	472	41,064	45.5	2.7	
2-S2	122	301	36,722	40.6	1.0	
3-S2	55	228	12,540	13.9	1.7	
Subtotal	264	342	90,326	100.0		1.5
Private						
2-S1	2,041	398	812,318	24.4	53.0	
2-S2	5,358	427	2,287,866	68.6	62.3	
3-S2	350	668	233,800	7.0	32.5	
Subtotal	7,749	430	3,333,984	100.0		56.3
Total			5,920,990			100.0

Source: Slater, J. Nelson, and Ray, Cadwell L., "Determination of Value Characteristics in Motor Truck Transport," Unpublished report to the United States Bureau of Public Roads, April, 1961.

TABLE B-4. DEVELOPMENT OF SELECTED LINE HAUL EXPENSES BY CARRIER GROUPS, SOUTHWESTERN REGION, FOR THE YEAR ENDED DECEMBER 31, 1959

	Selected Expenses (Per Mile)			Selected Expenses (Totals)	
	Vehicle License and Registration Fees	Real Estate and Personal Property Taxes	Total Miles Operated Per Year	Vehicle License and Registration Fees	Real Estate and Personal Property Taxes
Common Carriers of General Freight					
Class I	$.00991	$.00206	375,586,000	$ 3,722,057	$ 773,707
Class II	.01407	.00139	17,533,000	246,689	24,371
Intrastate	.00596	.00084	32,096,484	191,295	26,961
Subtotal			425,215,484	4,160,041	825,039
Contract Carriers					
Class I	$.00776	$.00101	26,673,000	$ 206,982	$ 26,940
Class II	.01186	.00047	14,928,570	177,053	7,016
Intrastate	.00934	.00162	53,455,920	499,278	86,599
Subtotal			95,057,490	883,313	120,555
Common Carriers of Commodities Other Than General Freight					
Class I	$.00833	$.00069	403,217,052	$ 3,358,798	$ 278,220
Class II	.01012	.00057	123,443,700	1,249,250	70,363
Intrastate	.01261	.00205	339,444,544	4,280,396	695,861
Subtotal			866,105,296	8,888,444	1,044,444
Total			1,386,378,270	$13,931,798	$1,990,038
Selected Expenses—Per Mile By Carrier Group					
Common Carrier—General Freight	$.009783	$.001940			
Contract Carriers	.009292	.001268			
Common Carriers—Other	.010049	.001435			

Appendix C

According to Highway Form B, 7-59*, real estate and personal property taxes (ICC Uniform System of Accounts No. 182.5230) are apportioned directly to general overhead. In assigning this part of general overhead between the line-haul operation and the entire operation, this report used the proportion of total investment represented by investment in line-haul equipment.

The present appendix purports to develop the real estate and personal property tax by axle-class for each carrier group. It is assumed that the relative proportions per unit of tax are proportional to the cost of the various axle-class combinations. The intercity portion of real estate and personal property tax per mile is given in Table B-4 of Appendix B for each carrier group. The average cost of 1958 model axle-classes 2-S1, 2-S2, and 3-S2 are \$14,014.00, \$23,231.00, and \$31,041.00, respectively. Using X to represent the cost of 2-S1, the following relative values may be derived:

Average cost of 2-S1 = \$14,014.00 = X

Average cost of 2-S2 = \$23,231.00 = 1.6577X

Average cost of 3-S2 = \$31,041.00 = 2.2150X

The value of real estate and personal property taxes per mile may be derived (by substituting values from Appendix Tables B-3 and B-4 and by use of the relative values above) by use of the following formula:

(1) $P_1(L) + P_2(M) + P_3(N) = P_t(C_t)$

where:

P_1 = the ratio of the mileage of axle-class 2-S1 observed in manual counts to total mileage of observed axle-classes 2-S1, 2-S2, and 3-S2, within a particular carrier group.

P_2 = the ratio of the mileage of axle-classes 2-S2 observed in manual counts to total mileage of observed axle-classes 2-S1, 2-S2, and 3-S2, within a particular carrier group.

P_3 = the ratio of the mileage of axle-class 3-S2 observed in manual counts to total mileage of observed axle-classes 2-S1, 2-S2, and 3-S2, within a particular carrier group.

P_t = the ratio of total mileage of axle-classes observed to total mileage of axle-classes observed (one, by definition.)

L = the relative cost of axle-class 2-S1.

M = the relative cost of axle-class 2-S2.

N = the relative cost of axle-class 3-S2.

C_t = the cost per mile of intercity real estate and personal property taxes for a particular carrier group.

*Bureau of Accounts, Cost Finding, and Valuation; Interstate Commerce Commission, **Simplified Procedure for Determining Cost of Handling Freight by Motor Carriers, Statement No. 3-59**, Washington, D. C., August, 1959, p. 5.

Common Carriers of General Freight

(1.1) .172(X) + .478(1.6577X) + .350(2.215X) = \$.001940 per mile.

X = \$.001114 per mile

Real Estate and Personal Property Tax of Axle-Class 2-S1 = X

= \$.001114 per mile

Real Estate and Personal Property Tax of Axle-Class 2-S2 = 1.6577X

= \$.001847 per mile

Real Estate and Personal Property Tax of Axle-Class 3-S2 = 2.215X

= \$.002468 per mile

Contract Carriers

(1.2) .455(X) + .406(1.6577X) + .139(2.215X) = \$.001268 per mile.

X = \$.000882 per mile

Real Estate and Personal Property Tax of Axle-Class 2-S1 = X

= \$.000882 per mile

Real Estate and Personal Property Tax of Axle-Class 2-S2 = 1.6577X

= \$.001462 per mile

Real Estate and Personal Property Tax of Axle-Class 3-S2 = 2.215X

= \$.001954 per mile

Common Carriers of Commodities Other Than General Freight

(1.3) .329(X) + .572(1.6577X) + .099(2.215X) = \$.001435 per mile

X = \$.000959 per mile

Real Estate and Personal Property Tax of Axle-Class 2-S1 = X

= \$.000959 per mile

Real Estate and Personal Property Tax of Axle-Class 2-S2 = 1.6577X

= \$.001590 per mile

Real Estate and Personal Property Tax of Axle-Class 3-S2 = 2.215X

= \$.002124 per mile

Private Carriers

(1.4) .244(X) + .686(1.6577X) + .070(2.215X) = \$.001268 per mile

X = \$.000825 per mile

Real Estate and Personal Property Tax of Axle-Class 2-S1 = X

= \$.000825 per mile

Real Estate and Personal Property Tax of Axle-Class 2-S2 = 1.6577X

= \$.001368 per mile

Real Estate and Personal Property Tax of Axle-Class 3-S2 = 2.215X

= \$.001827 per mile

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