A STUDY TO SELECT THE SITE LOCATION AND ASSOCIATED INVENTORY DISTRIBUTION LOGICS FOR A SERVICE WAREHOUSE

by

Dean Voye

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PREFACE

Commercial Shearing, Inc. manufactures hydraulic pumps and valves which are sold to original equipment manufacturers. These manufacturers, in turn, mount the hydraulic components on bulldozers, cranes, or similar equipment and sell them to a distributor who markets the product to the ultimate consumer.

Hydraulic components are normally part of large, costly construction equipment. The availability of repair parts are of extreme importance; therefore, the ability of a supplier to quickly react to customer repair needs is an important consideration.

The necessity of unusually high quality service for the repair parts business is the reason for establishing a service parts distribution center in a geographical location that is economically convenient to both the customer and the manufacturer.

The location of a inventory distribution system for a service distribution center is the topic of this paper.

TABLE OF CONTENTS

PAGE

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

INTRODUCTION

Repair parts business has traditionally been a high profit segment of many industries. The automotive industry is a prime example of a manufacturer of a product requiring extensive replacement and/or repair parts. The profit potential of manufacturing and marketing near duplicates or look alike components has lured many an entrepreneur into this potentially lucrative business. This "pirating" of business by manufacturing a duplicate, or near duplicate part, is widespread throughout the United States.

The success of pirate business hinges, like all other businesses, on quality, price and performance. Most original equipment manufacturers (OEM) claim that the pirates offer an inferior quality item at a lower price with dubious reliability. The pirates, on the other hand, build their business on the marketing and production weaknesses of the OEM. Thus, if the OEM charges too high of a markup or if the OEM performance falters, a market is opened for the pirate.

The pirate market for Commercial Shearing, Inc.'s (CSI) hydraulic components and assemblies is estimated at over eight million dollars per year. The growth of this market is thought to be based on price and performance, but with most emphasis on performance. The inability of the large OEM corporation to be flexible and to respond to the needs of the repair market has spawned the competition.

CSI marketing management is of the opinion that a Service Distribution Center concept oriented to high customer service and flexibility will allow CSI to improve its marketing posture and further penetrate the expanding pirate market. This penetration will depend on a high level of service made possible by segregating the repair parts from the assembly parts. An experienced repair parts manager would be assigned to the proposed facility.

The segregation of repair and assembly inventories each with its own management is suggested by CSI for the existing assembly/service warehouse. The proposed warehouse is to be located near major markets. This feature has the economic advantage of offering reduced delivery time. The new warehouse will also be used as a part of an advertising campaign to generate a larger share of the repair parts business at the expense of both OEM and the other pirates.

Statement of the Problem

This study will address two problems. First is the site location selection, and second is the associated inventory distribution problem.

Site Location

The selection of a plant or warehouse site location considers a number of factors. Maurice Fulton[1] suggests the following consideration for business executives who wish to position a warehouse:

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[1]Maurice Fulton, Readings in Physical Distribution (Illinois: Interstate Printers and Publishers, Inc., 1972), p.4.

1. Seek out that location which combines all location factors so as to give the lowest cost per unit of output.

2. Look for minimum transportation costs with maximum service; reasonable labor costs with satisfactory productivity; inexpensive utilities with reliable service; and pleasant surrounds with a modest cost of living.

3. Search for a plentiful supply of labor without sacrificing proficiency of skills; an attractive plant site without excessive cost; and a cooperative local attitude without limitation on his independence.

4. Find a tax structure which is healthy with low rates but not so low as to jeapardize normal services.

The optimum combination of these factors is increasingly difficult to find, and new complicating social and economic factors have arisen. The new elements influencing the location decision include:

Preservation (or improvement) of the environment.
Employment of minority groups.
Reliance on automobile commuting by the vast majority of employees.
Greater education and technical demands on the labor force.
Rapidly rising land costs and competition for nonindustrial land uses.
Impact of inflation in labor costs on the automation decision (the latter decrees a shift in the necessary qualifications of the labor force).
Supply and quality of utilities.
Insurance considerations as centralized facilities represent concentrated risks not readily assured by insurance companies.
Greater pressure from foreign competition.
More costly municipal services with all levels of government levying increased tax liabilities.
Rail service curtailment of abandonment in many areas.
Commuting fuel costs and car pool possibilities.
Access to interstate highway.
Rising costs of carrying inventory.

Although all of the above factors should be considered, the major areas of concern in this study will be transportation or distribution costs, labor rates, productivity and access to interstate highway systems. These four factors are rated most important by management. Minimizing the transportation costs are important because an estimated three million pounds of service parts are shipped each year and the transportation costs of heavy, bulky parts can be significant. Labor rates and productivity must be considered because the number of people employed in the manufacturing operation results in a labor expense which must be added into the product cost. Differences in labor rates available in various sections of the country can affect the location decision because, all things being equal, lower labor costs can result in a more competitively priced product. Access to interstate highways are of considerable importance because of the desire to offer fast customer service and also to provide ease of delivery of components from vendor sources.

Inventory Distribution

The fundamental purpose of a distributive inventory and, in fact, the distributive network is to provide service to the customer.

T. R. Morrison[2] suggests that distributive inventory requires analysis and solution of the following problem areas.

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[2]T.R. Morrison, "Inventory Theory Applied to Multi-Location Problems," American Production & Inventory Control Society, Production & Inventory Management (Washington D.C., 4th Quarter, 1974) pp. 23-26.

1. Method of resupply. The effect of a policy of direct shipment by vendor to regional center rather than shipment via a central warehouse.

2. Number of warehouses. Given the increased sales that should result from additional warehouses, what will be the associated effect on costs and, hence, the net change in profit.

3. Inventory of items to stock. The effect of a policy of expediting slow moving items direct to regional customers from a central warehouse rather than holding stocks in all locations and other related effects.

4. Definition of the warehouse which should be the distribution center. Given that there are no obvious reasons why one warehouse should be made the center for all products, which center represents the lowest cost center for a product or a related group of products.

5. Identification of the effects of large customers. The demand of a disproportionately large customer can be costly if serviced from a regional warehouse. This can be avoided by providing incentives for a customer to accept delivery from a central warehouse. What will be net effect on costs?

It is not the purpose of this research to go into these subjects in great depth, other than to point out the approach CSI will use for classification of products with respect to the service desired. Suffice to say, that at the outset in the creation of a distribution network, a great deal of market study and cost study is required to determine the proper balance between service and cost.

This paper will examine in some detail the stock control system to be implemented. Roger Willis suggests:

The objective of a stock control system is to maintain the stocks held at such a level that the business is able to operate at minimum costs while still offering acceptable customer service levels. Maintaining stock at too low a level can be equally as costly as maintaining stocks at too high a level.[3]

The two major disadvantages of low stock levels are:

1. Customer demand will often not be satisfied. Frequent stockouts will lead not only to an immediate loss of business but also future business will be affected by loss of customer goodwill.

2. Items will have to be reordered more frequently. Thus higher ordering costs and higher handling costs are incurred.

The disadvantages of high stock levels are:

1. A high capital investment in stocks will tie up money which could probably be more profitable used to finance other operations of the business.

2. Storage costs are high. These cover extra storage facilities, extra handling and stock taking costs and greater deterioration and spoilage of the product.

3. The risk of loss is increased because of a product becoming obsolete.

The issue of optimal inventory stock levels has been elaborated on by Robert Porter[4] who states the problems of distribution in a multi-level network in the form of the following questions which must be answered by management:

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[3]Roger Willis, An Analytical Approach to Cutting Costs, Physical Distribution Management (New Jersey; Noyes Data Corporation, 1977), p.51.

[4]Robert Porter, "Centralized Inventory Management in the Multi-Level Distribution Network." American Production Inventory Control Society, 22nd Annual Conference Proceedings (St. Louis, Missouri, 1979), p.81.

1. When to order at vendor?
2. Size of vendor order?
3. When to resupply the branch?
4. Size of branch resupply?

In actual practice the solution to the many suggested problems of distribution may be handled in a variety of ways. This paper will suggest different approaches to the above problem as a function of the item or product under consideration. It is suggested that controls be established that are based upon the demand and cost characteristics of individual part numbers.

Objective of the Study

The objective of this paper is to examine and quantify the theoretical justification of a service distribution center to determine if it is profitable. The marketing group forecasted substantial increases in business based on improved customer service. The ultimate objective is to improve service to the repair parts market which will "attack the pirates," increase the corporation's (CSI) market share and provide increased profits.

The quantitative justification of the service distribution center considers transportation costs, labor costs and inventory carrying costs related to the forecasted increases in sales volume. The location of the center is to be selected to minimize transportation and labor costs while the inventory policy minimizes inventory carrying costs through close control of high dollar volume items. Both of these actions will leave a favorable impact on profit margins.

In addition to the expected increase in profits from improved service is the sales advantage inherent in offering a new, full service, service distribution center in future advertising programs and salesmen calls. Other product lines may experience increased business and profits as a result of this sales tool.

Usefullness of the Results

The results of this study will be used in the actual site location selection and inventory distribution policy and procedures for the Commercial Shearing, Inc., service distribution center.

Although the data shown in this report has been altered to protect confidential information, the approach, analysis, site selection, inventory logic and conclusions are consistent with the real situation.

CHAPTER II

LITERATURE REVIEW, THEORY AND METHODOLOGY

Literature Review

Site Location

Site determination is an important activity because the site selected to establish a distribution warehouse or a production facility affects profits and distribution costs in addition to representing a substantial capital investment. Furthermore, numerous variables such as taxes, freight rate structures, labor, population, buying power and resources interact in site determination. Davis and Brown[5] point out that a basic knowledge of location theory and site determination factors is essential before embarking on a location project.

The early location theories that are best known were postulated by Von Thunen[6] on agricultural location and Weber[7] on industrial location. They were concerned with economic location. Von Thumen, in his early work, made use of a

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[5]Grant M. Davis, Stephen W. Brown, Logistics Management (Massachusetts: Lexington Books, 1974), p. 147.

[6]Johann Heinrich von Thunen, Der Isolierte Staat in Beiziehung Auf Landwirtschaft und Nationalokonomie (Berlin: Schuma cherAarchlin, 1876). References to Von Thunen's work are taken from a review of Management of Physical Distribution and Transportation (Illinois: Richard D. Irwin, Inc., 1972).

[7]Alfred Weber, Theory of Location of Industries, Translated by Carl J. Fredrick (Chicago; The University of Chicago Press, 1929), p.13.

model of land use and, in his "isolated state," he assumed a single city, a flat uniform plain, a single transport media, and other simple components. In this way, he was able to compute rent gradients that reflected alternation of land-use rings. That is, more expensive land was closer to the city and the land farther from the city was less expensive.

To elaborate Von Thunen's theory, the problem may be described in graphical terms (Figure 1). Let the horizontal axis measure the radial distance from the city and the vertical axis net revenue for acre. By net revenue, we mean revenue (price of product times quantity) minus labor cost (and fertilizer and other direct costs) and minus transportation cost. For any given product, net revenue at the city is easily calculated from the given product price, the input coefficients for this product and the price of labor and other input.

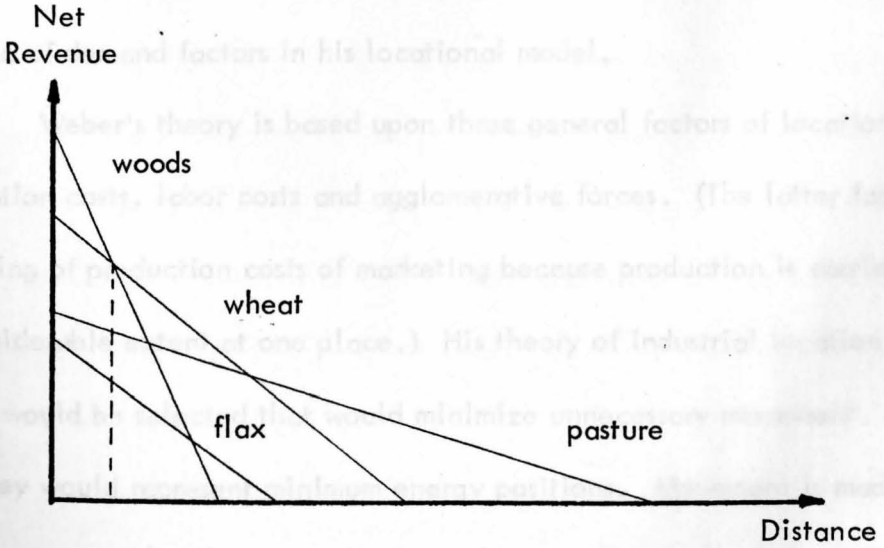

Fig. 1. Von Thunen Rings

As we move away from the city, net revenue decreases at the rate of transportation cost for the acre-product. For any product, net revenue is therefore described by a downward sloping line whose slope equals transportation cost per acre-product per unit-distance. A farmer located at a certain distance from the city and owning a given acreage will maximize profits by choosing the product (and growing this product exclusively) which at that distance has maximum net revenue.

Von Thunen theorized that the total cost of producing agricultural products varied with transport costs and the latter increased proportionately with the distance from a given market center. The assumption of a uniform, homogeneous plan would indicate that labor and capital are the same in unit cost and productivity at all locations. Hence, land rent and transportation costs were co-determinants of location. In his emphasis on cost factors, however, he did not recognize the importance of demand factors in his locational model.

Weber's theory is based upon three general factors of location: transportation costs, labor costs and agglomerative forces. (The latter factor is the lowering of production costs of marketing because production is carried on to some considerable extent at one place.) His theory of industrial location stated that sites would be selected that would minimize unnecessary movement. In other words, they would represent minimum energy positions. Movement is made up of three components: the distance units are to be moved, weight of the units to be moved and effort or cost of moving materials over unit distances. Weber considered transportation and labor costs as general regional influences, while agglomerative

advantages were local forces in the location of industry. (Agglomerating forces were defined by Weber as general local factors.) Weber stated that industry tends to concentrate in a region because cost and service advantages are associated with locating close to a related industry.

Weber recognized that it was necessary to substitute spatial cost factors to arrive at the least cost location. He used a simple weight relationship to derive his orientation index, a weight coefficient given by the division of the weight of the assembled material inputs by the weight of the distributed material outputs. The material index, which assigned typical values to various industries, enables him to classify industries into material and market-oriented locations.

For example, if the raw material input is an ubiquitous commodity, the plant or factory will be located at the market since the minimum transport expenses are incurred with respect to both raw materials and finished products. Transportation outlays, on the other hand, do not affect location when the raw material is fixed. In this situation, the fixed materials are located in a specific place, and since it is pure, no weight loss takes place, hence, transportation does not influence location. Conversely should the raw material be fixed and gross, the factory or industry would locate at the source of the raw material. Weber defined gross as weight lost during the manufacturing process.

More analyses in location theory have been made by contemporary analysts after these early efforts. Hoover[8] added the element of institutional

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[8]E.M. Hoover, The Location of Economic Activity (New York: McGraw-Hill Book Company, 1948).

influences to the traditional transportation, labor and agglomerative costs. These influences, as reflected by technology and rate-making practices, could distort the three primary locational factors. (Institutional influences include laws and regulations, tax structures, climate, availability of capital, adequate communication, schools, recreational facilities and churches.)

Greenhut[9,10] recognized the demand factor to be of equal importance with cost factors in plant location. He has pointed out that the concepts of market area and variable consumer demand at a particular plant location necessitates a broader approach to location theory than just a cost analysis. Furthermore, demand exerts an influence on plant location by forcing plants (1) to disperse in order to minimize transportation costs in delivering their goods to certain customers at lower prices than can be accomplished by competitors, and (2) to reduce time in transit to the customer and thus be more competitive servicewise.

Greenhut's theory is basically a general equilibrium theory in which the key variables are transportation cost, production cost and market demand. He came to the following conclusions:

1. When firms sell to a given buying point, they seek the least cost location in reference to this consumption center and ignore the locations or rivals in their plant sites.

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[9]Melvin L. Greenhut, Plant Location in Theory and in Practice (Chapel Hill, N.C.: University of North Carolina Press, 1956).

[10]Melvin L. Greenhut, "When is the Demand Factor of Location Important?" Land Economics, Vol.40, p. 176.

2. When firms sell over a market area, their site selections are influenced greatly by the location of rivals.

3. In selecting a plant site, each firm seeks that place which offers the optimum sales output at a cost that cannot be matched elsewhere.

4. When firms sell over a market area, the force of concentration is greater in the event of unequal costs at alternative locations than in the case of equal costs at all sites.

5. When firms sell over a market area, the tendency to disperse depends upon the height of freight costs, the elasticity of the demand function, the characteristics (slopes) of marginal costs, the degree of competition in location, the degree of competition from substitutable products at the various locations and the homegeneity or heterogeneity of the firms belonging to the industry.[11]

In the primary stages of site selection, the computer programs are being used to a greater extent in handling geographic and demographic market data. The vast amount of data regarding population, purchasing power, age groups and many other factors can be processed in a relatively short time. Charles A. Taff[12] states linear programming is a very useful tool in determining the best geographical location in a complex location problem. Programs can also be used in problems of plant size, mode of transportation and size of inventory. Through programming an equation system is created which can have a continuing benefit, since subsequent site problems can draw upon the analytical results and stored data from an initial exploration of site factors.

In summary, a frontier family or unit tends to settle in an area because it is easy to clear the land or water is available. Others locate in the same area

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[11]Greenhut, Land Economics, pp. 268-269.

[12]Charles A. Taff, Management of Physical Distribution and Transportation, 5th ed. (Illinois: Richard D. Irwin, 1972).

for the same reasons or to be near those already settled. All people may not be able to live in close proximity so other locations are established. For a society which engages predominantly in agricultural activities, the conceptual framework developed by Von Thunen and his followers is illuminating.

It is true that the father of location theorists, Von Thunen, who was far in advance of his time, did progress somewhat toward a general locational analysis. It may have been his interest and experiences in the operation of his estate that served to restrict the generality of his abstract thinking. Von Thunen's theories were the beginning of location theory and were primarily agriculturally oriented. Weber, Hoover, Greenhut and others followed with location theories related to industrial application with emphasis on transportation costs, labor costs, agglomerative costs and demand factors. It is important at this point to note that transportation costs are considered in the theories of each author.

The transportation problem is adaptable to linear programming. Linear programming is the solution of problems dealing with allocation of materials from sending points to receiving points. These problems may occur when one must determine how materials should be routed among departments in a plant, or it may occur in problems associated with separate plants. The object of the transportation method is to yield optimal answers in terms of minimizing shipping costs. To find an optimal answer, several procedures can be used. A complete discussion of the transportation method may be found in Hopeman.[13]

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[13]Richard J. Hopeman, Production Concepts Analysis Control, 2nd ed. (Columbus, Ohio: Charles E. Merrill Publishing Co., 1971), p. 202.

Inventory Logics

There is a great deal written on the subject of distribution but very little written on actual inventory logic required in a distribution enviornment. Perhaps the lack of prior research in inventory logic can be attributable to the observation that the employment of basic inventory control logic is unique to the product and goals established by each manufacturer.

Robert W. Porter states the problem of multi-level inventories has existed for some time and a number of approaches have been taken. Some of these methods are described as the Cascading System, the Double Order Point System, the Sales Department System and the Push Allocation System.[14]

In the Cascading System, the interactions between the central warehouse and the branch warehouses are mostly ignored. At the branches, the order decision is made independently. The order amount is usually a calculated or fixed economic order or shipping quantity which does not relate in any way to the inventory status of the balance of the system. The order point which is used to make the order decision would normally include safety stock to protect against the variability in the local demand and would be based on the time required to get an order from the central location.

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[14]Porter, Centralized Inventory Management, p. 81.

The demand pattern at the central warehouse becomes very erratic in this system because of the relatively large, random orders from the branches. The central warehouse order point must provide a large amount of safety stock to protect against the large fluctuations in branch requirements.

The other approaches to the multi-level inventory problem include attempts to reduce the excessive stocking requirements at the central location. The central warehouse order quantity is calculated the same way for all approaches discussed by computing Economic Order Quantity (E.O.Q.) based on total system demand.

In the Double Order Point System, two order points are used at the branch locations. One of these order points is based on the resupply lead-time as in the Cascading System. The other order point is based on the combined lead-time required to get an order from the vendor to the central location and then ship to the branch. This second order point is used to set a switch at the central location warning of a pending resupply order. The order quantity at the branch is determined the same way as the Cascading System.

At the central warehouse, the prime order point is based on the local demand only and its variability during the vendor lead-time. Each time a branch sets its switch by tripping its second order point, the prime order point is increased by the amount of the branch order quantity. The switch is reset when a resupply order is sent to the branch. This results in a variable order point system. The theory of this approach is that no safety stock is carried at the central location

for branch requirements; but by anticipating these requirements, it is possible to have stock available most of the time.

In the Sales Replacement System, the main feature is the method of restocking the branch warehouses. A stocking level is periodically established for each item at each location based on local demand. At the end of each replenishment period, shipments are made to each branch to bring them up to their respective stocking levels or in other words to exactly replace the sales during this period. The replenishment period is usually chosen to adjust the shipment size to a convenient level, such as truck load lots. The stocking level must be a time supply which exceeds by some margin the usage during the replenishment period plus the replenishment lead-time.

At the central location, the order point is determined in the normal manner. Since the demand is brought into the central location on a regular basis, the demand variability is reduced, resulting in lower safety stocks.

The main features of the Push-Allocation System are the way the decision to place a vendor order is made and the way the order is distributed when received. Only one order point exists in this system, and it is determined based on total system customer demand and its variability. The resulting order point is compared against the total system on hand and on order.

When the order is received, the total stock in the system is immediately distributed to give an equal time supply plus safety stock at each location. The allocation for the central warehouse is based only on local customer demands. No attempt is made to restock branch warehouses until another vendor order is received.

In actual operation, the safety factor used to determine the safety stock portion of the total system order point must be somewhat higher than normally used, because the total system demand variability is always less than the sum of the individual location demand variabilities.

Gustafson and Hageman suggest that managing a complex business with multiple warehouses and inventories must be simplified. There are a number of helpful techniques. Three important techniques are (1) control by importance and exception (CIE), (2) proportional value analysis (PVA) and (3) rolling forecasts.[15]

Control by importance and exception (CIE) is a management style that closely controls that item which is of major importance to the firm's operation, measured in profit expectations, and pays minimum attention to those which are not. CIE is a common and intuitive practice used almost unknowlingly by inventory managers in the course of their daily activities.

The purpose of proportional value analysis is to classify stocked items into ranking categories based on value and use. The sorting out process lists the factors to be controlled in descending order of dollar volume. For example, Table 1 lists the first five product items in descending order of dollar sales importance.

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[15]John F. Gustafson and Robert G. Hageman, "Logistics - Growing Intellectual Entourage," Production and Inventory Management, (Third Quarter 1976), p.1.

TABLE 1

EXAMPLE OF FIVE ITEMS ARRANGED

IN DECENDING ORDER OF DOLLAR VOLUME

Item	$ Value	Percent	Accumulated Value	Accumulated Percent
1	1670	11.3	1600	11.3
2	956	6.5	2556	17.8
3	918	6.2	3474	24.0
4	782	5.3	4256	29.3
5	768	5.2	5024	34.5

Figure 2 depicts the total product line graphically while Table 2 summarizes the relationships. "A", "B" and "C" have been assigned to items to indicate that different types of management attention will be given each product group.

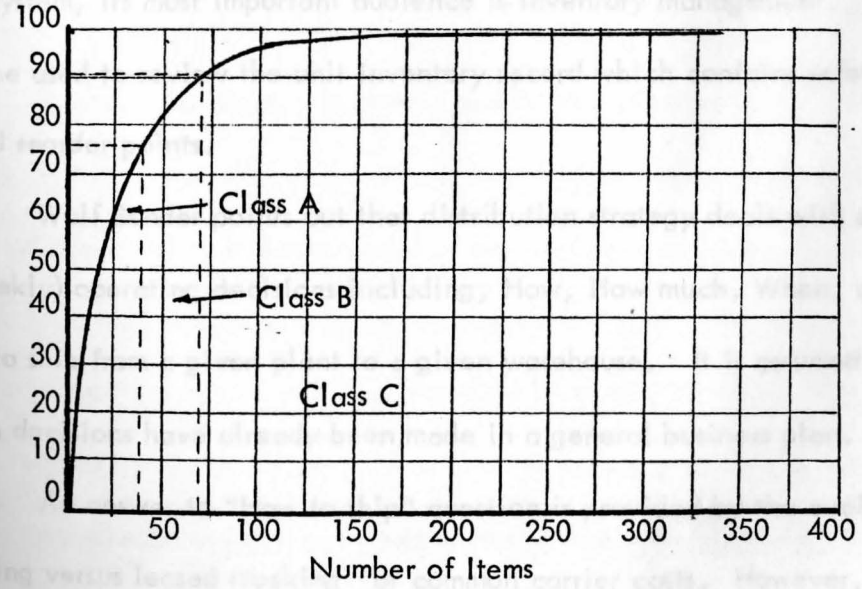

Fig. 2. ABC classification based on dollar volume of items.

TABLE 2

DISTRIBUTION OF CURRENT FINISHED

GOODS ITEMS BASED ON ONE YEAR'S ACTIVITIES

	ITEMS			DOLLARS		
Class	Number	Percent	Accumulated Percent	Amount	Percent	Accumulated Percent
A	36	26.8	26.8	112,000	76.0	76.0
B	34	25.4	52.0	21,200	14.1	90.1
C	64	47.8	100	14,200	9.9	100
Total	134			147,400		

The heart of logistics is proper management of all inventories. The demand forecast provides an important input into the system by supplying unit withdrawals from warehouses. While the unit forecast is used throughout the logistics system, its most important audience is inventory management. The forecast can be used to review the unit inventory record which contains safety stock levels and reorder points.

Wolf Bender points out that distribution strategy deals with short-term (daily/weekly) operating decisions including, How, How much, When, and What products to ship from a given plant to a given warehouse. It is assumed that all long-term decisions have already been made in a general business plan.

An answer to "How to ship" question is provided by the availability of CSI trucking versus leased trucking or common carrier costs. However, the size of load and distance traveled may dictate the transportation mode chosen. The

"How much to ship" question is normally answered by the classical economical order quantity (EOQ) formula:

$$EOQ = (2 \cdot AF/CC\%U)^{1/2}$$

Where:

A = annual demand

F = fixed cost of ordering

CC = cost of carrying inventory, as a percent of selling cost

U = unit cost

The answer to the question of "When to ship" is determined by the policy of shipping as late as possible to prevent any stock out. Implementing this policy requires having reliable estimates of the future average weekly consumption.

The predicting or forecasting demand is best performed by computer software packages such as IBM's Impact or similar programs available on the market today. The data base for the forecasting is the actual demand history.[16]

Porter, Gustafson, Hageman, and Bender all stress the importance of the accuracy of the forecast. The forecast must be developed for each stocking location and the warehouse demand against the central warehouse measured as an additional demand. Computer software packages designed to develop statistical forecasts provide the best results. The standard inventory concepts of EOQ, safety stock and reorder point, which have been applied for years to simple inventory situations, may also be applied to complex multi-level distribution inventory environments. Care must be taken, however, not to indiscriminately apply these

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[16]Wolf Bender, Computerized Procedure for Inventory Distribution and Control, American Production and Inventory Control Society, 19th Annual Conference Proceedings (Atlanta, Georgia, 1976), pp. 536-544.

techniques without regard to the strong tendency to increase the dollar investment in inventory at each site.

Methodology

Site Location Selection

Although site selection is a very important decision, it does not necessarily mean that the methodology used in each situation is the most analytical. Management in some companies simply use their business experiences, knowledge of marketing, and other factors as a basis for selecting one or more sites felt met future product availability requirements. Consultation with top executives usually narrows the list of possible sites and management subjectively chooses the best location. Under these circumstances, the decision is largely judgmental and somewhat intuitive.

Weber suggested locating the warehouse in an area which results in minimum product/material movement and take advantage of agglomerative forces by locating close to related industry. Greenhut pointed to the importance of customer demand locations. The initial test site locations used for this study were selected considering twelve major demand locations in the United States and the two present manufacturing locations. The initial selection of the six test sites provided the basis for determining the area with the lowest transportation cost. Additional sites were then chosen in a logical sequence to further define the optimum location. Least cost rings could then be developed as the warehouse was

moved from location to location and the transportation costs calculated. See map Figure 3. The six selected test sites for warehouse locations were then analyzed using the transportation method approach described by Hageman. This analysis was performed in order to determine the site for minimizing the transportation and labor costs.

The Buslib. "Transpo." computer program of Youngstown State University program library was used to perform the transportation method analysis. The transportation method is a linear programming model designed to minimize a single linear function referred to as the objective function. The basic solution method is applicable to many problem situations and derives its name from its early use in transportation scheduling. The transportation method requires three sets of data.

1. Individual demand required at each demand point.
2. Individual supply from each supply point.
3. Transportation cost per unit from each supply point to each demand point through warehouse.

The generalized mathematical statement to be minimized through the use of the transportation method is as follows.

$$\text{Min} \sum_i \sum_j C_{ij} X_{ij}$$

Subject to:

Demand cost, $\sum X_{ij} \geq D_j$ (all j)

Supply cost, $\sum X_{ij} \leq S_i$ (all i)

Non-negativity, $X_{ij} \geq 0$ (all ij)

($i=1....n$; $j=1....m$)

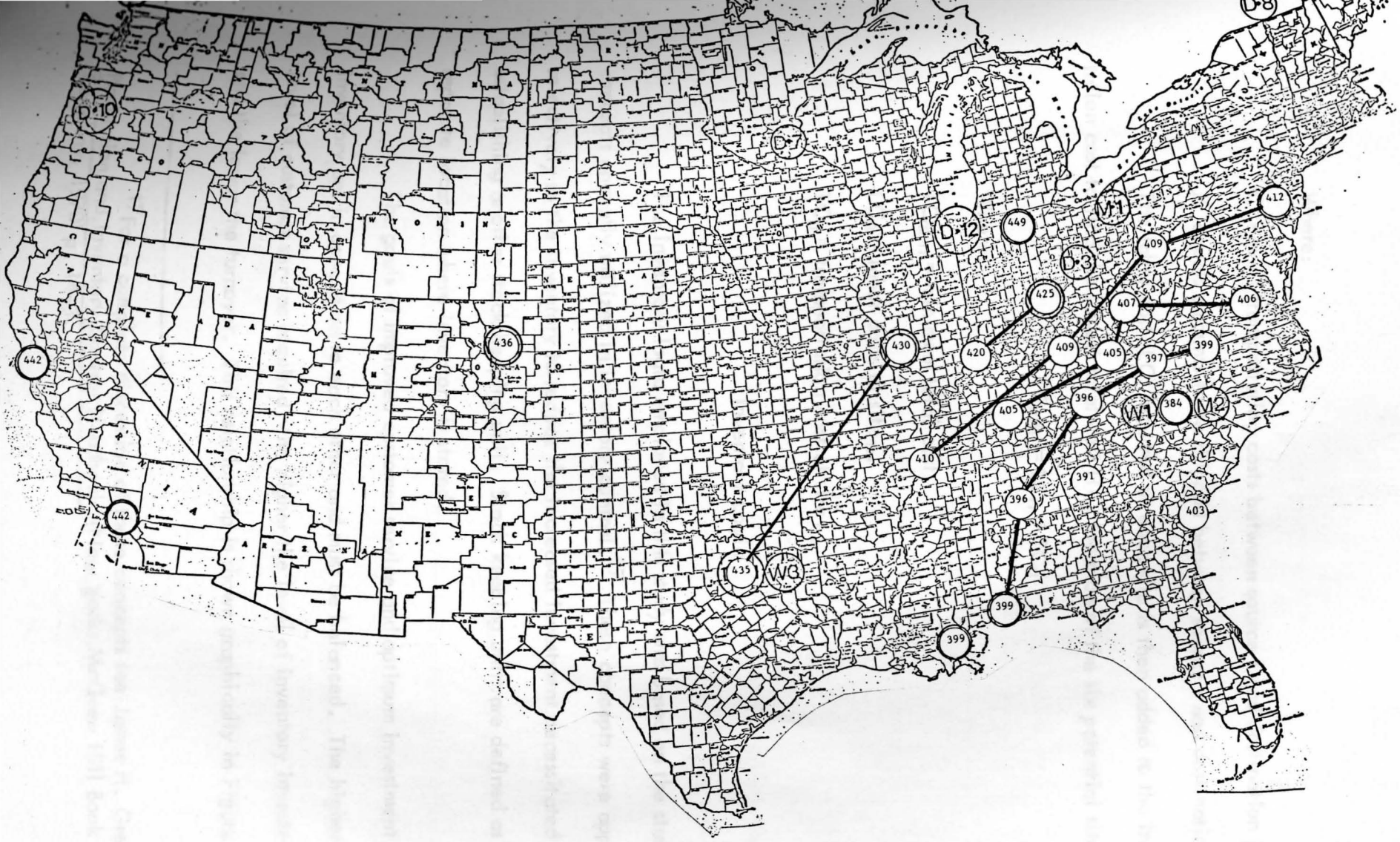

Fig. 3. Map of various site locations listing transportation cost by site.

Where:

C equals transportation costs between source i and destination j.

X equals amounts to be shipped between source i and destination j.

The labor cost (LC) incurred at each site is then added to the transportation cost to find the lowest total cost (TC) location of the six potential sites. That is,

$$TC_{min} = LC_n + TC_n$$

Where:

TC_{min} = minimum total cost.

LC_n = labor costs at site n.

TC_n = transportation cost at site n.

Inventory Logic

The inventory logic employed in this study was based on the standard concepts normally utilized in inventory control.[17] These concepts were applied selectively to the inventory to reduce the increased investment necessitated by establishing another stock keeping unit. Stock keeping units are defined as a separate location where inventory is stored.

The goals of improved customer service and optimum investment in inventory are in opposition to each other and must be balanced. The higher the level of customer service required, the higher the level of inventory investment and the lower the turnover. This relationship is shown graphically in Figure 4.

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[17]For a complete discussion of these concepts see James H. Greene, Production and Inventory Control Handbook (New York: McGraw Hill Book Company, 1970) p. 14-3.

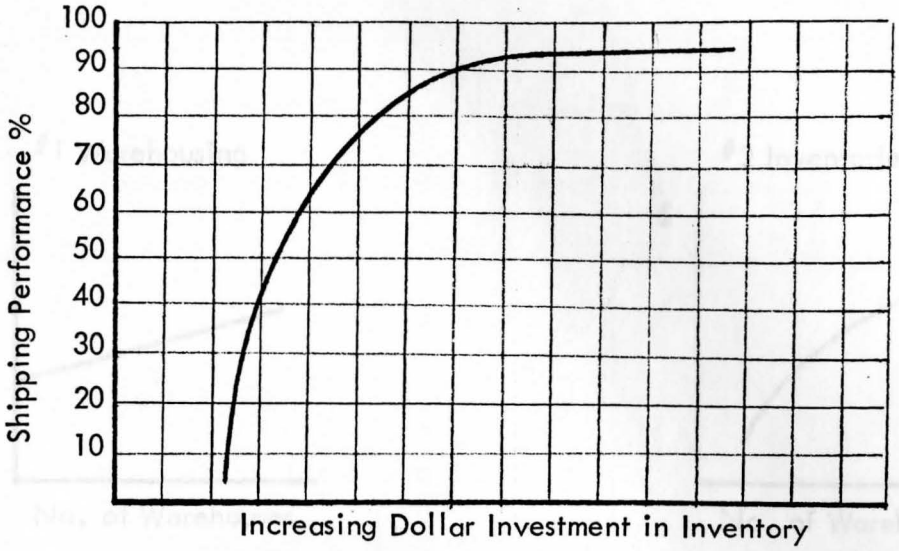

Fig. 4. Relationship between shipping performance and inventory investment.

The introduction of additional warehouses or inventory points requires added total inventory in the distribution system. Philip E. Neff[18] in an article titled, Inventory Dynamics and the Distribution System illustrates this relationship with the charts in Figure 5, page 28.

The theory behind the increasing cost associated with increasing numbers of warehouses can be illustrated using the standard EOQ formula. A segregation in the market demand caused by going from one warehouse to two warehouses results in a higher total EOQ calculation. Since average investment in inventory is generally stated as one-half EOQ plus safety stock, any increase in total EOQ will inflate the total investment in inventory. Also the safety stock is based on the deviations from the trend (mean absolute diviate) and the separation of demand will

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[18]Philip E. Neff, Inventory Dynamics and the Distribution System, American Production and Inventory Control Society, 22nd Annual Conference Proceedings (St. Louis, Missouri, 1979), p. 80.

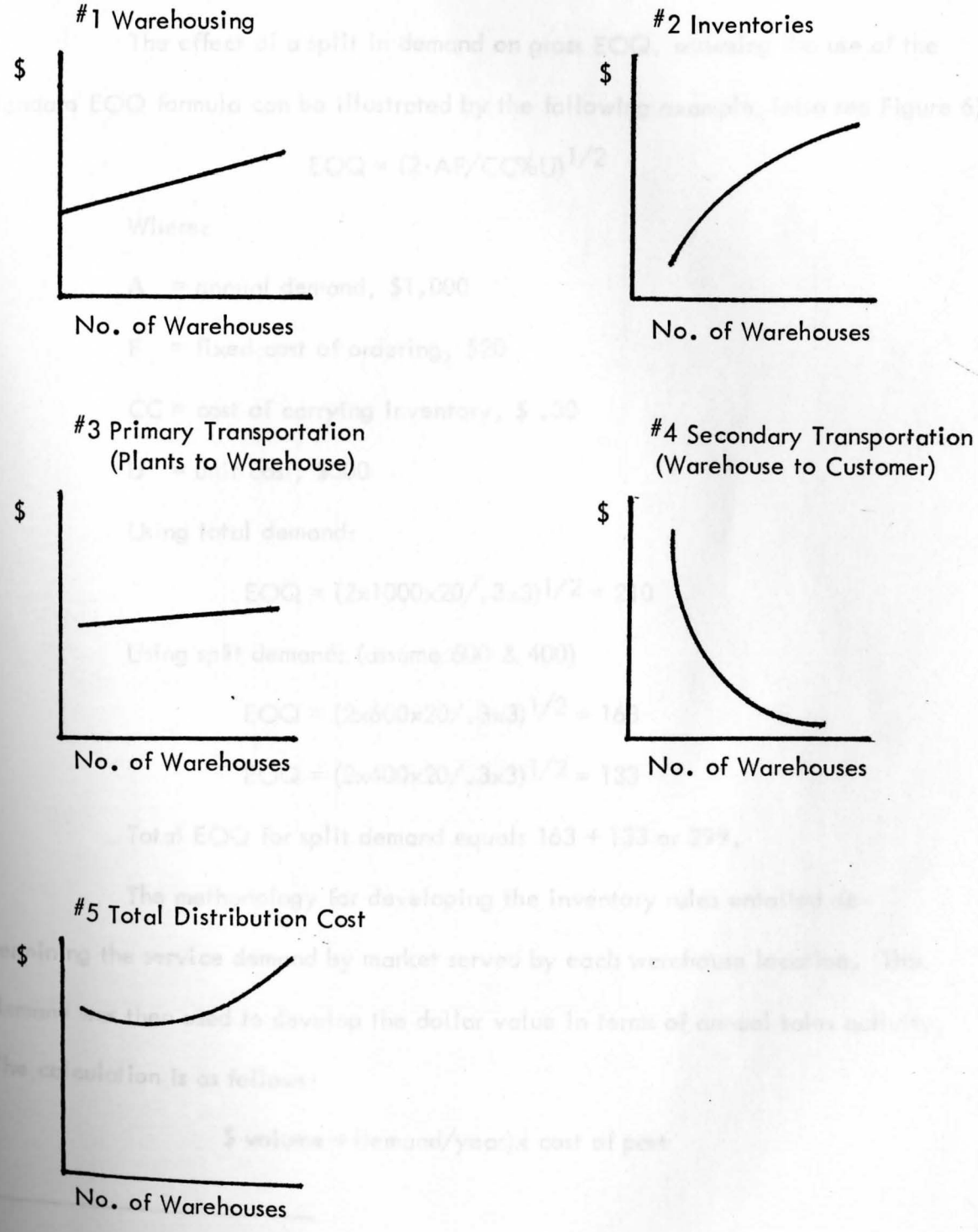

Fig. 5 Relationships between number of warehouses and total annual dollars.

have a tendency to restrict the numbers of demand, increasing the chance of greater deviations since there would be less of a cancelling effect.[19]

The effect of a split in demand on gross EOQ, assuming the use of the standard EOQ formula can be illustrated by the following example: (also see Figure 6)

$$EOQ = (2 \cdot AF/CC\%U)^{1/2}$$

Where:

A = annual demand, $1,000

F = fixed cost of ordering, $20

CC = cost of carrying inventory, $ .30

U = unit cost, $300

Using total demand:

$$EOQ = (2x1000x20/.3x3)^{1/2} = 210$$

Using split demand: (assume 600 & 400)

$$EOQ = (2x600x20/.3x3)^{1/2} = 163$$

$$EOQ = (2x400x20/.3x3)^{1/2} = 133$$

Total EOQ for split demand equals 163 + 133 or 299.

The methodology for developing the inventory rules entailed determining the service demand by market served by each warehouse location. This demand was then used to develop the dollar value in terms of annual sales activity. The calculation is as follows:

$$\$ \text{ volume} = (\text{demand/year}) \times \text{cost of part}$$

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[19]For a complete discussion of this effect see Donald J. Bowersox, Edward Smykay and Bernard Lalonde, Physical Distribution Management (New York, NY: The MacMillan Company, 1968) p. 218.

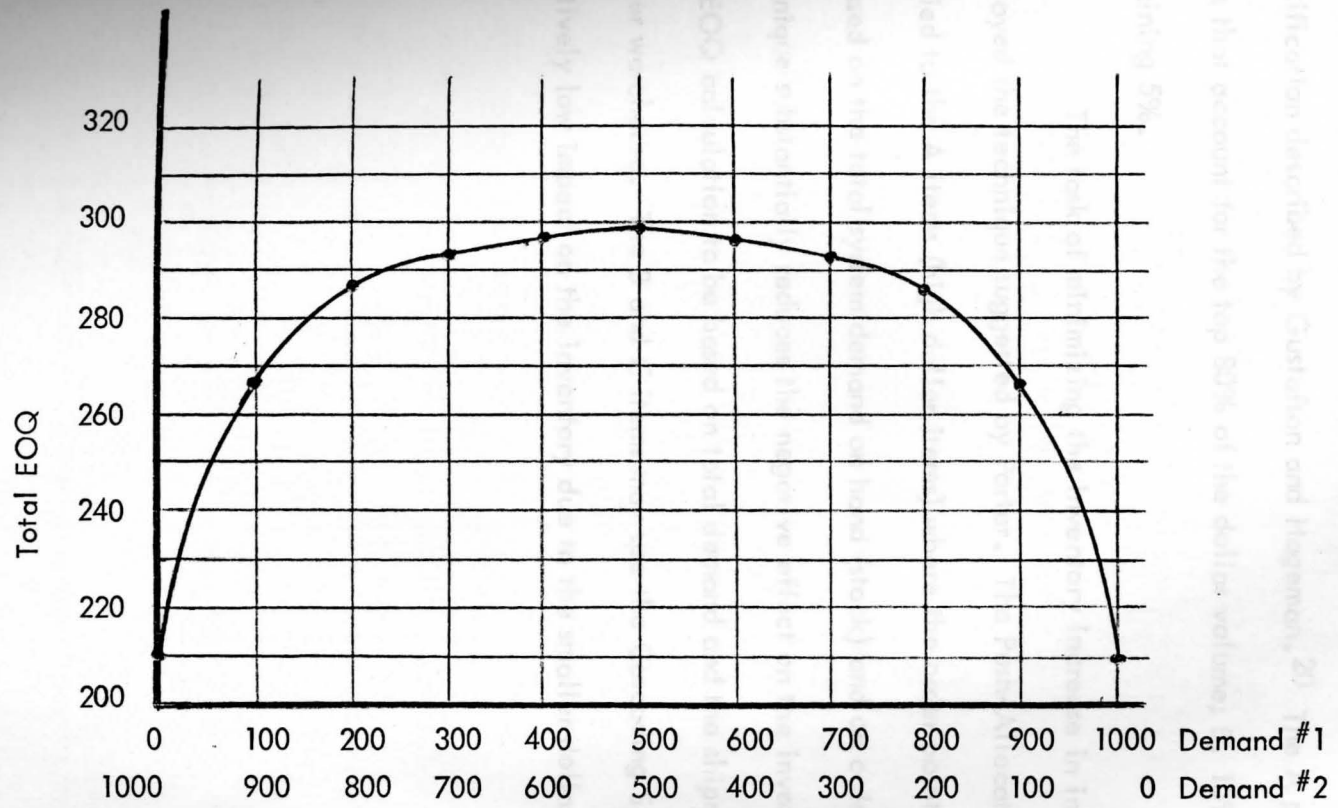

Fig. 6 Graph of total EOQ increase due to split of demand.

The dollar volume of each part number in the warehouse inventories was then arranged in descending order to produce what is referred to as an A.B.C. inventory classification described by Gustafson and Hageman.[20] The A part numbers were those that account for the top 80% of the dollar volume; B, 15%; and C, the remaining 5%.

The task of minimizing the inventory increase in inventory investment employed the technique suggested by Porter. The Push-Allocation System was applied to the A items (high dollar items) where the order point and order quantity is based on the total system demand on hand (stock) and on order balances. This technique substantially reduces the negative effect on the inventory by allowing the EOQ calculation to be based on total demand and the shipment split to the proper warehouse. The B and C items may use the Cascading System approach with relatively low impact on the inventory due to the smaller dollar volume.

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[20]Gustafson and Hageman, Production and Inventory Management, p.1.

CHAPTER III

ANALYSIS OF THE PROBLEM OF SITE LOCATION AND INVENTORY POLICY

Marketing Justification

The corporate marketing group justifies the addition of a service parts distribution center on the rationale that the market share will be increased when service is improved. This market share increase is expected to result in higher volumes and higher total profits. The customer service improvement will be brought about by the following factors:

1. Establishing a warehouse near demand markets which will shorten the lead-time to the customer.

2. The warehouse will be operated as a separate profit center with separate management organized and directed toward high customer service objectives.

3. The warehouse will have responsibility for the inventory, turnover, and high service oriented goals.

The corporate marketing staff prepared the sales forecast shown in Table 3. The forecast illustrates the market potential with and without the additional warehouse. The marketing forecast is based on the input and judgment of field sales representatives after extensive customer contact and market research.

TABLE 3

MARKETING FORECAST

(000)

	1979	1980	1981	1982	1983	1984
No Warehouse	7,194	7,913	8,704	9,575	10,532	11,586
% Increase		10%	10%	10%	10%	10%
With Warehouse		8,633	10,187	11,614	12,891	14,825
% Increase		20%	18%	14%	11%	15%

The sales forecast by the marketing group indicated a substantial percentage of increase, however, the sales increase must be weighed against the cost of the achievement. The following quantitative justification examines the overall cost implications.

Quantitative Justification

A complete cost study was prepared comparing the present one warehouse concept versus the proposed two warehouse configuration. The initial step was to use the transportation method to determine the least cost location of the six potential sites chosen by corporate management. The least cost site was chosen based on least transportation and labor costs, while other costs such as, land, building, and taxes were assumed equal. (The difference in land, building, and taxes was assumed to be insignificant and would not change the outcome.)

The cost study indicates that warehouse two was justified if the marketing estimates are correct. The five year projected income after taxes is

increased by $1.967 million or 18%. The comparative income estimates, income statements, and supporting schedules are included in Appendix A.

The increased revenue of $1,967 million over five years is accomplished with an initial capital expenditure of $1.232 million for land, buildings, and equipment.

A summary of the transportation and labor costs associated with the six potential sites of warehouse two is shown in Table 4.

TABLE 4

SUMMARY STATISTICS OF TWO

WAREHOUSE CONFIGURATIONS ($)

(000 omitted)

Site of Warehouse No. 2

	NC	AL	TX	CO	MS	OH
Transportation Cost	384	399	435	436	430	425
Labor Cost	106	127	150	145	145	175
Total Cost	490	526	585	581	545	600

The explanation of the development of the statistics shown in Table 4 is in the following section, pages 34-39.

Site Location Selection

The Youngstown State University Transportation Program was used in the computer analysis of the selected sites. The program is designed to minimize

the distribution or transportation costs for a fixed multi-facility situation. One warehouse is fixed, and the second warehouse is placed at six strategic locations and the distribution costs analyzed for each of the six locations.

The six locations were chosen based on desirability, marketing, existing facilities and judgment. The six locations are as follows:

W1. Charlotte, North Carolina

W2. Mobile, Alabama

W3. Dallas, Texas

W4. Denver, Colorado

W5. St. Louis, Missouri

W6. Cincinnati, Ohio

The twelve major demand sites, existing supply, and warehouse and potential warehouses were located on a map (Figure 7) with D indicating demand site, W warehouse, and M supply source.

Demand Locations (D)

The twelve demand locations represent the twelve major service parts markets which account for 87% of the volume. The demand quantities associated with each demand point are based on actual existing data for 1979. The demand quantities expressed as pounds of parts are shown in Table 5.

Fig. 7 Map of site, warehouse and source locations.

TABLE 5

DEMANDS IN THOUSANDS OF POUNDS
(000 omitted)

D1	397	D7	135
D2	331	D8	112
D3	253	D9	106
D4	211	D10	103
D5	182	D11	86
D6	154	D12	80

Total Demand = 2150

Supply Locations (M)

The two supply locations are existing and have the equal capability of supplying the various demand points up to the capacity of each location. However, all supply cannot be through any one warehouse. Supply capacities in pounds of parts are shown below (in 000).

$M_1 = 1,604$

$M_2 = 546$

Total Supply = 2,150

Warehouse Locations (W)

The existing warehouse location is identified as EW and the balance of the potential locations as W1 through W6. Each warehouse can ship to any market D or between warehouses. The warehouse processing capacity is limited only by the total available supply.

Transportation Costs

Transportation costs are based on average freight costs for 2000 lb. shipments between typical cities. This computation yielded a cost per pound mile of $ .00015. Application of this rate to the various warehouse locations determined the transportation costs associated with each situation. See Appendix B.

Transportation Method Results

The transportation method results indicate that the North Carolina site location provides the least distribution cost. Results by location are as follows:

TABLE 6

SITE DISTRIBUTION COSTS

Site	Cost
One Warehouse	$ 449,451
Charlotte, North Carolina	384,078
Mobile, Alabama	399,689
Dallas, Texas	435,768
Denver, Colorado	436,261
St. Louis, Missouri	430,496
Cincinnati, Ohio	425,880

The determination of Charlotte, North Carolina as the least cost site of the six suggested by corporate management provided the basis for additional testing analysis. Since Charlotte, North Carolina may not be the optimum location, additional points were tested near the Charlotte area. This testing revealed that the Charlotte area was the least cost location. A visual analysis of the map on

page 36 illustrates as the site is moved away from the Charlotte area the costs increase. The least cost area being within the ring connecting Atlanta, Georgia, Knoxville, Tennessee, and Danville, Virginia.

In addition to the transportation costs shown above, labor costs were incurred at the various sites. The average labor costs by state were obtained from the Handbook of Labor Statistics and extended for thirteen employees for 2000 hours per year. This extension indicated labor costs in North Carolina at $106,600 per year, which was $20,000 less than the next least expensive site, Alabama.

Inventory Control and Distribution Logics

The Present Inventory Concept

The current inventory control system is a computer based, order point approach utilizing statistical forecasting and bill of material processor for requirements explosion. Explosion is defined as an extension of a bill of material into the total of each of the components required.

Sales orders were entered through an IBM Model 3741 on a floppy disc and then batch transferred to the Honeywell Level 66 host computer. New sales orders are updated daily on the open sales order file. This open sales order file serves as a complete listing of all open sales orders and can be displayed on a CRT screen located in several production control offices. The sales file may be accessed and displayed by sales order number or by part number.

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[21] U.S. Department of Labor Bureau of Labor Statistics, Handbook of Labor Statistics, Bulletin 2000 (Washington DC: Government Printing Office, 1979), P. 331.

The daily update of sales orders was also accumulated for a weekly explosion of assembly requirements and a gathering of service parts requirements. These requirements are added to the inventory status report in the proper date bucket. The date bucket was developed by a predetermined set of logics which considers the request and promise dates, the assembly, test, shipping and/or processing time. These requirements, together with a computer based statistical forecast are the basis for generating reorders.

Sales order changes and shipments also update the sales file daily and are accumulated to update the stock status report weekly. The new orders and order changes plus, minus, and move requirements which are used in the inventory replenishment system.

Currently, all sales order requirements and inventories are listed in a single data base for a three plant operation. Two plants produce machined components while the other is an assembly, test, and warehouse facility.

Reorders of manufactured and purchased parts are based on the standard reorder point approach. Component parts are classified as specials or standards with the specials being reordered based on requirements and the standards based on the higher of requirements or forecast. (Both classes are reviewed through lead-time plus one week for paper processing.)

The forecast used in developing reorders is computer calculated based on sales (demand) history. The Honeywell software package developed a trend line

with seasonability, selects the best alpha factor[22] and projects a monthly forecast for the next twelve months. The new month of actual demand is compared to the forecast at the conclusion of the month, and the difference heavily weighed in calculating the next month. Even with the weight of the most current months, the forecast has a tendency to lag in a changing market.

The inventory will consist of all part numbers with service demand history and those parts with no recent demand. Otherwise, the service warehouses will store the inactive and obsolete parts which are presently stored at the assembly facility. Inactive and obsolete parts will most likely be sold as service parts, therefore, logically should be stored at the service facility. Also service parts are sold at a higher profit margin so the service distribution center can bear the expense of the slow moving inventory and still show a higher than normal profit.

The Second Warehouse

In establishing the new warehouse for a particular market, it was necessary to identify that market and collect the sales histories of parts. This sales history or shipment record will be referred to as demand history. Since the present demand history data base encompassed the total market, it was necessary to write a computer program to segregate the demand by market.

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[22]For definitions of alpha factor, seasonability and basic forecasting theory, see R.G. Brown, Statistical Forecasting For Inventory Control (New York, NY: McGraw-Hill Book Company, Inc., 1959) pp. 1-25.

Commercial Shearing, Inc., corporate policy directed that the remotely placed warehouse will be operated as a separate profit center under the management of a service parts manager reporting to the Vice President of Sales. The warehouse inventory is to consist of service part numbers with service demand histories as well as those parts with no recent demand history. Inactive and obsolete parts will likely be sold as service parts. Therefore, the service warehouse will store the inactive and obsolete parts which are presently stored at the assembly facility. Because the service parts are sold at a higher profit margin, the service distribution center can bear the expense of the slow moving inventory and still show a normal profit margin. Customer sales orders will be transmitted directly to the warehouse through an IBM Model 3741 data entry machine, similar to the present Commercial Shearing, Inc., corporate approach using a separate inventory data base. The warehouse data base will be structured to utilize the service parts demand history for its local market.

ABC Classification of Inventory

Once the separate demand base for service parts by market was established, sufficient data was available to develop an ABC inventory classification. The annual service demand was multiplied times the standard cost to arrive at the annual dollar volume. These annual dollar volumes were then arranged in descending order which provided a ranking of all inventory part numbers. The computed ranking would be used in the creation of the inventory control logic for the warehouse. "A" part numbers were said to be those that typically account for the top 80% of the

dollar volume. "B" part numbers accounted for the dollar volume between 80% and 95%. "C" part numbers accounted for the balance of the volume. The classification of parts was as shown in Table 7.

TABLE 7

ABC CLASSIFICATION

Class	No. of Parts	%	Amount of Volume	%
A	389	13	6052	80
B	608	20	1135	15
C	2051	67	379	5
Total	3048	100	7566	100

Honeywell Forecaster Software

The warehouse service demand history by market can be used as input to the Honeywell forecaster software package to generate a statistical forecast, EOQ, and safety stock calculation for each part number. The statistical forecast model was based on the concept outlined by R.G. Brown[23] while the EOQ and safety stock calculations was based on the standard formulas suggested by Green.[24]

New Warehouse Size and Dollar Investment

To perform the initial planning for plant size and inventory investment, a trial inventory profile was developed. This profile was prepared by the computer

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[23]Brown, Statistical Forecasting For Inventory Control, pp. 1-25.

[24]Greene, Production and Inventory Control Handbook, p. 14.3.

utilizing a special program written for that purpose. The inventory profile listed the part numbers, prices, and total dollar value expected to be inventoried at the warehouse during the start-up phase. The profile listed the following data. See page 45.

1. Total average dollar investment required.
2. Total average pieces stored.
3. Individual part numbers to be moved to the warehouse.
4. Quantity of each part to be moved to the warehouse.
5. Annual new warehouse demand for the past year.
6. Annual existing warehouse demand for the past year.

The quantity of parts that was calculated to be moved to the new warehouse was based on the following rules and assumptions.

1. Part numbers with only a new warehouse demand history would have all available inventory transferred to the new warehouse.

2. Part numbers with only old warehouse demand history would have all available inventory remain at the old warehouse. No future sales of the part numbers would be expected at the new warehouse, based on historical data.

3. Part numbers with mixed demand history would have the available inventory factored on the basis of past demand. That is, an inventory part with a demand history of 10% old warehouse and 90% new warehouse would have the inventory split proportionally. The old warehouse would retain a maximum of one EOQ plus safety stock with the balance being transferred to the new warehouse. The new warehouse would then bear all available inventory excesses.

301 0100 002 EA1669		41	B	.63	4130	42.4	5614	57.6	2888	143	5151	1428	902
301 0100 004 K1569		81	0	2.03			29	100.0	10	1	38		
301 1133 001	R 1133-001-000	81	C	5.24	174	53.4	152	46.6	49	3	25	116	608
301 1133 003	R1133-3	41	C	5.32	209	28.1	534	71.9	223	15	196	175	932
301 1134 002	G 1134-001-000	81	0	8.41	89	55.6	71	44.4	5	2	57	32	269
301 1134 003	G1134-2	81	0	12.98	17	40.5	25	59.5	40		33	13	168
301 1134 004	G 1134-003-000	81	0	7.57							3	3	22
301 1134 006	H 1134-001-000	81	0	8.81	17	100.0			5		39	39	343
301 1134 008	K1134-1	81	0	15.56	6	100.0					9	9	140
301 1135 001	CA1135-1	81	0	7.26							19	19	138
301 1135 002	CB1135	81	0	12.12	12	100.0					8	8	97
301 1135 003	E 1135-001-000	81	B	8.55	81	45.3	98	54.7	33	4	30	38	325
301 1135 005	F1135-1	81	0	6.55	186	100.0			10	2	15	15	98
301 1135 006	F1135-2 PROJ R	61	A	5.70	1971	54.7	1629	45.3	749	55	37	339	1933
301 1135 007	F1135-3	41	B	5.55	331	42.1	455	57.9	211	13	54	111	617
301 1135 009	G1135-1	81	C	6.79	109	87.9	15	12.1		2	28	87	591
301 1135 012	H1135-1	81	0	15.79							9	9	142
301 1135 013	H1135-2	81	0	5.98	175	100.0			101	1	55	55	329
301 1135 014	HA1135-1	81	0	6.29							5	5	31
301 1135 016	J 1135-001-000	81	C	4.62	88	29.6	209	70.4	149	6	21	75	347
301 1135 017	J1135-2	80	0	4.84							28	28	135
301 1135 019	JA1135-2	81	0	4.06	1	100.0					12	12	48
301 1135 022	M 1135-001-000	81	B	6.29	210	80.8	50	19.2	43	5		84	529
301 1135 023	M1135-2	41	B	6.74	892	42.3	1219	57.7	1051	33	357	279	1883
301 1135 025	M1135-10	81	0	3.02							4	4	12
301 1135 026	M1135-11	61	A	6.54	1181	45.2	1434	54.8	488	36	394	214	1400
301 1135 028	M1135-13	81	0	5.30	387	34.6	730	65.4	300	7	203	70	371
301 1135 029	MA1135-1	81	0	3.45							68	68	234

The results of this inventory profile indicate that 374 part numbers be stored, having an initial inventory value of $3.3 million. The inventory value was not additional inventory, but rather existing inventory which would be relocated.

New Warehouse Control Logic

The creation of an additional warehouse or stock keeping location (SKL) requires determining forecasts or knowledge of the following variables: forecast of use (demand), EOQ, lead-time, safety stock, and reorder point at each SKL. A detailed discussion of these variables, their forecasting problems, and related calculation methodology is given in the paragraphs that follow.

Forecasting is the foundation for any inventory control system. The need to separate the inventory into several SKL's suggests a separate forecast at each SKL to identify and measure local market demand characteristics. However, the possibility of SKL "A" requesting material from SKL "B" suggests "B" operate on a forecast which is the sum of "A" and "B."

EOQ calculations require the use of an accurate SKL forecast. It has already been shown that EOQ generated for split forecasts significantly increase the dollar investment in inventory. This problem suggests that the total forecast be used on the EOQ computation and the total lot be "split shipped" (segregated by destination) to the various SKL's.

The replenishment lead-time of a given part must reflect the total time needed to obtain the part from the source specified. The location of the parts

source can dictate that the part have a variety of lead-times, if the part must originate from a vendor or from another warehouse or from the vendor through the warehouse.

The safety stock at each SKL is a function of the deviations from forecast demand. The addition of more SKL's suggests less demand because the market area is smaller, therefore, there occurs a higher risk of random demand. Also, if one warehouse obtains parts from another warehouse in large quantity, the order is a demand deviation. The larger quantity would be outside the normal or trend of average demand and would create a higher safety stock calculation.

The reorder point can be based on the SKL demand during lead-time plus safety stock or be based on total demand and total lead-time to SKL and total safety stock. As was pointed out by Porter[25] several options exist when analyzing the reorder mechanics.

Applying the Control Logic

Gustafson and Hageman[26] suggest excercising close control of expensive parts through ABC analysis.

The application of this technique to identify the part numbers which account for the top 80% of the investment in inventory provides the basis for lot sizing based on total forecast. Control of the class "A" produced parts would be

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[25]Porter, Proceedings, p. 81.

[26]Gustafson and Hageman, p.1.

based on a total forecast and corresponding lot size. This approach would counteract any effect of split forecasts increasing the average investment in inventory.

An example of the proposed control logic is as follows:

	Forecast	EOQ	Estimated Safety Stock	Avg. Inventory (1/2 EOQ + S.S.)
Warehouse A	600	163	50	131
Warehouse B	400	133	33	100
Total	1000	296	83	231
Warehouse A&B	1000	210	83	188

The calculation of the EOQ based on the total forecast reduces the average investment by 43 pieces (from 231 to 188). This method of control of class A parts is best executed by utilizing blanket ordering (projected monthly contract release) with inventory balancing at the time of vendor shipment. (Inventory balancing is defined as determining the current level of stock at each SKL and splitting the vendor shipment accordingly, resulting in a proper stock level at each SKL.) Since this procedure must be done manually at the time of shipment and for the quantity being shipped, it is not recommended to be used throughout the inventory. This approach is similar to Porter's[27] Push-Allocation System, however, the inventory balancing is done at time of shipment so that direct shipments are possible. This reduces handling costs and transport time to ultimate destination.

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[27]Porter, p. 81.

The Class B standard purchased components utilize Porter's[28] Cascading System approach. The new warehouse would order parts from the existing warehouse where demand exists in both markets. For the case where demand exists in only one market, see logic under Class B special below. The total forecast and/or requirements will be used to calculate the EOQ, safety stock, and reorder print. This will provide a normal lot size at the vendor's site. Orders will be shipped to the existing warehouse and then transhipped to the new warehouse. The new warehouse will list a cumulative lead-time which will account for the vendor lead-time. Although this approach tends to increase the inventory investment, the adverse financial effects of the increase will be minimized because this category of parts are low in unit cost.

The Class B and Class C special purchased parts will be acquired independently of the other warehouse. Each warehouse will requisition replenishments through a central purchasing channel for direct shipment. Each warehouse will furnish purchasing with local demand data, inventory balance-on-hand, and an EOQ determined by the local forecast. Although this approach has the disadvantage of inflating purchase and setup costs, it places primary responsibility and order follow-up in the hands of the warehouse manager.

The category, Manufactured Parts, will be manufactured and stored by the classification, Market, in each warehouse. (See transportation results, page 38.) Each warehouse will list local demand and inventory on hand and local

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[28]Porter, p. 81.

forecast when calculating the EOQ, safety stock, and reorder point. Imbalances in the individual warehouse inventories will be screened by a computer, whose program is designed to identify shipments between warehouses that are possible.

Applied Control Logic Results

A computer inventory simulation was performed which uses the control logic discussed above. The average inventory investment (1/2 EOQ + S.S. x standard cost) was calculated using a total forecast for an one warehouse inventory case. The forecast was then split for the two warehouse model, and the average inventory investment was recalculated. The inventory control logic was applied to the simulation,and the average inventory investment was recalculated. The results of this analysis are as follows. (See example page 51)

	Average Inventory Investment
One warehouse (total forecast).	$ 5,696,162
Two warehouse (split forecast).	6,828,105
Two warehouse (controls applied).	5,785,434

The split in the forecast, which therefore resulted in increased EOQ, caused a 20% increase in the average investment in inventory. The computation results show that application of the control logic created an increase of only 2%, as compared to the 20% increase from the previous method.

312	044 BD	5-00002-00017	16.20	119	453		3671.11	85	403	21	3868.28	28	206						
312	046 BD	5-00003-00010	18.62	112	516	16	5104.35	56	355	42	4089.07	82	397	31	4275.36	4	4		
312	050 BD	5-00003-00020	19.15	56	534	66	6376.95	23	391	20	4126.83	27	365	4	3571.48	4	4		
312	056 ED	5-00001-00010	15.30	98	521	65	4950.20	71	434	57	4575.30	9	188	5	1514.90	4	4		
312	057 ED	5-00001-00012	15.44	61	371	23	3296.44	50	349	17	2956.76	13	128	1	1003.60	4	4		
312	059 ED	5-00001-00017	15.46	62	482	75	4387.57	70	449	71	4570.50	13	193		1492.57	4	4		
312	060 ED	5-00001-00020	15.43	186	798	23	6532.56	192	789	9	6246.18	3	118		913.32	4	4		
312	060 ED	5-00003-00010	19.01	27	279		2652.45	12	198		1882.39	13	187		1777.81	4	4		
312	068 ED	5-00003-00015	20.27	78	391	63	5239.80	8	143	45	2361.46	61	385	31	4530.35	4	4		
312	069 ED	5-00003-00017	19.05	44	403		3839.78	25	266	7	2667.84	42	326		3106.13	4	4		
312	070 ED	5-00003-00020	20.77	62	310	24	3718.90	22	168	27	2306.14	36	264		2742.43	4	4		
312	106 HE	5-00001-00012	17.57	83	481	14	4472.07	52	407	5	3663.76	27	271	3	2433.72	4	4		
12	115 BD	5-00013-00025	15.90	90	711	82	6959.31	74	676	74	6553.68	16	229		1821.35	4	4		
12	139 BD	5-00007-00015	18.22	115	468	152	7035.24	66	429	134	6351.76	8	163	8	1631.23	4	4		
12	140 BD	5-00007-00017	19.26	26	215	18	2417.13	4	185	22	2205.27	1	60	2	808.92	4	4		
12	141 BD	5-00007-00020	19.07	132	698	111	6774.50	87	596	68	6981.45	31	377	117	5627.41	4	4		
12	143 BD	5-00001-00007	15.01	79	457	102	4961.80	62	436	106	4864.21	3	147		1103.46	4	4		
12	153 AU	5-00003-00010	17.94	58	423	97	5537.27	58	422	97	5528.29					4	4		
12	155 AU	5-00003-00015	18.76	45	323	121	5302.24	53	325	72	4401.33					4	4		
12	352 NEW		19.56	70	550	237	10017.28	70	550	237	10017.28					4	4		
12	000 WD	7-00000-00000	11.87	795	522	1249	17928.23	731	499	1212	17352.39					4	0		
12	100 WD	7-00000-00000	16.10	842	1070	654	21158.90	789	1023	598	20081.95					4	4		
12	315 RA	8-00010-00057	7.22	502	361	434	4439.15	494	355	422	4330.79	21	70	12	339.53	4	4		
13	001 PD	5-00003-00015	20.07	261	1001	151	13078.21	160	851	140	11351.85	76	529	25	5811.42	4	4		
13	002 PD	5-00003-00010	20.43	100	321	37	4035.72	6	98	2	1042.13	44	287	9	3116.19	4	4		
13	003 PD	5-00003-00012	20.61	42	348	17	3937.08	11	202	16	2411.72	37	293	8	3184.71	4	4		
13	004 PD	5-00003-00017	20.21	555	1418	18	14696.49	432	1245	99	14567.29	89	655	20	7625.76	4	4		
13	005 PD	5-00003-00020	20.77	335	1227	95	14717.67	265	1044	13	11113.56	88	641	71	8132.63	4	4		
13	006 PD	5-00003-00022	22.80	69	402	5	4697.42	37	267		3044.20	43	304		3466.06	4	4		
13	007 PD	5-00003-00025	22.26	127	646	35	7969.80	52	514	7	5877.17	72	391		4352.22	4	4		
13	012 PD	5-00004-00020	20.48	174	716	154	10485.76	144	642	133	9297.92	28	296	24	3522.56	4	4		
13	017 PD	5-00001-00015	16.73	130	520	63	5404.11	90	488	79	5404.11	12	160	2	1371.94	4	4		
13	018 PD	5-00001-00017	17.07	229	773	9	6753.95	138	602	67	6264.34	4	476		4064.33	4	4		
13	019 PD	5-00001-00020	17.91	155	520	43	5429.15	129	497	58	5491.87	8	143		1281.14	4	4		
13	020 PD	5-00001-00022	18.26	71	494	148	7215.86	84	487	139	6987.51	6	103		940.80	4	4		
13	021 PD	5-00001-00025	18.95	130	570	47	8292.06	126	550	69	6519.49	13	161	13	1772.01	4	4		
13	028 PD	5-00002-00025	18.76	75	381	86	5187.14	74	376	86	5140.24					4	4		
13	032 SD	5-00001-00017	17.63	27	162	66	2592.79	13	138	79	2610.42	5	75		661.43	4	4		
13	033 SD	5-00001-00020	18.38	50	445	5	4181.45	34	397	12	3868.99	13	209		1920.71	4	4		
13	034 SD	5-00001-00022	19.24	128	420	221	8295.46	68	402	66	5138.95	11	112		1077.83	4	4		
13	035 SD	5-00001-00025	19.08	56	462	50	5362.89	83	446	38	4981.19	7	142		1355.04	4	4		
13	045 SD	5-00003-00015	21.68	62	349	43	4716.05	9	115	18	1637.07	62	332	57	4835.31	4	4		
13	047 SD	5-00003-00020	21.25	118	762	24	8608.68	81	637		6770.04	45	466	6	5080.18	4	4		
13	049 SD	5-00003-00025	23.72	55	344	39	5005.34	22	234	18	3202.47	38	263	3	3190.61	4	4		
13	103 VD	5-00001-00020	18.56	95	331	39	3796.54	38	279	14	2849.73	14	167		1550.18	4	4		
13	104 VD	5-00001-00022	19.11	33	266	21	2943.56	11	98	42	1739.37	27	260	13	2733.30	4	4		
13	105 VD	5-00001-00025	19.41	164	592	65	7007.73	98	495	25	5269.77	45	320	4	3183.57	4	4		
13	117 VD	5-00003-00020	23.29	35	232	19	3145.37	7	112	23	1640.62	24	211	6	2597.84	4	4		
13	100 NEW		6.55	1483	731	220	3836.20	1050	683	392	4805.89	105	239	66	1215.40	4	4		
13	202 NEW		12.29	1191	422	542	9256.89	508	385	216	5022.92	68	122	14	922.20	4	4		
13	100 TA	7-00011-00000	14.29	515	499	120	5283.48	375	448	182	5805.39	98	210	36	2016.16	4	4		
13	100 NEW		23.47	331	327	55	5129.72	251	293	66	4988.86	46	130	27	2159.88	4	4		
14	005 DE	5-00020-00000	17.20	1204	274	2052	37063.93	200	217	1643	30136.31	651	173	785	14995.03	4	4		
14	007 DE	5-00025-00000	18.34	1298	365	4886	93023.39	56	328	2492	48726.98	499	170	1227	24069.95	4	4		
14	100	ECIAL C 0101	126.57	140	82	496	67972.92	140	82	496	67972.92					4	5		
14	100	ECIAL C 0101	128.58	1023	132	1254	169732.20	1023	132	1254	169732.20					4	5		

CHAPTER IV

SUMMARY AND CONCLUSIONS

Summary

The second warehouse for Commercial Shearing, Inc. was justified from marketing forecasts projecting increased market penetration from improved customer service. Cost studies indicate that after tax income would increase by 18% over a five year period.

The selection of North Carolina as the site for the second warehouse was based on minimizing the individual transportation costs incurred utilizing six potential sites. The North Carolina site had a distribution cost of $384,078 which was $15,611 less than the next least expensive site and a labor cost of $106,600 per year which was $20,000 less than the next best site.

The inventory control for the distribution system used the ABC classification of the inventory by market. The increase in the total corporate inventory investment is limited based on gross lot sizing the class A components and splitting the shipments to the separate stock keeping units. The balance of the inventory will either be purchased from the existing warehouse or direct from the vendor, depending on activity, setup consideration, and part value. The movement of low activity inventory between warehouse, although not planned, will be permitted using computer analysis of both inventory positions.

Conclusions

The selection of the North Carolina site in this study was based on several key operating assumptions. The study would have been complicated considerably if all relevant factors had been considered. The existance of a second warehouse was cost justified based on the relative cost factors and forecast increases in sales. Transportation costs played an important part in the final location decision. In reality, the CSI traffic department understands that rates vary with the relative location of source and destination cities and the amount of weight in the shipment. As described in the problem statement of this study, many variables had to be considered in site selection; however, they have not all been included in this study due to the desire to limit the scope of the study.

In contrast to the exacting detail which may be employed in site selection, in actuality, the corporate decision making process is sometimes based upon rather flimsy reason, sketchy logic and limited facts.

The marketing estimates of market growth, importance of service level, and their interrelationship is subjective at best. The size of the pirate market cannot be precisely defined and the size of the actual market served by the pirates may be questioned. The normal business risks inherent in all business decision making are also present here. Without a substantial increase in sales, the establishment of the warehouse would not likely be profitable.

The inventory control technique which is suggested here is essentially an application of an order point technique. The current authors, lecturers and

practitioners in inventory control, however, would suggest a material requirements planning (MRP) approach. (MRP is defined as the planning of requirements for components based upon requirements for higher level assemblies. The production schedule is exploded and the results netted against the inventory.) This advanced technique will be considered by CSI management for implementation after that technology is installed in existing facilities.

APPENDIX A

Cost Justification Reference Data

TABLE 1

INCOME STATEMENT

IN THOUSANDS WITH ONE WAREHOUSE

	1980	1981	1982	1983	1984
Net Sales	7,913	8,704	9,575	10,532	11,586
Variable Costs					
Labor	232 (13)	268 (15)	304 (17)	322 (18)	358 (20)
Material	3956	4352	4788	5266	5793
Plant Overhead	245	270	297	326	359
Total Variable Cost	4433	4890	5389	5914	6510
Economic Profit	3480	3814	4186	4618	5076
% to Sales	44%	44%	44%	44%	44%
Manufacturing Overhead	100	100	100	100	100
Manufacturing Profit	3380	3714	4086	4518	4979
Interest Expense	0	0	0	0	0
Income before Taxes	3380	3714	4086	4518	4979
Income Taxes (47%)	1588	1745	1920	2123	2340
Net Income	1792	1969	2166	2395	2639
% of Sales	22.6%	22.6%	22.6%	22.7%	22.7%

INCOME STATEMENT

IN THOUSANDS WITH TWO WAREHOUSES

	1980	1981	1982	1983	1984
Net Sales	8633	10187	11614	12891	14825
Variable Cost					
Labor	154 (13)	178 (15)	201 (17)	213 (18)	237 (20)
Material	4316	5093	5807	6445	7412
Plant Overhead	267	316	360	400	459
Total Variable Cost	4737	5587	6368	7058	8108
Economic Profit	3896	4600	5246	5833	6717
% to Sales	45.1%	45.2%	45.2%	45.2%	45.3%
Manufacturing Overhead	258	258	258	258	258
Manufacturing Profit	3638	4342	4988	5575	6459
Operating Expense	20	20	20	20	20
Operating Profit	3618	4322	4968	5555	6439
Interest Expense (9.5)	117	78	39		
Income before Income Taxes	3501	4244	4929	5555	6439
Income Taxes (47%)	1647	1994	2316	2610	3026
Less Inv. tax credit	86				
Net Income	1942	2250	2613	2945	3413
% of Sales	22.5%	22.1%	22.5%	22.8%	23.0%

TABLE 3

EQUIPMENT REQUIRED FOR SECOND WAREHOUSE

Plant Equipment	
Air Compressor	$ 15,000
Sweeper - Tennant	12,000
Shipping Scales	15,000
Lift Trucks (1)	20,000
Pickup Truck	8,000
Lockers	5,000
Containers (baskets)	25,000
Shelving	30,000
Office Equipment and Furniture	6,000
	$136,000
Shipping	
Shipping (tools)	$ 5,000
Inspection	
Gauges	$ 25,000
Benches	2,000
Q.C. Office	2,000
	$ 29,000

TABLE 4

CAPITAL INVESTMENT REQUIRED FOR SECOND WAREHOUSE

LAND		
15 acres at $7,500/acre		$112,500
BUILDINGS		
Site preparation =	$ 50,000	
Building - 45,000 sq. ft. at $20 per sq. ft. =	$900,000	950,000
EQUIPMENT		170,000
Total Investment		$1,232,500

TABLE 5

MANPOWER REQUIRED FOR SECOND WAREHOUSE

STOREROOM	
Pickers	9
Receivers	1
Truckers	1
INSPECTION	
Receiving	2
	13
SUPERVISION	
Plant Manager	1
Production Control	1
Clerk	1
	3

TABLE 6

DETAIL OF LABOR COST FOR SECOND WAREHOUSE

WAGE	
2000 hours at an average rate of $5.00 per hour	$ 10,000
FRINGE BENEFITS	
Vacation - two weeks	400
FICA - 6.13% of annual wage including vacation pay up to $22,900.	613
Unemployment benefits - 3.4% of the first $6000 of wages	204
Holidays - eight days	320
Group insurance - 2080 hours at $.15 per hour	312
TOTAL ANNUAL COST PER EMPLOYEE	$ 11,849
NUMBER OF HOURLY EMPLOYEES	13
TOTAL ANNUAL COST	$154,037

TABLE 7

MATERIAL COST, PLANT OVERHEAD AND MANUFACTURING OVERHEAD FOR SECOND WAREHOUSE

MATERIAL COST

The average material cost is estimated to be 50% of the sales price.

PLANT OVERHEAD

Plant overhead is estimated as a percent of sales at 3.1% based on history.

MANUFACTURING OVERHEAD

Salary and Fringe Benefits	$60,000
Real and Personal Property Tax	55,000
Insurance	20,000
Fixed Power	15,000
Others	10,000
Depreciation	
Building (SL 40 years $23,000)	
Equipment (SL 20 years $72,000)	
(SL 10 years $2,600)	
	97,600
Total	$257,600

TABLE 8

LABOR COST COMPARISON

Labor and Fringe Benefits Projected for Warehouse Number Two. ($5.70/hr.)	$ 154,057
Labor and Fringe Benefits for Comparable Employee at Warehouse Number One. ($ 8.60/hr.)	$ 232,544

TABLE 9

WAREHOUSE AVERAGE INVENTORY INVESTMENT SIMULATION

In order to establish the increase in the average investment in inventory with one warehouse versus two, a computer simulation was run. See Table 10, page 65.

The standard EOQ and safety stock were generated assuming all service demand to be shipped from one warehouse. The market demand was then split and the EOQ's and safety stocks were regenerated for the separate demand markets. The average inventory for each approach was calculated by using the formula 1/2 EOQ + S.S.times the standard cost. The results are as follows:

AVERAGE INVENTORY INVESTMENT

One Warehouse	$5,696,162
Two Warehouse	$6,828,105

	TO RIGHT	END NO	COST	FRCST	EOQ	SS	INV	FRCST	EOQ	SS	INV					
341	I 100 AP	1-00000-00000	6.14	1	54	5	196.58	1	36	4	135.15					1 4
342	I 100 NEN		6.54	1	5	1	22.90	1	5	1	22.90					1 1
344	I 100 Y	1-00000-00000	4.47	5	30		67.10	5	30		67.10					1 4
353	I 282 DD	8-00000-SF000	15.85	4	59	7	378.71	1	29		229.90					1 4
							865.29				455.05					
301	I 002 EA I	9-00000-000PP	.82	509	1347	1037	1409.45	369	1061	732	1040.30	264	894	590	854.49	4 1
301	I 003 R I	3-00003-00000	6.03	31	234	100	1309.16	35	204	60	977.35	19	128	19	500.74	4 1
301	007 F I	5-00003-00000	5.82	40	220	34	838.80	34	168	40	722.30	16	149	2	445.61	4 1
301	023 M I	5-00002-00000	5.74	85	338	171	1752.62	52	267	31	944.72	24	232	11	729.36	4 1
301	206 U I	6-00004-00000	23.74	66	574		6815.10	78	577	16	7230.66					4 4
302	019 JB I	4-00001-00000	9.25	74	207	24	1179.63	46	157	12	837.31	28	134	22	823.43	4 1
302	020 KB I	4-00000-00000	6.30	55	251	43	1061.89	39	188	30	781.45	12	162	8	560.88	4 1
302	039 ZB I	4-00000-00000	7.56	34	227	49	1228.50	15	87	43	653.94	22	206	36	1050.84	4 1
303	001 AC I	5-00000-00000	10.02	125	285	262	4053.09	19	172	69	1553.10	83	245	178	3011.01	4 1
303	002 BC I	5-00000-00000	12.91	68	174	51	1732.55	44	137	38	1375.66	26	110	17	930.02	4 1
303	004 DC I	5-00000-00000	9.55	28	175	30	1096.36	3	79	6	424.74	35	165	18	938.17	4 1
303	011 GC I	5-00000-00000	9.75	74	246	71	1891.50	44	199	64	1594.13	27	148	8	799.50	4 1
303	035 YB I	5-00000-00000	9.58	35	151		723.59	21	101	11	589.42	19	118	3	594.21	4 1
303	072 NEN		9.70	106	160	346	4136.03	110	152	202	2699.10	13	57	16	432.05	4 1
303	I 501 NEN		11.95	46	182	93	2198.98	43	126	28	1087.54	21	140	61	1565.58	4 1
303	I 116 RA L	3-00002-00000	6.25	546	572	97	2395.67	499	539	127	2480.11	62	199	16	722.45	4 4
303	I 316 RA E	3-00058-00000	6.27	416	436	95	1963.45	390	421	93	1903.86	25	120	8	426.56	4 4
303	I 132 MA E	8-00020-00008	9.13	662	350	248	5885.68	511	314	165	2957.89	197	159	68	1354.94	4 4
303	I 132 MA L	8-00025-00008	12.27	390	270	198	4086.58	201	241	176	3638.65	136	117	23	1000.17	4 4
304	001 PA E	3-00000-00000	13.96	18	127	63	1652.47	20	115	50	1404.27					4 1
305	008 CJ 0	4-00000-00000	11.42	174	274	88	2569.95	75	173	100	2130.20	97	208	10	1302.11	4 1
311	001 XA 0	3-00000-00000	12.75	135	266	86	2792.47	133	264	86	2779.72					4 1
311	000 P 0	7-00000-00000	19.10	42	116	86	2751.26	20	102	80	2502.89					4 0
311	I 100 MA 0	3-00001-00000	35.68	135	463	38	9615.76	135	463	38	9615.76					4 4
311	I 101 KA 0	3-00000-00000	42.40	20	210	36	5979.39	20	209	36	5958.18					4 4
311	I 202 BB 0	5-00000-C0000	31.93	107	131	100	5284.58	105	130	94	5077.03					4 4
311	I 203 YA 0	5-00000-SF000	30.05	20	34	96	3396.22	20	34	96	3396.22					4 4
311	I 403 YA 0	5-00000-C0000	32.03	12	48	26	1601.90	12	48	26	1601.90					4 4
311	I 801 BB 0	5-00000-SF000	28.69	137	72	150	5336.71	136	72	147	5250.64					4 4
311	I 201 AB 0	5-00001-00000	41.30	140	62	147	7351.93	137	60	171	8301.90					4 4
311	I 101 HA 0	3-00000-00000	50.57	49	219	61	8623.55	42	197	59	7966.04					4 4
311	100 JA 0	8-00015-00001	49.09	137	55	160	9205.13	135	54	168	9573.33					4 4
312	I 002 TB 0	9-00000-00000	.61	616	1763	51	571.62	166	1229		376.69	164	1248		382.51	4 1
312	002 AF 0	5-00000-00000	9.37	68	236	29	1378.42	67	218	25	1256.52	12	95	4	482.92	4 1
312	003 AB 0	5-00000-00000	6.94	90	294	83	1597.81	59	202	42	993.42	43	233	88	1420.66	4 1
312	006 BD 0	5-00001-00010	15.04	137	502	142	5912.29	85	443	12	3512.77	5	221		1662.36	4 4
312	007 BD 0	5-00001-00012	14.41	87	692	22	5303.98	86	671	34	5325.60	8	184		1326.00	4 4
312	008 BD 0	5-00001-00015	14.63	281	1024	128	9363.20	255	964	12	7227.22	32	356	28	3013.78	4 4
312	010 BD 0	5-00001-00020	15.11	252	1022	52	8511.43	237	994	48	8239.31	16	264	3	2040.93	4 4
312	014 BD 0	5-00002-00017	15.13	84	538	27	4479.96	95	487		3685.37	8	220	24	2028.09	4 4
312	016 BD 0	5-00003-00010	17.40	170	782	11	6996.01	92	536		4664.00	137	570	65	6091.05	4 4
312	017 BD 0	5-00003-00012	18.01	189	610		5495.19	91	398	5	3675.47	101	460		4143.91	4 4
312	018 BD 0	5-00003-00015	17.55	330	1180	65	11495.91	216	942	48	9108.97	107	766	22	7108.16	4 4
312	019 BD 0	5-00003-00017	17.72	220	1044	57	10259.88	95	695	161	9010.62	121	778	25	7336.08	4 4
312	020 BD 0	5-00003-00020	18.21	314	1074	55	10785.06	189	835	41	8352.95	114	707	20	6804.42	4 4
312	024 BD 0	5-00004-00017	18.31	228	648	198	9558.86	133	616	105	7562.86	0	138		1263.53	4 4
312	036 DD 0	5-00001-00010	15.17	93	466	57	4400.17	50	342	52	3383.58	17	311	4	2420.09	4 4
312	037 DD 0	5-00001-00012	15.20	50	348	26	3041.20	43	299	33	2775.10	12	177	9	1482.59	4 4
312	038 DD 0	5-00001-00015	15.42	105	621	142	6978.46	40	442		3408.26	61	292	90	3639.59	4 4

TABLE 11

ANALYSIS OF COST INCREASES

Supervision and clerical salary and fringe benefits.		$ 60,000
Insurance and taxes.	$75,000	
Less reduction at warehouse #1 for expense associated with decreased volume.	$15,000	$ 60,000
Depreciation on equipment which presently exists at warehouse #1.		
(SL 20 year $72,000) (SL 10 year $26,000)		$ 74,600
Operating expenses - projected staff increase to handle inventory distribution.		$ 20,000
Projected increase in inventory at a carrying cost of 15% of $1,131,943.		$169,791

TABLE 12

COMPARATIVE INCOME ESTIMATES

(000)

	One Warehouse	Two Warehouse
Five year income after taxes. (from income statements)	$10,961	$13,163
Added costs		-170
Distribution costs	+65	
Total income	$11,026	$12,993

APPENDIX B

Transportation Costs

Table 1 Transportation Costs Table

TABLE 1

TRANSPORTATION COSTS TABLE

		All Warehouses		NC (W_1)	AL (W_2)	TX (W_3)	CO (W_4)	MS (W_5)	OH (W_6)
S_1	EW	.033							
S_1	W_2			.070	.141	.178	.213	.087	.038
S_2	EW	.082							
S_2	W_2			0	.089	.158	.228	.096	.057
W_1	W_2			.082	.128	.152	.181	.059	.026
EW_1	D_1	.141	WD_1	.109	.022	.076	.185	.100	.120
EW_1	D_2	.089	WD_2	.078	.165	.222	.268	.139	.085
EW_1	D_3	.022	D_3	.061	.120	.152	.198	.067	.016
EW_1	D_4	.344	D_4	.390	.344	.257	.163	.298	.348
EW_1	D_5	.326	D_5	.395	.374	.302	.187	.302	.341
EW_1	D_6	.321	D_6	.361	.302	.213	.144	.270	.322
EW_1	D_7	.083	D_7	.159	.174	.150	.119	.078	.102
EW_1	D_8	.114	D_8	.141	.224	.261	.285	.172	.126
EW_1	D_9	.071	D_9	0	.087	.158	.231	.096	.078
EW_1	D_{10}	.322	D_{10}	.389	.359	.277	.165	.291	.337
EW_1	D_{11}	.152	D_{11}	.159	.091	0	.113	.091	.139
EW_1	D_{12}	.022	D_{12}	.096	.128	.139	.161	.046	.026

APPENDIX C

Bus Lib Transpo Program Computer Output

```
    HIT ENTER TO CONTINUE
    & YOUR MAILBOX IS EMPTY

    NOW ISSUE YOUR NEXT BUSLIB COMMAND ???
    (EITHER: BUSRUN, BUSINDEX, RENEW, SAVEFILE, QUIT, LOG)
    R: T=0.22/0.49 12:05:19
     BUSRUN

   PLEASE SPECIFY THE NAME OF THE PROGRAM YOU WISH TO EXECUTE. ENTER 'STAT' FOR ANY
   STAT/BASIC PROGRAMS. ENTER 'HALT' TO STOP.

   NOW WHAT DO YOU WISH TO DO ?
     TRANSPO

  DO YOU WISH TO REVIEW A TUTORIAL FOR TRANSPO ? ( YES OR NO )
    NO

  HAVE YOU CREATED YOUR DATA STATEMENTS YET? (YES,NO, OR HALT)
    NO

  PLEASE ENTER A REFERENCE NAME FOR THESE DATA STATEMENTS?
    WAREHOUSE

   ENTER YOUR DATA STATEMNTS ACCORDING TO THE GENERAL FORM:
      <STATEMENT NUMBER> DATA <VALUE 1>,<VALUE 2>,.....<VALUE N>
                         .....ETC.....
   THE PRECISE FORM IS PRESENTED IN THE TUTORIAL FOR THE PROGRAM IN QUESTION.
  (NOTE: AFTER ALL DATA IS ENTERED YOU MUST ISSUE THE COMMAND <FILE> TO CONTINUE.)

  NOW ENTER YOUR DATA STATEMENTS!!!
  NEW FILE:
  EDIT:
    100
  LINE NOT FOUND
    100 DATA 4
    200 DATA 14
    300 DATA 1604,546,2150,2150
    400 DATA 397,331,253,211,182,154,135,112,106,103,86,80,2150,2150
    500 DATA 500,500,500,500,500,500,500,500,500,500,500,500,33,56
    600 DATA 500,500,500,500,500,500,500,500,500,500,500,500,82,22
    700 DATA 14,89,22,344,326,321,83,114,71,322,152,22,0,74
    800 DATA 130,56,52,392,395,374,156,120,22,391,174,91,74,0
    FILE

  PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
    1

                      A BASIC TRANSPORTATION PROGRAM

  THROUGHOUT THE PROGRAM, YOU MAY ISSUE ONE OF THE
  FOLLOWING CODE NUMBERS TO CONTROL EXECUTION OPTIONS:

       * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
            1     INSTRUCTIONS FOR DATA INPUT
            2     OPTIMIZE THE DATA ALREADY ENTERED
            3     PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
```

```
          9     CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINTION
         10     STOP
 WHICH OPTION DO YOU WANT?
  2

   FINAL DISTRIBUTION

 SOURCE DESTINATION    UNITS

   1          13        1604
   2          14         546
   3           1         397
   3           3         253
   3           4         211
   3           5         182
   3           6         154
   3           7         135
   3           8           3
   3          10         103
   3          11          86
   3          12          80
   3          13         546
   4           2         331
   4           8         109
   4           9         106
   4          14        1604

TOTAL COST = $ 350911

WOULD YOU LIKE TO MODIFY THE CURRENT DATA AND/OR RUN AGAIN?
  YES
WHAT OPTION? (999 FOR OPTION LIST)?
  10

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
  3

JUST RE-TYPE THE LINE NUMBER WHICH YOU WISH TO CHANGE OR USE STANDARD CMS EDIT
COMMANDS. WHEN YOU'RE FINISHED WITH ALL CHANGES TYPE 'FILE'.
EDIT:
  500 DATA 500,500,500,500,500,500,500,500,500,500,500,500,33,52
  600 DATA 500,500,500,500,500,500,500,500,500,500,500,500,82,43,
  700 DATA 141,89,22,344,326,321,83,114,71,322,152,22,0,43
  800 DATA 104,89,30,352,350,326,115,135,43,345,130,52,43,0
  FILE

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
  1
IOD221 LINE   600: SYNTAX ERROR AT 3,

A PROGRAM ERROR HAS OCCURED: I'LL CHECK THE AIDFILES AND SEE IF I CAN HELP.

        RUNBDB AIDFILE
```

```
      NUMBER FORMAT. THE CORRECT FORMAT IS:
        <STATEMENT NUMBER> DATA <VALUE 1>,<VALUE 2>,.....<VALUE N>

   3. IF VSBASIC ERROR IC0419 WAS GENERATED YOU FAILED TO ENTER ENOUGH DATA FOR
      AND THE PROGRAM IN QUESTION.

 BETTER LUCK NEXT TIME.


  NOW PLEASE SPECIFY YOUR NEXT BUSLIB COMMAND?????
 (EITHER: BUSRUN, BUSINDEX, RENEW, SAVEFILE, QUIT, LOG)
 R: T=1.42/2.90 12:15:49
   BUSRUN

PLEASE SPECIFY THE NAME OF THE PROGRAM YOU WISH TO EXECUTE. ENTER 'STAT' FOR ANY
STAT/BASIC PROGRAMS. ENTER 'HALT' TO STOP.

NOW WHAT DO YOU WISH TO DO ?
  TRANSPO

DO YOU WISH TO REVIEW A TUTORIAL FOR TRANSPO ? ( YES OR NO )
  NO

HAVE YOU CREATED YOUR DATA STATEMENTS YET? (YES,NO, OR HALT)
  YES

WHAT IS THE REFERENCE NAME OF THE ORIGINAL DATA STATEMENTS?
  WAREHOUSE

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
  10

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
  3

JUST RE-TYPE THE LINE NUMBER WHICH YOU WISH TO CHANGE OR USE STANDARD CMS EDIT
COMMANDS. WHEN YOU'RE FINISHED WITH ALL CHANGES TYPE 'FILE'.
EDIT:
  500 DATA 500,500,500,500,500,500,500,500,500,500,500,500,33,52,
  600 DATA 500,500,500,500,500,500,500,500,500,500,500,500,82,43
  700 DATA 141,89,22,344,326,321,83,114,71,322,152,22,0,43
  800 DATA 104,89,30,352,350,326,115,135,43,345,130,52,43,0
  FILE

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
  1
IC0221 LINE   500: SYNTAX ERROR AT 2,

A PROGRAM ERROR HAS OCCURED: I'LL CHECK THE AIDFILES AND SEE IF I CAN HELP.


          RUNB08 AIDFILE

1. IF VSBASIC ERROR IC0264 WAS GENERATED YOUR DATA STATEMENT NUMBERS ARE
```

```
<STATEMENT NUMBER> DATA <VALUE 1>,<VALUE 2>,.....<VALUE N>

3. IF VSBASIC ERROR IC0419 WAS GENERATED YOU FAILED TO ENTER ENOUGH DATA FOR
   FOR THE PROGRAM IN QUESTION.

BETTER LUCK NEXT TIME.


 NOW PLEASE SPECIFY YOUR NEXT BUSLIB COMMAND?????
(EITHER: BUSRUN, BUSINDEX, RENEW, SAVEFILE, QUIT, LOG)
R: T=0.78/1.64 12:20:05
  BUSRUN

PLEASE SPECIFY THE NAME OF THE PROGRAM YOU WISH TO EXECUTE. ENTER 'STAT' FOR ANY
STAT/BASIC PROGRAMS. ENTER 'HALT' TO STOP.

NOW WHAT DO YOU WISH TO DO ?
  TRANSPO

DO YOU WISH TO REVIEW A TUTORIAL FOR TRANSPO ?( YES OR NO )
  NO

HAVE YOU CREATED YOUR DATA STATEMENTS YET? (YES,NO, OR HALT)
  YES

WHAT IS THE REFERENCE NAME OF THE ORIGINAL DATA STATEMENTS?
  WAREHOUSE

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
  1
IC0201 LINE   500: SYNTAX ERROR AT 2.

A PROGRAM ERROR HAS OCCURED: I'LL CHECK THE AIDFILES AND SEE IF I CAN HELP.


          RUNBD8 AIDFILE

1. IF VSBASIC ERROR IC0264 WAS GENERATED YOUR DATA STATEMENT NUMBERS ARE
   MISPLACED. PLEASE CHECK THE TUTORIAL FOR THE PROGRAM IN QUESTION TO
   OBTAIN THE PROPER NUMBERS.

2. IF VSBASIC ERROR IC0210 WAS GENERATED YOUR DATA STATEMENTS ARE NOT IN THE
   PROPER FORMAT. THE CORRECT FORMAT IS:
      <STATEMENT NUMBER> DATA <VALUE 1>,<VALUE 2>,.....<VALUE N>

3. IF VSBASIC ERROR IC0419 WAS GENERATED YOU FAILED TO ENTER ENOUGH DATA FOR
   FOR THE PROGRAM IN QUESTION.

BETTER LUCK NEXT TIME.


 NOW PLEASE SPECIFY YOUR NEXT BUSLIB COMMAND??????
(EITHER: BUSRUN, BUSINDEX, RENEW, SAVEFILE, QUIT, LOG)
R: T=0.69/1.38 12:22:28
  BUSRUN
```

```
TRANSPO
DO YOU WISH TO REVIEW A TUTORIAL FOR TRANSPO ?! ( YES OR NO )
 NO

HAVE YOU CREATED YOUR DATA STATEMENTS YET? (YES,NO, OR HALT)
 YES

WHAT IS THE REFERENCE NAME OF THE ORIGINAL DATA STATEMENTS?
 WAREHOUSE

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
 10

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
 3

JUST RE-TYPE THE LINE NUMBER WHICH YOU WISH TO CHANGE OR USE STANDARD CMS EDIT
COMMANDS. WHEN YOU'RE FINISHED WITH ALL CHANGES TYPE 'FILE'.
EDIT:
 500
 500 DATA 500,500,500,500,500,500,500,500,500,500,500,500,33,52,
 500 DATA 500,500,500,500,500,500,500,500,500,500,500,500,33,52
 FILE

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
 1

                    A BASIC TRANSPORTATION PROGRAM

THROUGHOUT THE PROGRAM, YOU MAY ISSUE ONE OF THE
FOLLOWING CODE NUMBERS TO CONTROL EXECUTION OPTIONS:

     * * * * * * * * * * * * * * * * * * * * * * * * * * *
          1      INSTRUCTIONS FOR DATA INPUT
          2      OPTIMIZE THE DATA ALREADY ENTERED
          3      PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
          4      PRINT THE COST MATRIX
          5      CHANGE THE NUMBER OF SOURCES
          6      CHANGE THE NUMBER OF DESTINATIONS
          7      CHANGE THE CAPACITY OF A SOURCE
          8      CHANGE THE REQUIREMENT OF A DESTINATION
          9      CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINTION
         10      STOP
WHICH OPTION DO YOU WANT?
 2

  FINAL DISTRIBUTION

SOURCE DESTINATION    UNITS

  1          13          1561
  1          14          43
  2          14          546
  3          2           331
```

```
      3          10          103
      3          12          80
      3          13          589
      4          1           397
      4          9           106
      4          11          86
      4          14          1561

 TOTAL COST = $ 409527


WOULD YOU LIKE TO MODIFY THE CURRENT DATA AND/OR RUN AGAIN?
  YES
WHAT OPTION? (999 FOR OPTION LIST)?
  10

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
  3

JUST RE-TYPE THE LINE NUMBER WHICH YOU WISH TO CHANGE OR USE STANDARD CMS EDIT
COMMANDS. WHEN YOU'RE FINISHED WITH ALL CHANGES TYPE 'FILE'.
EDIT:
  500 DATA 500,500,500,500,500,500,500,500,500,500,500,500,33,48
  600 DATA 500,500,500,500,500,500,500,500,500,500,500,500,82,30
  700 DATA 141,89,22,344,326,321,83,114,71,322,152,22,0,50
  800 DATA 113,76,33,369,365,343,130,128,30,361,147,65,50,0
  FILE

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
  1

                    A BASIC TRANSPORTATION PROGRAM

THROUGHOUT THE PROGRAM, YOU MAY ISSUE ONE OF THE
FOLLOWING CODE NUMBERS TO CONTROL EXECUTION OPTIONS:

    * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
          1     INSTRUCTIONS FOR DATA INPUT
          2     OPTIMIZE THE DATA ALREADY ENTERED
          3     PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
          4     PRINT THE COST MATRIX
          5     CHANGE THE NUMBER OF SOURCES
          6     CHANGE THE NUMBER OF DESTINATIONS
          7     CHANGE THE CAPACITY OF A SOURCE
          8     CHANGE THE REQUIREMENT OF A DESTINATION
          9     CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINTION
         10     STOP
WHICH OPTION DO YOU WANT?
  2

   FINAL DISTRIBUTION

SOURCE DESTINATION    UNITS
```

```
                3           6           182
                3           7           154
                3           8           135
                3           9           112
                3           10          103
                3           11          86
                3           12          80
                3           13          546
                4           1           397
                4           2           43
                4           9           106
                4           14          1604

TOTAL COST = $ 405140


WOULD YOU LIKE TO MODIFY THE CURRENT DATA AND/OR RUN AGAIN?
  YES
WHAT OPTION? (999 FOR OPTION LIST)?
  10

PLEASE ENTER THE NUMBER OF YOUR OPTION,1,2,3,4,9 OR HELP?
  3

JUST RE-TYPE THE LINE NUMBER WHICH YOU WISH TO CHANGE OR USE STANDARD CMS EDIT
COMMANDS. WHEN YOU'RE FINISHED WITH ALL CHANGES TYPE 'FILE'.
EDIT:
  500 DATA 500,500,500,500,500,500,500,500,500,500,500,500,33,52
  600 DATA 500,500,500,500,500,500,500,500,500,500,500,500,82,17
  700 DATA 141,89,22,344,326,321,83,114,71,322,152,22,0,65
  800 DATA 119,65,43,387,387,358,145,126,17,378,160,80,65,0
  FILE

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
  1

                    A BASIC TRANSPORTATION PROGRAM

THROUGHOUT THE PROGRAM, YOU MAY ISSUE ONE OF THE
FOLLOWING CODE NUMBERS TO CONTROL EXECUTION OPTIONS:

     * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
           1      INSTRUCTIONS FOR DATA INPUT
           2      OPTIMIZE THE DATA ALREADY ENTERED
           3      PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
           4      PRINT THE COST MATRIX
           5      CHANGE THE NUMBER OF SOURCES
           6      CHANGE THE NUMBER OF DESTINATIONS
           7      CHANGE THE CAPACITY OF A SOURCE
           8      CHANGE THE REQUIREMENT OF A DESTINATION
           9      CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINTION
          10      STOP
WHICH OPTION DO YOU WANT?
  3
```

```
                1404                397
          2     444               331
          3     2150                253
          4     2150                211
          5                       182
          6                       154
          7                       135
          8                       112
          9                       106
          10                      103
          11                      86
          12                      80
          13                      2150
          14                      2150

WHAT OPTION? (999 FOR OPTION LIST)?
  2

   FINAL DISTRIBUTION

SOURCE DESTINATION    UNITS

  1          13          1316
  1          14          288
  2          14          546
  3          3           253
  3          4           211
  3          5           182
  3          6           154
  3          7           135
  3          8           112
  3          10          103
  3          11          86
  3          12          80
  3          13          834
  4          1           397
  4          2           331
  4          9           106
  4          14          1316

TOTAL COST = $ 397133


WOULD YOU LIKE TO MODIFY THE CURRENT DATA AND/OR RUN AGAIN?
  =!>
WHAT OPTION? (999 FOR OPTION LIST)?
  10

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
  3

JUST RE-TYPE THE LINE NUMBER WHICH YOU WISH TO CHANGE OR USE STANDARD CMS EDIT
COMMANDS. WHEN YOU'RE FINISHED WITH ALL CHANGES TYPE 'FILE'.
EDIT:
  500 DATA 500,500,500,500,500,500,500,500,500,500,500,500,33,19
```

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,5,6 OR HELP?
1

A BASIC TRANSPORTATION PROGRAM

THROUGHOUT THE PROGRAM, YOU MAY ISSUE ONE OF THE
FOLLOWING CODE NUMBERS TO CONTROL EXECUTION OPTIONS:

* *

1	INSTRUCTIONS FOR DATA INPUT
2	OPTIMIZE THE DATA ALREADY ENTERED
3	PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
4	PRINT THE COST MATRIX
5	CHANGE THE NUMBER OF SOURCES
6	CHANGE THE NUMBER OF DESTINATIONS
7	CHANGE THE CAPACITY OF A SOURCE
8	CHANGE THE REQUIREMENT OF A DESTINATION
9	CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINTION
10	STOP

WHICH OPTION DO YOU WANT?
4

COST MATRIX

	DESTINATION							
	1	2	3	4	5	6	7	8
SOURCE								
1	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00
2	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00
3	141.00	89.00	22.00	344.00	326.00	321.00	83.00	114.00
4	148.00	45.00	24.00	384.00	369.00	363.00	126.00	91.00

	DESTINATION					
	9	10	11	12	13	14
SOURCE						
1	500.00	500.00	500.00	500.00	33.00	19.00
2	500.00	500.00	500.00	500.00	82.00	54.00
3	71.00	322.00	152.00	22.00	.00	43.00
4	54.00	369.00	176.00	65.00	43.00	.00

WHAT OPTION? (999 FOR OPTION LIST)?
2

FINAL DISTRIBUTION

SOURCE	DESTINATION	UNITS
1	13	951
1	14	653
2	14	546
3	4	211
3	5	182
3	6	154
3	7	135
3	10	103

```
      4          8          293
      4          8          112
      4          9          106
      4         14          951

 TOTAL COST = $ 409466

 WOULD YOU LIKE TO MODIFY THE CURRENT DATA AND/OR RUN AGAIN?
   NO

 PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
   HELP
THE FOLLOWING OPTIONS ARE AVAILABLE:
1 EXECUTE TRANSPO USING WAREHOUS
2 PRINT THE CONTENTS OF WAREHOUS
3 CHANGE THE CONTENTS OF WAREHOUS
4 START FROM THE BEGINNING
9 STOP EXECUTION

PLEASE ENTER THE NUMBER OF YOUR OPTION,1,2,3,4,9 OR HELP?
   2

   100 DATA 4
   200 DATA 14
   300 DATA 1604,546,2150,2150
   400 DATA 397,331,253,211,182,154,135,112,106,103,86,80,2150,2150
   500 DATA 500,500,500,500,500,500,500,500,500,500,500,500,33,19
   600 DATA 500,500,500,500,500,500,500,500,500,500,500,500,82,54
   700 DATA 141,89,22,344,326,321,83,114,71,322,152,22,0,43
   800 DATA 148,45,24,384,369,363,126,91,54,369,176,65,43,0


PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
   9

 NOW PLEASE SPECIFY YOUR NEXT BUSLIB COMMAND?????
(EITHER: BUSRUN, BUSINDEX, RENEW, SAVEFILE, QUIT, LOG)
R: T=3.15/6.80 12:39:58
   LOG
RUN FILE 6719  TO  ASBSLB01 COPY 01 NOHOLD
     YOU HAVE CREATED THE FOLLOWING FILES/PROGRAMS THIS SESSION.

FILENAME  FILETYPE
--------  --------
WAREHOUS VSBASIC  A2

 D I R E C T I O N S:
    AS EACH FILE IS LISTED, ENTER 'YES' TO SAVE THE FILE FOR TWO WEEKS----
    ENTER 'NO' OR 'N' IF YOU DONT WANT TO SAVE THE FILE. IF YOU DO SAVE A
    FILE, MAKE A NOTE OF THE FILENAME & TODAYS DATE FOR FUTURE REFERENCE!!!

TODAY IS 04/11/80 . IN TWO WEEKS, THESE FILES WILL BE ERASED UNLESS YOU
ISSUE THE 'RENEW' COMMAND FOR EACH FILE TO RENEW.
```

```
YOU ISSUE YOUR NEXT BUSLIN COMMAND ???
(ATTACH, BUSRUN, BUSINDEX, QUIT, LOG)
[illegible] 13:33:09
BUSRUN TRANSPO

DO YOU WISH TO REVIEW A TUTORIAL FOR TRANSPO ? ( YES OR NO )
NO

HAVE YOU CREATED YOUR DATA STATEMENTS YET? (YES,NO, OR HALT)
NO

PLEASE ENTER A REFERENCE NAME FOR THESE DATA STATEMENTS?
WAREHOUSE

ENTER YOUR DATA STATEMNTS ACCORDING TO THE GENERAL FORM:
    <STATEMENT NUMBER> DATA <VALUE 1>,<VALUE 2>.......<VALUE N>
                          .......ETC.......
THE PRECISE FORM IS PRESENTED IN THE TUTORIAL FOR THE PROGRAM IN QUESTION.
(NOTE: AFTER ALL DATA IS ENTERED YOU MUST ISSUE THE COMMAND <FILE> TO CONTINUE.)

NOW ENTER YOUR DATA STATEMENTS!!!
NEW FILE:
EDIT:
100 DATA 4
200 DATA 14
300 DATA 1604,546,2150,2150
400 DATA 397,331,253,211,182,154,135,112,106,103,86,80,2150,2150
500 DATA 500,500,500,500,500,500,500,500,500,500,500,500,33,70
600 DATA 500,500,500,500,500,500,500,500,500,500,500,500,82,0
700 DATA 141,29,22,344,326,321,83,114,71,322,152,22,0,82
800 DATA 109,78,61,390,395,361,159,141,0,389,159,96,82,0
FILE

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
1

                 A BASIC TRANSPORTATION PROGRAM

THROUGHOUT THE PROGRAM, YOU MAY ISSUE ONE OF THE
FOLLOWING CODE NUMBERS TO CONTROL EXECUTION OPTIONS:

    * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
       1     INSTRUCTIONS FOR DATA INPUT
       2     OPTIMIZE THE DATA ALREADY ENTERED
       3     PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
       4     PRINT THE COST MATRIX
       5     CHANGE THE NUMBER OF SOURCES
       6     CHANGE THE NUMBER OF DESTINATIONS
       7     CHANGE THE CAPACITY OF A SOURCE
       8     CHANGE THE REQUIREMENT OF A DESTINATION
       9     CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINTION
      10     STOP
WHICH OPTION DO YOU WANT?
2
```

NC #1

```
                    253
3       5           211
3       6           182
3       6           154
3       7           135
3       8           112
3       10          103
3       11          86
3       12          80
3       13          545
4       1           397
4       2           43
4       9           106
4       14          1604

TOTAL COST = $ 386078

WOULD YOU LIKE TO MODIFY THE CURRENT DATA AND/OR RUN AGAIN?
YES
WHAT OPTIONS (999 FOR OPTION LIST)?
999

1 INSTRUCTIONS FOR DATA INPUT
2 OPTIMIZE THE CURRENT DATA SET
3 PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
4 PRINT THE COST MATRIX
5 CHANGE THE NUMBER OF SOURCES
6 CHANGE THE NUMBER OF DESTINATIONS
7 CHANGE THE CAPACITY OF A SOURCE
8 CHANGE THE REQUIREMENT OF A DESTINATION
9 CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINATION
10 STOP

OPTION?
10

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
3

JUST RE-TYPE THE LINE NUMBER WHICH YOU WISH TO CHANGE OR USE STANDARD CMS EDIT
COMMANDS. WHEN YOU'RE FINISHED WITH ALL CHANGES TYPE 'FILE'.
EDIT:
400 DATA 1604,1624,3224,3224
400 DATA 595,496,379,317,273,231,203,168,159,155,130,121,3224,3224
FILE

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
1

                    A BASIC TRANSPORTATION PROGRAM
```

NC #1

NC #7

```
 5      PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
 6      PRINT THE COST MATRIX
 5      CHANGE THE NUMBER OF SOURCES
 6      CHANGE THE NUMBER OF DESTINATIONS
 7      CHANGE THE CAPACITY OF A SOURCE
 8      CHANGE THE REQUIREMENT OF A DESTINATION
 9      CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINTION
 10     STOP
WHICH OPTION DO YOU WANT?
2

   FINAL DISTRIBUTION

SOURCE DESTINATION     UNITS

   1          13          1604
   2          14          1623
   3          3           304
   3          4           317
   3          5           273
   3          6           231
   3          7           203
   3          10          155
   3          12          121
   3          13          1520
   4          1           595
   4          2           496
   4          3           75
   4          8           168
   4          9           159
   4          11          130
   4          14          1601

TOTAL COST = $ 553714

WOULD YOU LIKE TO MODIFY THE CURRENT DATA AND/OR RUN AGAIN?
YES
WHAT OPTION? (999 FOR OPTION LIST')?
10

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
3

JUST RE-TYPE THE LINE NUMBER WHICH YOU WISH TO CHANGE OR USE STANDARD CMS EDIT
COMMANDS. WHEN YOU'RE FINISHED WITH ALL CHANGES TYPE 'FILE'.
EDIT:
300 DATA 1604,2695,4300,4300
400 DATA 793,661,506,422,363,307,270,224,213,206,173,161,4300,4300
FILE

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
1
```

```
 2      OPTIMIZE THE DATA ALREADY ENTERED
 3      PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
 4      PRINT THE COST MATRIX
 5      CHANGE THE NUMBER OF SOURCES
 6      CHANGE THE NUMBER OF DESTINATIONS
 7      CHANGE THE CAPACITY OF A SOURCE
 8      CHANGE THE REQUIREMENT OF A DESTINATION
 9      CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINATION
10.     STOP
WHICH OPTION DO YOU WANT?
2

   FINAL DISTRIBUTION

SOURCE DESTINATION    UNITS

  1          13         1604
  2          14         2695
  3          4           422
  3          5           363
  3          6           182
  3          7           270
  3          10          206
  3          12          141
  3          13         2696
  4          1           793
  4          2           661
  4          3           506
  4          6           125
  4          8           224
  4          9           213
  4          11          173
  4          14         1605

TOTAL COST = $ 740221

WOULD YOU LIKE TO MODIFY THE CURRENT DATA AND/OR RUN AGAIN?
YES
WHAT OPTION? (999 FOR OPTION LIST)?
YES
IGG45S I-ME  1130: INVALID DATA..RETRY
10

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
3

JUST RETYPE THE LINE NUMBER WHICH YOU WISH TO CHANGE OR USE STANDARD CMS EDIT
COMMANDS. WHEN YOU'RE FINISHED WITH ALL CHANGES TYPE 'FILE'.
EDIT:
500 DATA 500.500.500.500.500.500.500.500.500.500.500.500.33.141
600 DATA 500.550.500.500.500.500.500.500.500.500.500.500.82.99
700 DATA 141.99.22.344.326.321.83.114.71.322.152.22.0.82
```

M #3

```
4 PRINT THE CONTENTS OF VARIABLES
5 CHANGE THE CONTENTS OF VARIABLES
6 START OVER THE BEGINNING
0 STOP EXECUTION

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
?

100 DATA 4
200 DATA 14
300 DATA 1604,2695,4300,4300
400 DATA 783,661,506,422,363,307,270,224,213,205,173,161,4300,4300
500 DATA 500,500,500,500,500,500,500,500,500,500,500,500,33,141
600 DATA 500,550,500,500,500,500,500,500,500,500,500,500,92,89
700 DATA 141,89,22,344,326,321,83,114,71,322,152,22,0,82
900 DATA 22,165,120,344,374,302,174,224,87,359,91,129,129,0

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
3

JUST RE-TYPE THE LINE NUMBER WHICH YOU WISH TO CHANGE OR USE STANDARD CMS EDIT
COMMANDS. WHEN YOU'RE FINISHED WITH ALL CHANGES TYPE 'FILE'.
EDIT:
700 DATA 141,89,22,344,326,321,83,114,71,322,152,22,0,128
FILE

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
1

                A BASIC TRANSPORTATION PROGRAM

THROUGHOUT THE PROGRAM, YOU MAY ISSUE ONE OF THE
FOLLOWING CODE NUMBERS TO CONTROL EXECUTION OPTIONS:

* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
      1     INSTRUCTIONS FOR DATA INPUT
      2     OPTIMIZE THE DATA ALREADY ENTERED
      3     PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
      4     PRINT THE COST MATRIX
      5     CHANGE THE NUMBER OF SOURCES
      6     CHANGE THE NUMBER OF DESTINATIONS
      7     CHANGE THE CAPACITY OF A SOURCE
      8     CHANGE THE REQUIREMENT OF A DESTINATION
      9     CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINTION
     10     STOP
WHICH OPTION DO YOU WANT?
?

   FINAL DISTRIBUTION

SOURCE DESTINATION    UNITS
```

M#3

[illegible]	[illegible]	[illegible]
[illegible]	5	[illegible]
[illegible]	6	[illegible]
[illegible]	7	270
[illegible]	9	226
[illegible]	[illegible]	213
3	10	206
3	12	161
3	13	1274
4	1	703
4	6	307
4	11	173
4	14	3027

```
TOTAL COST = $ 975146

WOULD YOU LIKE TO MODIFY THE CURRENT DATA AND/OR RUN AGAIN?
YES
WHAT OPTION? (999 FOR OPTION LIST)?
10

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
?

JUST RE-TYPE THE LINE NUMBER WHICH YOU WISH TO CHANGE OR USE STANDARD CMS EDIT
COMMANDS. WHEN YOU'RE FINISHED WITH ALL CHANGES TYPE 'FILE'.
EDIT:
300 DATA 1604,546,2150,2150
400 DATA 397,331,253,211,182,154,135,112,106,103,86,80,2150,2150     M#1
FILE

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
1

                'A BASIC TRANSPORTATION PROGRAM

THROUGHOUT THE PROGRAM, YOU MAY ISSUE ONE OF THE
FOLLOWING CODE NUMBERS TO CONTROL EXECUTION OPTIONS:

    * * * * * * * * * * * * * * * * * * * * * * * * * * *
          1      INSTRUCTIONS FOR DATA INPUT
          2      OPTIMIZE THE DATA ALREADY ENTERED
          3      PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
          4      PRINT THE COST MATRIX
          5      CHANGE THE NUMBER OF SOURCES
          6      CHANGE THE NUMBER OF DESTINATIONS
          7      CHANGE THE CAPACITY OF A SOURCE
          8      CHANGE THE REQUIREMENT OF A DESTINATION
          9      CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINTION
         10.     STOP
WHICH OPTION DO YOU WANT?
2

   FINAL DISTRIBUTION
```

2	5	211
2	6	142
2	7	135
3	8	112
3	9	104
3	10	103
3	12	90
3	13	546
4	1	307
4	5	63
4	11	86
4	14	1604

M#1

TOTAL COST = $ 399600

WOULD YOU LIKE TO MODIFY THE CURRENT DATA AND/OR RUN AGAIN?
YES
WHAT OPTION? (999 FOR OPTION LIST)?
10

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
3

JUST RE-TYPE THE LINE NUMBER WHICH YOU WISH TO CHANGE OR USE STANDARD CMS EDIT
COMMANDS. WHEN YOU'RE FINISHED WITH ALL CHANGES TYPE 'FILE'.
EDIT:
300
300 DATA 1604,546,2150,2150
FILE

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
3

JUST RE-TYPE THE LINE NUMBER WHICH YOU WISH TO CHANGE OR USE STANDARD CMS EDIT
COMMANDS. WHEN YOU'RE FINISHED WITH ALL CHANGES TYPE 'FILE'.
EDIT:
300 DATA 1604,1623,3224,3224
400 DATA 595,496,379,317,273,231,203,168,159,155,130,121,3224,3224
FILE

M#2

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
1

A BASIC TRANSPORTATION PROGRAM

THROUGHOUT THE PROGRAM, YOU MAY ISSUE ONE OF THE
FOLLOWING CODE NUMBERS TO CONTROL EXECUTION OPTIONS:

* *

1 INSTRUCTIONS FOR DATA INPUT
2 OPTIMIZE THE DATA ALREADY ENTERED
3 PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?

A BASIC TRANSPORTATION PROGRAM

THROUGHOUT THE PROGRAM, YOU MAY ISSUE ONE OF THE
FOLLOWING CODE NUMBERS TO CONTROL EXECUTION OPTIONS:

* *

1	INSTRUCTIONS FOR DATA INPUT
2	OPTIMIZE THE DATA ALREADY ENTERED
3	PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
4	PRINT THE COST MATRIX
5	CHANGE THE NUMBER OF SOURCES
6	CHANGE THE NUMBER OF DESTINATIONS
7	CHANGE THE CAPACITY OF A SOURCE
8	CHANGE THE REQUIREMENT OF A DESTINATION
9	CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINTION
10	STOP

WHICH OPTION DO YOU WANT?
2

FINAL DISTRIBUTION

SOURCE	DESTINATION	UNITS
1	13	1504
2	13	557
2	14	954
3	2	496
3	3	379
3	4	317
3	5	273
3	7	203
3	8	168
3	9	159
3	10	155
3	12	121
3	13	953
4	1	595
4	6	231
4	11	130
4	14	2268

TOTAL COST = $ 637782

WOULD YOU LIKE TO MODIFY THE CURRENT DATA AND/OR RUN AGAIN?
YES
WHAT OPTION? (0OR FOR OPTION LIST)?
10

```
[illegible].135.112.106.103.86.40.2150.2150
[illegible] DATA [illegible].500.500.500.500.500.500.33.178
601 DATA 500.500.500.500.500.500.500.500.500.500.500.500.82.158
501 DATA 500.500.500.500.500.500.500.500.500.500.500.500.0.152
700 DATA 141.89.22.344.326.321.83.114.71.322.152.22.0.152
800 DATA 76.222.152.257.302.213.150.261.158.277.0.139.152.0
FILE

PLEASE ENTER THE NUMBER OF YOUR OPTION 1.2.3.4.9 OR HELP?
1

                    A BASIC TRANSPORTATION PROGRAM

THROUGHOUT THE PROGRAM, YOU MAY ISSUE ONE OF THE
FOLLOWING CODE NUMBERS TO CONTROL EXECUTION OPTIONS:

    * * * * * * * * * * * * * * * * * * * * * * * * * *
         1       INSTRUCTIONS FOR DATA INPUT
         2       OPTIMIZE THE DATA ALREADY ENTERED
         3       PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
         4       PRINT THE COST MATRIX
         5       CHANGE THE NUMBER OF SOURCES
         6       CHANGE THE NUMBER OF DESTINATIONS
         7       CHANGE THE CAPACITY OF A SOURCE
         8       CHANGE THE REQUIREMENT OF A DESTINATION
         9       CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINTION
        10       STOP
WHICH OPTION DO YOU WANT?
2

   FINAL DISTRIBUTION

SOURCE DESTINATION      UNITS

   1        13         1604
   2        13         95
   2        14         451
   3        1          397
   3        2          331
   3        3          253
   3        5          182
   3        7          135
   3        8          112
   3        9          106
   3        10         103
   3        12         80
   3        13         451
   4        4          211
   4        6          154
   4        11         86
   4        14         1699

TOTAL COST = $ 435768
```

D #1

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?

JUST RE-TYPE THE LINE NUMBER WHICH YOU WISH TO CHANGE OR USE STANDARD CMS EDIT
COMMANDS. WHEN YOU'RE FINISHED WITH ALL CHANGES TYPE 'FILE'.
EDIT:
500 DATA 503.500.550.550.500.500.500.500.500.500.500.500.33.213
600 DATA 501.500.500.500.500.500.500.500.500.500.500.500.92.228
700 DATA 141.90.22.344.326.321.83.114.71.322.152.22.0.181
800 DATA 185.269.199.163.187.144.119.295.231.155.113.161.191.0
FILE

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
1

A BASIC TRANSPORTATION PROGRAM

THROUGHOUT THE PROGRAM, YOU MAY ISSUE ONE OF THE
FOLLOWING CODE NUMBERS TO CONTROL EXECUTION OPTIONS:

* *

1	INSTRUCTIONS FOR DATA INPUT
2	OPTIMIZE THE DATA ALREADY ENTERED
3	PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
4	PRINT THE COST MATRIX
5	CHANGE THE NUMBER OF SOURCES
6	CHANGE THE NUMBER OF DESTINATIONS
7	CHANGE THE CAPACITY OF A SOURCE
8	CHANGE THE REQUIREMENT OF A DESTINATION
9	CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINTION
10	STOP

WHICH OPTION DO YOU WANT?
2

FINAL DISTRIBUTION

SOURCE	DESTINATION	UNITS
1	13	1604
2	13	78
2	14	468
3	1	397
3	2	331
3	3	253
3	5	182
3	7	126
3	9	112
3	0	106
3	11	85
3	12	80
3	13	468
4	4	211
4	6	154
4	10	103

```
DO YOU WANT TO SEE THE OPTION LIST?
YES
PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
3
JUST RE-TYPE THE LINE NUMBER WHICH YOU WISH TO CHANGE OR USE STANDARD CMS EDIT
COMMANDS. WHEN YOU'RE FINISHED WITH ALL CHANGES TYPE 'FILE'.
EDIT:
500 DATA 503.500.500.500.500.500.500.500.500.500.500.500.33.97
600 DATA 500.500.500.500.500.500.500.500.500.500.500.500.82.96
700 DATA 141.99.22.344.326.321.83.114.71.322.152.22.0.59
800 DATA 100.130.67.298.302.270.78.172.96.291.91.45.59.0
FILE

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
1

                    A BASIC TRANSPORTATION PROGRAM

THROUGHOUT THE PROGRAM, YOU MAY ISSUE ONE OF THE
FOLLOWING CODE NUMBERS TO CONTROL EXECUTION OPTIONS:

      * * * * * * * * * * * * * * * * * * * * * * * * * * * *
            1     INSTRUCTIONS FOR DATA INPUT
            2     OPTIMIZE THE DATA ALREADY ENTERED
            3     PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
            4     PRINT THE COST MATRIX
            5     CHANGE THE NUMBER OF SOURCES
            6     CHANGE THE NUMBER OF DESTINATIONS
            7     CHANGE THE CAPACITY OF A SOURCE
            8     CHANGE THE REQUIREMENT OF A DESTINATION
            9     CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINTION
           10     STOP
WHICH OPTION DO YOU WANT?
2

   FINAL DISTRIBUTION

SOURCE DESTINATION    UNITS

   1          13        1404
   2          14         546
   3           1         302
   3           2         331
   3           3         253
   3           5         182
   3           7         135
   3           8         112
   3           9         106
   3          10         103
   3          12          80
   3          13         546
```

WOULD YOU LIKE TO MODIFY THE CURRENT DATA AND/OR RUN AGAIN?
YES
WHAT OPTION? (999 FOR OPTION LIST)?
10

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
3

JUST RE-TYPE THE LINE NUMBER WHICH YOU WISH TO CHANGE OR USE STANDARD CMS EDIT
COMMANDS. WHEN YOU'RE FINISHED WITH ALL CHANGES TYPE 'FILE'.
EDIT:
500 DATA 500,500,500,500,500,500,500,500,500,500,500,500,33,38
600 DATA 500,500,500,500,500,500,500,500,500,500,500,500,82,57
700 DATA 141,89,22,344,326,321,83,114,71,322,152,22,0,26
800 DATA 120,85,16,348,341,322,102,126,78,337,139,26,26,0
FILE

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
1

A BASIC TRANSPORTATION PROGRAM

THROUGHOUT THE PROGRAM, YOU MAY ISSUE ONE OF THE
FOLLOWING CODE NUMBERS TO CONTROL EXECUTION OPTIONS:

* *

1 INSTRUCTIONS FOR DATA INPUT
2 OPTIMIZE THE DATA ALREADY ENTERED
3 PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
4 PRINT THE COST MATRIX
5 CHANGE THE NUMBER OF SOURCES
6 CHANGE THE NUMBER OF DESTINATIONS
7 CHANGE THE CAPACITY OF A SOURCE
8 CHANGE THE REQUIREMENT OF A DESTINATION
9 CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINTION
10 STOP

WHICH OPTION DO YOU WANT?
2

FINAL DISTRIBUTION

SOURCE	DESTINATION	UNITS
1	13	1414
1	14	190
2	14	565
3	2	331
3	4	211
3	5	182
3	6	154
3	7	135

```
     3          1          253
     4          11         45
     5          14         1414

TOTAL COST = $ 425880

WOULD YOU LIKE TO MODIFY THE CURRENT DATA AND/OR RUN AGAIN?
NO

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
HELP
THE FOLLOWING OPTIONS ARE AVAILABLE:
1 EXECUTE TRANSPO USING WAREHOUS
2 PRINT THE CONTENTS OF WAREHOUS
3 CHANGE THE CONTENTS OF WAREHOUS
4 START FROM THE BEGINNING
9 STOP EXECUTION

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
9

 NOW PLEASE SPECIFY YOUR NEXT BUSLIB COMMAND?????
(EITHER: BUSRUN, BUSINDEX, QUIT, LOG)
R; T=7.67/16.14 14:29:27
LOG
GOODBYE, IT'S BEEN NICE WORKING WITH YOU.
PUN FILE 3094  TO  ASSBA001 COPY 01 NOHOLD
CONNECT= 00:57:16 VIRTCPU= 000:07.88 TOTCPU= 000:16.92
LOGOFF AT 14:29:37 EDT THURSDAY 11/08/79
```

```
NOW ISSUE YOUR NEXT BUSLIB COMMAND ???
(LETTER=, BUSDIM, BUSINDEX, RENEW, SAVEFILE, QUIT, LOG)
?: T-0,22/0.49 17:10:24
  BUSDIM

 PLEASE SPECIFY THE NAME OF THE PROGRAM YOU WISH TO EXECUTE. ENTER 'STAT' FOR ANY
STAT/BASIC PROGRAMS. ENTER 'HALT' TO STOP.

NOW WHAT DO YOU WISH TO DO ?
  TRANSPO

DO YOU WISH TO REVIEW A TUTORIAL FOR TRANSPO ? ( YES OR NO )
  NO

HAVE YOU CREATED YOUR DATA STATEMENTS YET? (YES,NO, OR HALT)
  NO

PLEASE ENTER A REFERENCE NAME FOR THESE DATA STATEMENTS?
  WAREHOUSE

 ENTER YOUR DATA STATEMNTS ACCORDING TO THE GENERAL FORM:
    <STATEMENT NUMBER> DATA <VALUE 1>,<VALUE 2>,.....<VALUE N>
                          .....ETC.....
 THE PRECISE FORM IS PRESENTED IN THE TUTORIAL FOR THE PROGRAM IN QUESTION.
(NOTE: AFTER ALL DATA IS ENTERED YOU MUST ISSUE THE COMMAND <FILE> TO CONTINUE.)

NOW ENTER YOUR DATA STATEMENTS!!!
NEW FILE:
EDIT:
  100 DATA 4
  200 DATA 14
  300 DATA 1604,546,2150,2150
  400 DATA 397,331,253,211,182,154,135,112,106,103,86,80,2150,2150
  500 DATA 500,500,500,500,500,500,500,500,500,500,500,500,33,356
  600 DATA 500,500,500,500,500,500,500,500,500,500,500,500,83,361
  700 DATA 141,89,22,344,326,321,83,114,71,322,152,22,0,328
  800 DATA 287,409,339,60,185,0,263,428,353,141,211,305,328,0
  FILE

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
  1

                    A BASIC TRANSPORTATION PROGRAM

THROUGHOUT THE PROGRAM, YOU MAY ISSUE ONE OF THE
FOLLOWING CODE NUMBERS TO CONTROL EXECUTION OPTIONS:

     * * * * * * * * * * * * * * * * * * * * * * * * * * * *
          1      INSTRUCTIONS FOR DATA INPUT
          2      OPTIMIZE THE DATA ALREADY ENTERED
          3      PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
          4      PRINT THE COST MATRIX
          5      CHANGE THE NUMBER OF SOURCES
```

```
         CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINATION
    10   STOP
WHICH OPTION DO YOU WANT?

   FINAL DISTRIBUTION

 SOURCE DESTINATION    UNITS

   1         13         1604
   2         13          181
   2         14          355
   3          1          397
   3          2          331
   3          3          253
   3          5          182
   3          7          135
   3          8          112
   3          9          106
   3         10          103
   3         11           86
   3         12           80
   3         13          365
   4          4          211
   4          6          154
   4         14         1785

TOTAL COST = $ 442030

WOULD YOU LIKE TO MODIFY THE CURRENT DATA AND/OR RUN AGAIN?
  YES
WHAT OPTION? (999 FOR OPTION LIST)?
  10

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
  3

JUST RE-TYPE THE LINE NUMBER WHICH YOU WISH TO CHANGE OR USE STANDARD CMS EDIT
COMMANDS. WHEN YOU'RE FINISHED WITH ALL CHANGES TYPE 'FILE'.
EDIT:
  500 DATA 500,550,500,500,500,500,500,500,500,500,500,500,33,372
  600 DATA 500,500,500,500,500,500,500,500,500,500,500,500,82,392
  700 DATA 141,89,22,344,326,321,83,114,71,322,152,22,0,341
  800 DATA 331,426,359,0,135,60,272,439,391,89,254,320,341,0
  FILE

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
  1

                    A BASIC TRANSPORTATION PROGRAM

THROUGHOUT THE PROGRAM, YOU MAY ISSUE ONE OF THE
FOLLOWING CODE NUMBERS TO CONTROL EXECUTION OPTIONS:

    * * * * * * * * * * * * * * * * * * * * * * * * * * *
          1      INSTRUCTIONS FOR DATA INPUT
```

9 CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINTION
10 STOP

WHICH OPTION DO YOU WANT?
2

FINAL DISTRIBUTION

SOURCE	DESTINATION	UNITS
1	13	1604
2	13	335
2	14	211
3	1	397
3	2	331
3	3	253
3	5	182
3	6	154
3	7	135
3	8	112
3	9	106
3	10	103
3	11	86
3	12	80
3	13	211
4	4	211
4	14	1939

TOTAL COST = $ 442379

WOULD YOU LIKE TO MODIFY THE CURRENT DATA AND/OR RUN AGAIN?
YES
WHAT OPTIONS (999 FOR OPTION LIST)?
10

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
3

JUST RE-TYPE THE LINE NUMBER WHICH YOU WISH TO CHANGE OR USE STANDARD CMS EDIT
COMMANDS. WHEN YOU'RE FINISHED WITH ALL CHANGES TYPE 'FILE'.
EDIT:
500 DATA 500,500,500,500,500,500,500,500,500,500,500,33,157
600 DATA 500,500,500,500,500,500,500,500,500,500,500,82,109
700 DATA 141,89,22,344,326,321,83,114,71,322,152,22,0,144
800 DATA 0,178,135,335,370,291,185,241,109,350,76,141,144,0
FILE

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
1

A BASIC TRANSPORTATION PROGRAM

THROUGHOUT THE PROGRAM, YOU MAY ISSUE ONE OF THE

```
 4      PRINT THE COST MATRIX
 5      CHANGE THE NUMBER OF SOURCES
 6      CHANGE THE NUMBER OF DESTINATIONS
 7      CHANGE THE CAPACITY OF A SOURCE
 8      CHANGE THE REQUIREMENT OF A DESTINATION
 9      CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINATION
10      STOP
WHICH OPTION DO YOU WANT?
 2

   FINAL DISTRIBUTION

SOURCE DESTINATION    UNITS

 1          13          1604
 2          14           546
 3           2           331
 3           3           253
 3           4           211
 3           5           182
 3           6            91
 3           7           135
 3           8           112
 3           9           106
 3          10           103
 3          12            80
 3          13           546
 4           1           397
 4           6            63
 4          11            86
 4          14          1604

TOTAL COST = $ 39892


WOULD YOU LIKE TO MODIFY THE CURRENT DATA AND/OR RUN AGAIN?
 YES
WHAT OPTION? (999 FOR OPTION LIST)?
 10

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
 3

JUST RE-TYPE THE LINE NUMBER WHICH YOU WISH TO CHANGE OR USE STANDARD CMS EDIT
COMMANDS. WHEN YOU'RE FINISHED WITH ALL CHANGES TYPE 'FILE'.
EDIT:
 500 DATA 500,500,500,500,500,500,500,500,500,500,500,500,33,91
 600 DATA 500,500,500,500,500,500,500,500,500,500,500,500,82,36
 700 DATA 141,89,22,344,326,321,93,114,71,322,152,22,0,89
 800 DATA 69,113,73,365,381,335,154,174,37,369,124,96,89,0
 FILE

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
 1
```

```
* * * * * * * * * * * * * * * * * * * * * * * * * *
     1     INSTRUCTIONS FOR DATA INPUT
     2     OPTIMIZE THE DATA ALREADY ENTERED
     3     PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
     4     PRINT THE COST MATRIX
     5     CHANGE THE NUMBER OF SOURCES
     6     CHANGE THE NUMBER OF DESTINATIONS
     7     CHANGE THE CAPACITY OF A SOURCE
     8     CHANGE THE REQUIREMENT OF A DESTINATION
     9     CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINTION
    10     STOP
WHICH OPTION DO YOU WANT?
 2

  FINAL DISTRIBUTION

 SOURCE-DESTINATION    UNITS

   1       13          1604
   2       14           546
   3        2           331
   3        3           253
   3        4           211
   3        5           182
   3        6           154
   3        7           135
   3        8           112
   3       10           103
   3       11            43
   3       12            80
   3       13           546
   4        1           397
   4        9           106
   4       11            43
   4       14          1604

 TOTAL COST = $ 391045

WOULD YOU LIKE TO MODIFY THE CURRENT DATA AND/OR RUN AGAIN?
 YES
WHAT OPTION? (999 FOR OPTION LIST)?
 10

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
 3

JUST RE-TYPE THE LINE NUMBER WHICH YOU WISH TO CHANGE OR USE STANDARD CMS EDIT
COMMANDS. WHEN YOU'RE FINISHED WITH ALL CHANGES TYPE 'FILE'.
EDIT:
  500 DATA 500,500,500,500,500,500,500,500,500,500,500,500,33,65
  600 DATA 500,500,500,500,500,500,500,500,500,500,500,500,82,30
  700 DATA 141,89,22,344,326,321,83,114,71,322,152,22,0,65
  800 DATA 91,91,46,382,37,332,135,148,30,359,131,72,65,0
```

A BASIC TRANSPORTATION ...

THROUGHOUT THE PROGRAM. YOU MAY ISSUE ONE OF THE
FOLLOWING CODE NUMBERS TO CONTROL EXECUTION OPTIONS:

* *

1 INSTRUCTIONS FOR DATA INPUT
2 OPTIMIZE THE DATA ALREADY ENTERED
3 PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
4 PRINT THE COST MATRIX
5 CHANGE THE NUMBER OF SOURCES
6 CHANGE THE NUMBER OF DESTINATIONS
7 CHANGE THE CAPACITY OF A SOURCE
8 CHANGE THE REQUIREMENT OF A DESTINATION
9 CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINTION
10 STOP

WHICH OPTION DO YOU WANT?
2

FINAL DISTRIBUTION

SOURCE	DESTINATION	UNITS
1	13	1465
1	14	139
2	14	546
3	2	331
3	3	253
3	4	211
3	5	154
3	7	135
3	8	112
3	10	103
3	11	86
3	12	80
3	13	585
4	1	397
4	5	182
4	9	106
4	14	1465

TOTAL COST = $ 348815

WOULD YOU LIKE TO MODIFY THE CURRENT DATA AND/OR RUN AGAIN?
YES
WHAT OPTION? (999 FOR OPTION LIST)?
10

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
3

JUST RE-TYPE THE LINE NUMBER WHICH YOU WISH TO CHANGE OR USE STANDARD CMS EDIT
COMMANDS. WHEN YOU'RE FINISHED WITH ALL CHANGES TYPE 'FILE'.
EDIT:

```
PLEASE ENTER THE NUMBER OF YOUR OPTION 1.2.3.4.9 OR HELP?
 1

                    A BASIC TRANSPORTATION PROGRAM

 THROUGHOUT THE PROGRAM, YOU MAY ISSUE ONE OF THE
 FOLLOWING CODE NUMBERS TO CONTROL EXECUTION OPTIONS:

 * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
          1      INSTRUCTIONS FOR DATA INPUT
          2      OPTIMIZE THE DATA ALREADY ENTERED
          3      PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
          4      PRINT THE COST MATRIX
          5      CHANGE THE NUMBER OF SOURCES
          6      CHANGE THE NUMBER OF DESTINATIONS
          7      CHANGE THE CAPACITY OF A SOURCE
          8      CHANGE THE REQUIREMENT OF A DESTINATION
          9      CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINTION
         10      STOP
WHICH OPTION DO YOU WANT?
 2

   FINAL DISTRIBUTION

 SOURCE DESTINATION    UNITS

   1          13          1604
   2          14           546
   3           2           331
   3           3           253
   3           4           211
   3           5           182
   3           6            91
   3           7           135
   3           8           112
   3           9           106
   3          10           103
   3          12            80
   3          13           546
   4           1           397
   4           6            63
   4          11            86
   4          14          1604

 TOTAL COST = $ 405107


 WOULD YOU LIKE TO MODIFY THE CURRENT DATA AND/OR RUN AGAIN?
  YES
 WHAT OPTION? (999 FOR OPTION LIST)?
  10

 PLEASE ENTER THE NUMBER OF YOUR OPTION 1.2.3.4.9 OR HELP?
  3
```

```
700 DATA 141,89,22,344,326,321,93,1[illegible]
800 DATA 185,0,70,431,407,409,165,67,76,409,222,109,87,0
END

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
  1

                    A BASIC TRANSPORTATION PROGRAM

THROUGHOUT THE PROGRAM, YOU MAY ISSUE ONE OF THE
FOLLOWING CODE NUMBERS TO CONTROL EXECUTION OPTIONS:

    * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
          1     INSTRUCTIONS FOR DATA INPUT
          2     OPTIMIZE THE DATA ALREADY ENTERED
          3     PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
          4     PRINT THE COST MATRIX
          5     CHANGE THE NUMBER OF SOURCES
          6     CHANGE THE NUMBER OF DESTINATIONS
          7     CHANGE THE CAPACITY OF A SOURCE
          8     CHANGE THE REQUIREMENT OF A DESTINATION
          9     CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINTION
         10     STOP
WHICH OPTION DO YOU WANT?
  2

  FINAL DISTRIBUTION

SOURCE DESTINATION     UNITS

   1        13          1604
   2        14           546
   3         1           397
   3         3           253
   3         4           211
   3         5           182
   3         6           154
   3         7           135
   3         9             3
   3        10           103
   3        11            86
   3        12            80
   3        13           546
   4         2           331
   4         8           112
   4         9           103
   4        14          1604

TOTAL COST = $ 412069

WOULD YOU LIKE TO MODIFY THE CURRENT DATA AND/OR RUN AGAIN?
  YES
WHAT OPTION? (999 FOR OPTION LIST)?
```

```
COMMANDS. WHEN YOU'RE FINISHED WITH ONE, TYPE
EDIT:
 500 DATA 500,500,500,500,500,500,500,500,500,500,500,500,500,33,56
 600 DATA 500,500,500,500,500,500,500,500,500,500,500,500,500,82,44
 700 DATA 141,89,22,344,326,321,83,114,71,322,152,22,0,80
 800 DATA 152,35,54,413,406,389,163,102,43,402,193,100,80,0
 FILE

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
 !

                    A BASIC TRANSPORTATION PROGRAM

THROUGHOUT THE PROGRAM, YOU MAY ISSUE ONE OF THE
FOLLOWING CODE NUMBERS TO CONTROL EXECUTION OPTIONS:

      * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
          1     INSTRUCTIONS FOR DATA INPUT
          2     OPTIMIZE THE DATA ALREADY ENTERED
          3     PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
          4     PRINT THE COST MATRIX
          5     CHANGE THE NUMBER OF SOURCES
          6     CHANGE THE NUMBER OF DESTINATIONS
          7     CHANGE THE CAPACITY OF A SOURCE
          8     CHANGE THE REQUIREMENT OF A DESTINATION
          9     CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINTION
         10     STOP
WHICH OPTION DO YOU WANT?
 2

   FINAL DISTRIBUTION

SOURCE DESTINATION    UNITS

  1          13          1604
  2          14          546
  3          1           397
  3          3           253
  3          4           211
  3          5           182
  3          6           154
  3          7           135
  3          8           3
  3          10          103
  3          11          86
  3          12          80
  3          13          546
  4          2           331
  4          8           109
  4          9           106
  4          14          1604

TOTAL COST = $ 406655
```

```
PLEASE ENTER THE NUMBER OF YOUR OPTION 1.2.3.4.9 OR HELP?
 4

 MUST RE-TYPE THE LINE NUMBER WHICH YOU WISH TO CHANGE OR USE STANDARD CMS EDIT
 COMMANDS. WHEN YOU'RE FINISHED WITH ALL CHANGES TYPE 'FILE'.
 EDIT:
  500 DATA 500.500.500.500.500.500.500.500.500.500.500.500.33.32
  600 DATA 500.500.500.500.500.500.500.500.500.500.500.500.82.39
  700 DATA 141.89.22.344.326.321.33.114.71.322.153.22.0.46
  800 DATA 128.63.21.37.367.352.128.113.39.363.158.61.46.0
  FILE

PLEASE ENTER THE NUMBER OF YOUR OPTION 1.2.3.4.9 OR HELP?
 1

                    A BASIC TRANSPORTATION PROGRAM

THROUGHOUT THE PROGRAM, YOU MAY ISSUE ONE OF THE
FOLLOWING CODE NUMBERS TO CONTROL EXECUTION OPTIONS:

 * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
       1     INSTRUCTIONS FOR DATA INPUT
       2     OPTIMIZE THE DATA ALREADY ENTERED
       3     PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
       4     PRINT THE COST MATRIX
       5     CHANGE THE NUMBER OF SOURCES
       6     CHANGE THE NUMBER OF DESTINATIONS
       7     CHANGE THE CAPACITY OF A SOURCE
       8     CHANGE THE REQUIREMENT OF A DESTINATION
       9     CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINTION
      10     STOP
WHICH OPTION DO YOU WANT?
 2

  FINAL DISTRIBUTION

SOURCE DESTINATION    UNITS

   1          13        740
   1          14        864
   2          14        546
   3          5         182
   3          6         154
   3          7         135
   3          10        103
   3          11        86
   3          12        80
   3          13        1410
   4          1         397
   4          2         331
   4          3         253
   4          4         211
   4          8         112
   4          9         106
```

```
YES
WHAT OPTIONS (999 FOR OPTION LIST)?
 10

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
 3

JUST RE-TYPE THE LINE NUMBER WHICH YOU WISH TO CHANGE OR USE STANDARD CMS EDIT
COMMANDS. WHEN YOU'RE FINISHED WITH ALL CHANGES TYPE 'FILE'.
EDIT:
 500 DATA 500,500,500,500,500,500,500,500,500,500,500,500,33,109
 600 DATA 500,500,500,500,500,500,500,500,500,500,500,500,83,39
 700 DATA 141,89,22,344,326,321,83,114,71,322,152,22,0,113
 800 DATA 91,108,96,400,415,367,189,176,39,404,157,126,113,0
 FILE

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
 1

                    A BASIC TRANSPORTATION PROGRAM

THROUGHOUT THE PROGRAM, YOU MAY ISSUE ONE OF THE
FOLLOWING CODE NUMBERS TO CONTROL EXECUTION OPTIONS:

      * * * * * * * * * * * * * * * * * * * * * * * * * * * *
           1      INSTRUCTIONS FOR DATA INPUT
           2      OPTIMIZE THE DATA ALREADY ENTERED
           3      PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
           4      PRINT THE COST MATRIX
           5      CHANGE THE NUMBER OF SOURCES
           6      CHANGE THE NUMBER OF DESTINATIONS
           7      CHANGE THE CAPACITY OF A SOURCE
           8      CHANGE THE REQUIREMENT OF A DESTINATION
           9      CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINTION
          10      STOP
WHICH OPTION DO YOU WANT?
 2

   FINAL DISTRIBUTION

SOURCE DESTINATION    UNITS

   1          13        1604
   2          14         546
   3           2         331
   3           3         253
   3           4         211
   3           5         182
   3           6         154
   3           7         135
   3           8         112
   3          10         103
   3          11          43
   3          12          80
```

```
WOULD YOU LIKE TO MODIFY THE CURRENT DATA AND/OR RUN AGAIN?
  YES
WHAT OPTION? (999 FOR OPTION LIST)?
  10

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
  3

JUST RE-TYPE THE LINE NUMBER WHICH YOU WISH TO CHANGE OR USE STANDARD CMS EDIT
COMMANDS. WHEN YOU'RE FINISHED WITH ALL CHANGES TYPE 'FILE'.
EDIT:
  500 DATA 500,500,500,500,500,500,500,500,500,500,500,500,33,104
  600 DATA 500,500,500,500,500,500,500,500,500,500,500,500,82,60
  700 DATA 141,89,22,344,326,321,93,114,71,322,152,22,0,91
  800 DATA 52,132,84,343,365,309,148,189,60,350,97,96,91,0
  FILE

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
  1

                    A BASIC TRANSPORTATION PROGRAM

THROUGHOUT THE PROGRAM, YOU MAY ISSUE ONE OF THE
FOLLOWING CODE NUMBERS TO CONTROL EXECUTION OPTIONS:

      * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
           1      INSTRUCTIONS FOR DATA INPUT
           2      OPTIMIZE THE DATA ALREADY ENTERED
           3      PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
           4      PRINT THE COST MATRIX
           5      CHANGE THE NUMBER OF SOURCES
           6      CHANGE THE NUMBER OF DESTINATIONS
           7      CHANGE THE CAPACITY OF A SOURCE
           8      CHANGE THE REQUIREMENT OF A DESTINATION
           9      CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINTION
          10      STOP
WHICH OPTION DO YOU WANT?
  2

   FINAL DISTRIBUTION

SOURCE DESTINATION    UNITS

  1          13         1604
  2          14          546
  3           2          331
  3           3          253
  3           4          211
  3           5          182
  3           6           91
  3           7          135
```

```
                14          1604.

 TOTAL COST = $ 396722

 WOULD YOU LIKE TO MODIFY THE CURRENT DATA AND/OR RUN AGAIN?
   YES
 WHAT OPTION? (999 FOR OPTION LIST)?
   10

 PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
   3

 JUST RE-TYPE THE LINE NUMBER WHICH YOU WISH TO CHANGE OR USE STANDARD CMS EDIT
 COMMANDS. WHEN YOU'RE FINISHED WITH ALL CHANGES TYPE 'FILE'.
 EDIT:
   500 DATA 500,500,500,500,500,500,500,500,500,500,500,33,109
   600 DATA 500,500,500,500,500,500,500,500,500,500,500,82,87.
   700 DATA 141,89,22,344,326,321,83,114,71,322,152,22,0,87
   800 DATA 59,150,87,306,328,276,119,194,87,315,72,80,87,0
   FILE

 PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
   1
 IGD221 LINE   600: SYNTAX ERROR AT 7.

 A PROGRAM ERROR HAS OCCURED: I'LL CHECK THE AIDFILES AND SEE IF I CAN HELP.


          RUNAOB AIDFILE

 1. IF VSBASIC ERROR IGD264 WAS GENERATED YOUR DATA STATEMENT NUMBERS ARE
    MISPLACED. PLEASE CHECK THE TUTORIAL FOR THE PROGRAM IN QUESTION TO
    OBTAIN THE PROPER NUMBERS.

 2. IF VSBASIC ERROR IGD210 WAS GENERATED YOUR DATA STATEMENTS ARE NOT IN THE
    PROPER FORMAT. THE CORRECT FORMAT IS:
       <STATEMENT NUMBER> DATA <VALUE 1>,<VALUE 2>,.....<VALUE N>

 3. IF VSBASIC ERROR IGD419 WAS GENERATED YOU FAILED TO ENTER ENOUGH DATA FOR
    FOR THE PROGRAM IN QUESTION.

 BETTER LUCK NEXT TIME.


 NOW PLEASE SPECIFY YOUR NEXT BUSLIB COMMAND?????
 (EITHER: BUSRUN, BUSINDEX, RENEW, SAVEFILE, QUIT, LOG)
 R: T=8.76/17.89 18:08:04
   SAVEFILE
 WOULD YOU LIKE A TUTORIAL FOR SAVEFILE AND OTHER COMMANDS ? ( YES/NO )
   YES
```

THAT WILL PERMIT PEOPLE WHO DO NOT HAVE PERMANENT DISK SPACE (THAT IS,
MOST BUSLIB USERS WITH SC- OR EC- TYPE ACCOUNT NUMBERS) TO STORE FILES
THAT THEY CREATE FOR TWO WEEKS.

THIS FACILITY IS USEFUL FOR STORING DATA FILES CREATED OR USED BY THE
STAT/RUNNER FORECASTING PACKAGE, THE STAT/BASIC PACKAGE, OR PROGRAMS THAT
USE DATA STATEMENT INPUT. USERS MAY ALSO STORE THEIR OWN PROGRAMS (EXCEPT
EXECS OR MODULES) ON THIS LIBRARY DISK.

THE COMMANDS USED BY THIS SYSTEM ARE AS FOLLOWS:
SAVEFILE,RENEW,RETRIEVE.

THE SAVEFILE ROUTINE IS ALSO CALLED BY ISSUING THE QUIT OR LOG
COMMANDS.

C O M M A N D D E S C R I P T I O N

SAVEFILE: THIS COMMAND IS EITHER ISSUED MANUALLY, OR AUTOMATICALLY BY
THE QUIT OR LOG COMMANDS. FILES THAT ARE ELIGIBLE TO BE SAVED WILL
BE LISTED FOR YOU; AS EACH FILE IS LISTED, YOU WILL BE GIVEN
THE CHANCE TO SAVE THEM. ANSWER YES OR NO.

NOTE: IF YOUR FILE HAS THE SAME NAME AND TYPE AS AN EXISTING
FILE ON ONE OF THE BUSLIB RESIDENCE DISKS, YOU MUST RENAME IT.
YOU WILL BE TOLD WHICH ONES THESE ARE. ALSO, IF THERE IS A
COPY ON THE LIBRARY DISK, YOU MUST RENAME IT IF YOU DID NOT
CREATE IT AT FIRST. REPLACING SOMEONE ELSE'S FILE WITH YOURS
IS NOT NICE, ETHICAL, OR SMART. YOU WILL BE CAUGHT.

NOTE ALSO: IF THIS COMMAND IS ISSUED MANUALLY (NOT BY QUIT
OR LOG COMMANDS) THE FILES YOU SAVE WILL BE ERASED FROM
YOUR A-DISK, BUT WILL STILL BE EXECUTABLE ON THE LIBRARY DISK.
THIS IS BECAUSE THE QUIT OR LOG COMMANDS WILL ATTEMPT TO
SAVE THE SAME FILES AGAIN. FILES NOT SAVED WILL NOT BE ERASED,
ONLY FILES THAT YOU ANSWERED YES TO. THE RETRIEVE COMMAND WILL
BRING IT BACK FOR YOU IF YOU WISH TO SEE IT AGAIN.

YES

RENEW: THIS COMMAND WILL TAKE A FILE ALREADY ON THE LIBRARY DISK
AND GIVE AN EXTENSION OF FOURTEEN MORE DAYS TO ITS LIFE.
YOU DO NOT NEED TO RENEW A FILE DAILY; HOWEVER IT IS YOUR
RESPONSIBILITY TO SEE THAT IT IS RENEWED, OR ELSE IT WILL
BE ERASED IN FOURTEEN DAYS. END THIS PROGRAM BY SAYING 'STOP'
WHEN IT ASKS FOR A FILENAME AND FILETYPE.

GETFILE : THIS COMMAND WILL COPY A FILE FROM THE LIBRARY DISK AND
PLACE IT ON YOUR A-DISK. YOU MAY THEN CHANGE IT, UPDATE IT,
OR DO ANYTHING YOU WANT WITH IT. THE DATE IT WAS SAVED WILL BE
GIVEN AT THAT TIME. TO STORE IT AGAIN, ISSUE THE SAVEFILE
COMMAND. SYNONYM IS RETRIEVE.

NOW PLEASE SPECIFY YOUR NEXT BUSLIB COMMAND?????
(EITHER: BUSRUN, BUSINDEX, RENEW, SAVEFILE, QUIT, LOG)
YOU HAVE CREATED THE FOLLOWING FILES/PROGRAMS THIS SESSION.

```
AS EACH FILE IS LISTED YOU MUST ENTER 'YES' OR 'NO' IF YOU DON'T WANT TO SAVE THE FILE. IF YOU DO WANT TO SAVE THE
FILE, MAKE A NOTE OF THE FILENAME & TODAYS DATE FOR FUTURE REFERENCE!!!

TODAY IS 04/10/80 . IN TWO WEEKS, THESE FILES WILL BE ERASED UNLESS YOU
ISSUE THE 'RENEW' COMMAND FOR EACH FILE TO RENEW.

   NOW.....  ENTER    YES OR NO    AS EACH FILENAME APPEARS.
WAREHOUS VSBASIC A2
RUN FILE 5636  TO BUSLIB  COPY 01 NOHOLD


 NOW PLEASE SPECIFY YOUR NEXT BUSLIB COMMAND?????
(EITHER:  BUSRUN, BUSINDEX, RENEW, SAVEFILE, QUIT, LOG)
R(01355): T=0.30/0.74 18:10:50
  BUSRUN

PLEASE SPECIFY THE NAME OF THE PROGRAM YOU WISH TO EXECUTE. ENTER 'STAT' FOR ANY
STAT/BASIC PROGRAMS. ENTER 'HALT' TO STOP.

NOW WHAT DO YOU WISH TO DO ?.
  TRANSDO

DO YOU WISH TO REVIEW A TUTORIAL FOR TRANSDO ? ( YES OR NO )
  NO

HAVE YOU CREATED YOUR DATA STATEMENTS YET? (YES,NO, OR HALT)
  NO

PLEASE ENTER A REFERENCE NAME FOR THESE DATA STATEMENTS?
  WAREHOUS1

 ENTER YOUR DATA STATEMNTS ACCORDING TO THE GENERAL FORM:
    <STATEMENT NUMBER> DATA <VALUE 1>,<VALUE 2>.....<VALUE N>
                       .....ETC.....
 THE PRECISE FORM IS PRESENTED IN THE TUTORIAL FOR THE PROGRAM IN QUESTION.
(NOTE: AFTER ALL DATA IS ENTERED YOU MUST ISSUE THE COMMAND <FILE> TO CONTINUE.)

NOW ENTER YOUR DATA STATEMENTS!!!
NEW FILE:
EDIT:
  100 DATA 4
  200 DATA 14
  300 DATA 1604,546,2150,2150
  400 DATA 397,331,253,211,182,154,135,112,106,103,86,80,2150,2150
  500 DATA 500,500,500,500,500,500,500,500,500,500,500,33,109
  600 DATA 500,500,500,500,500,500,500,500,500,500,500,82,87
  700 DATA 141,89,22,344,326,321,83,114,71,322,152,22,0,87
  800 DATA 59,150,87,306,328,276,119,194,87,315,72,80,87,0
  FILE

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
  1
```

```
THROUGHOUT THE PROGRAM, YOU MAY ENTER THE
FOLLOWING CODE NUMBERS TO CONTROL EXECUTION OPTIONS:
      1      INSTRUCTIONS FOR DATA INPUT
      2      OPTIMIZE THE DATA ALREADY ENTERED
      3      PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
      4      PRINT THE COST MATRIX
      5      CHANGE THE NUMBER OF SOURCES
      6      CHANGE THE NUMBER OF DESTINATIONS
      7      CHANGE THE CAPACITY OF A SOURCE
      8      CHANGE THE REQUIREMENT OF A DESTINATION
      9      CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINATION
     10      STOP
WHICH OPTION DO YOU WANT?
  2

  FINAL DISTRIBUTION

SOURCE DESTINATION    UNITS

  1          13          1604
  2          14           546
  3           2           331
  3           3           253
  3           4           211
  3           5           182
  3           6            91
  3           7           135
  3           8           112
  3           9           106
  3          10           103
  3          12            80
  3          13           546
  4           1           397
  4           6            63
  4          11            86
  4          14          1604

TOTAL COST = 4.41001E4

WOULD YOU LIKE TO MODIFY THE CURRENT DATA AND/OR RUN AGAIN?
  YES
WHAT OPTION? (999 FOR OPTION LIST)?
  10

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
  3

JUST RE-TYPE THE LINE NUMBER WHICH YOU WISH TO CHANGE OR USE STANDARD CMS EDIT
COMMANDS. WHEN YOU'RE FINISHED WITH ALL CHANGES TYPE 'FILE'.
EDIT:
  500 DATA 500,500,500,500,500,500,500,500,500,500,500,500,33,67
  600 DATA 500,500,500,500,500,500,500,500,500,500,500,500,82,70
  700 DATA 141,89,22,344,326,321,83,114,71,322,152,22,0,46
  800 DATA 98,115,48,32,328,298,97,156,69,319,108,43,46,0
  FILE
```

FOLLOWING CODE NUMBERS TO CONTROL EXECUTION OPTIONS:

* *

1 INSTRUCTIONS FOR DATA INPUT
2 OPTIMIZE THE DATA ALREADY ENTERED
3 PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
4 PRINT THE COST MATRIX
5 CHANGE THE NUMBER OF SOURCES
6 CHANGE THE NUMBER OF DESTINATIONS
7 CHANGE THE CAPACITY OF A SOURCE
8 CHANGE THE REQUIREMENT OF A DESTINATION
9 CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINTION
10 STOP

WHICH OPTION DO YOU WANT?
2

FINAL DISTRIBUTION

SOURCE	DESTINATION	UNITS
1	13	1456
1	14	148
2	14	546
3	2	331
3	3	253
3	5	182
3	6	154
3	7	135
3	8	112
3	9	106
3	10	103
3	12	80
3	13	694
4	1	397
4	4	211
4	11	86
4	14	1456

TOTAL COST = $ 361346

WOULD YOU LIKE TO MODIFY THE CURRENT DATA AND/OR RUN AGAIN?
YES
WHAT OPTION? (999 FOR OPTION LIST)?
10

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
3

JUST RE-TYPE THE LINE NUMBER WHICH YOU WISH TO CHANGE OR USE STANDARD CMS EDIT COMMANDS. WHEN YOU'RE FINISHED WITH ALL CHANGES TYPE 'FILE'.
EDIT:
500 DATA 500,500,500,500,500,500,500,500,500,500,500,500,33,56

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
? 1

A BASIC TRANSPORTATION PROGRAM

THROUGHOUT THE PROGRAM, YOU MAY ISSUE ONE OF THE
FOLLOWING CODE NUMBERS TO CONTROL EXECUTION OPTIONS:

* *

1	INSTRUCTIONS FOR DATA INPUT
2	OPTIMIZE THE DATA ALREADY ENTERED
3	PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
4	PRINT THE COST MATRIX
5	CHANGE THE NUMBER OF SOURCES
6	CHANGE THE NUMBER OF DESTINATIONS
7	CHANGE THE CAPACITY OF A SOURCE
8	CHANGE THE REQUIREMENT OF A DESTINATION
9	CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINTION
10	STOP

WHICH OPTION DO YOU WANT?
? 2

FINAL DISTRIBUTION

SOURCE	DESTINATION	UNITS
1	13	1456
1	14	148
2	14	546
3	2	331
3	3	253
3	5	182
3	6	154
3	7	135
3	8	112
3	9	106
3	10	103
3	12	80
3	13	694
4	1	397
4	4	211
4	11	86
4	14	1456

TOTAL COST = $ 333510

WOULD YOU LIKE TO MODIFY THE CURRENT DATA AND/OR RUN AGAIN?
? YES
WHAT OPTION? (999 FOR OPTION LIST)?
? 10

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
? 3

```
[illegible]
800 DATA 130,55,52,40,40,374,155,120,22,391,174,91,74,0
END

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
 1

              A BASIC TRANSPORTATION PROGRAM

THROUGHOUT THE PROGRAM, YOU MAY ISSUE ONE OF THE
FOLLOWING CODE NUMBERS TO CONTROL EXECUTION OPTIONS:

   * * * * * * * * * * * * * * * * * * * * * * * * * * *
        1     INSTRUCTIONS FOR DATA INPUT
        2     OPTIMIZE THE DATA ALREADY ENTERED
        3     PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
        4     PRINT THE COST MATRIX
        5     CHANGE THE NUMBER OF SOURCES
        6     CHANGE THE NUMBER OF DESTINATIONS
        7     CHANGE THE CAPACITY OF A SOURCE
        8     CHANGE THE REQUIREMENT OF A DESTINATION
        9     CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINTION
       10     STOP
WHICH OPTION DO YOU WANT?
 2

   FINAL DISTRIBUTION

SOURCE DESTINATION   UNITS

  1        13         1320
  1        14          284
  2        14          546
  3         1          397
  3         3          253
  3         6          154
  3         7          135
  3         8          112
  3        10          103
  3        11           86
  3        12           80
  3        13          830
  4         2          331
  4         4          211
  4         5          182
  4         9          106
  4        14         1320

TOTAL COST = $ 291012

WOULD YOU LIKE TO MODIFY THE CURRENT DATA AND/OR RUN AGAIN?
 NO
```

```
3 PRINT THE CONTENTS OF WAREHOUS
4 CHANGE THE CONTENTS OF WAREHOUS
4 START FROM THE BEGINNING
9 STOP EXECUTION

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
 9

 NOW PLEASE SPECIFY YOUR NEXT BUSLIB COMMAND?????
(EITHER: BUSRUN, BUSINDEX, RENEW, SAVEFILE, QUIT, LOG)
9: T=3.03/5.30-19:30:20
  LOG
RUN FILE 5574  TO  ASBSLB01 COPY 01 NOHOLD
    YOU HAVE CREATED THE FOLLOWING FILES/PROGRAMS THIS SESSION.

FILENAME  FILETYPE
--------  --------
WAREHOUS VSBASIC  A2

 D I R E C T I O N S:
    AS EACH FILE IS LISTED, ENTER 'YES' TO SAVE THE FILE FOR TWO WEEKS----
    ENTER 'NO' OR 'N' IF YOU DONT WANT TO SAVE THE FILE. IF YOU DO SAVE A
    FILE, MAKE A NOTE OF THE FILENAME & TODAYS DATE FOR FUTURE REFERENCE!!!

TODAY IS 04/10/80 . IN TWO WEEKS, THESE FILES WILL BE ERASED UNLESS YOU
ISSUE THE 'RENEW' COMMAND FOR EACH FILE TO RENEW.

    NOW.....   ENTER    YES  OR  NO    AS EACH FILENAME APPEARS.
WAREHOUS VSBASIC  A2
  NO

    GOODBYE. IT'S BEEN NICE WORKING WITH YOU.

CONNECT= 01:25:05 VIRTCPU= 000:12.47 TOTCPU= 000:26.11
LOGOFF AT 19:30:49 EST THURSDAY 04/10/80
```

```
PLEASE BE CAREFUL AND MAKE SURE THAT YOU PICK UP THE RIGHT PRINTOUT .
HIT ENTER TO CONTINUE
> YOUR MAILBOX IS EMPTY

NOW ISSUE YOUR NEXT BUSLIB COMMAND ???
(EITHER: BUSRUN, BUSINDEX, RENEW, SAVEFILE, QUIT, LOG)
R: T=0.22/0.49 15:55:17
  BUSRUN TRANSPO

DO YOU WISH TO REVIEW A TUTORIAL FOR TRANSPO ?! ( YES OR NO )
  NO

HAVE YOU CREATED YOUR DATA STATEMENTS YET? (YES,NO, OR HALT)
  YES

WHAT IS THE REFERENCE NAME OF THE ORIGINAL DATA STATEMENTS?
  WAREHOUSE

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
  10

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
  3

JUST RE-TYPE THE LINE NUMBER WHICH YOU WISH TO CHANGE OR USE STANDARD CMS EDIT
COMMANDS. WHEN YOU'RE FINISHED WITH ALL CHANGES TYPE 'FILE'.
EDIT:
  500
  500 DATA 500,500,500,500,500,500,500,500,500,500,500,500,33,109
  500 DATA 500,500,500,500,500,500,500,500,500,500,500,500,33,56
  600 DATA 500,500,500,500,500,500,500,500,500,500,500,500,82,22
  700 DATA 141,89,22,344,326,321,83,114,71,322,152,22,0,74
  800 DATA 130,56,52,392,395,374,156,120,22,391,174,91,74,0
  FILE

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
  1

                    A BASIC TRANSPORTATION PROGRAM

THROUGHOUT THE PROGRAM, YOU MAY ISSUE ONE OF THE
FOLLOWING CODE NUMBERS TO CONTROL EXECUTION OPTIONS:

    * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
          1     INSTRUCTIONS FOR DATA INPUT
          2     OPTIMIZE THE DATA ALREADY ENTERED
          3     PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
          4     PRINT THE COST MATRIX
          5     CHANGE THE NUMBER OF SOURCES
          6     CHANGE THE NUMBER OF DESTINATIONS
          7     CHANGE THE CAPACITY OF A SOURCE
          8     CHANGE THE REQUIREMENT OF A DESTINATION
          9     CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINTION
         10     STOP
WHICH OPTION DO YOU WANT?
  2
```

```
   3          3          253
   3          4          211
   3          5          182
   3          6          154
   3          7          135
   3          8          112
   3          10         103
   3          11         86
   3          12         80
   3          13         546
   4          1          109
   4          2          331
   4          9          106
   4          14         1604

TOTAL COST = $ 399477


WOULD YOU LIKE TO MODIFY THE CURRENT DATA AND/OR RUN AGAIN?
  YES
WHAT OPTION? (999 FOR OPTION LIST)?
  10

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
  3

JUST RE-TYPE THE LINE NUMBER WHICH YOU WISH TO CHANGE OR USE STANDARD CMS EDIT
COMMANDS. WHEN YOU'RE FINISHED WITH ALL CHANGES TYPE 'FILE'.
EDIT:
  500 DATA 500,500,500,500,500,500,500,500,500,500,500,500,33,65
  600 DATA 500,500,500,500,500,500,500,500,500,500,500,500,82,30
  700 DATA 141,89,22,344,326,321,83,114,71,322,152,22,0,65
  800 DATA 91,91,46,382,374,332,135,148,30,359,131,72,65,0
  FILE

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
  1

                    A BASIC TRANSPORTATION PROGRAM

THROUGHOUT THE PROGRAM, YOU MAY ISSUE ONE OF THE
FOLLOWING CODE NUMBERS TO CONTROL EXECUTION OPTIONS:

     * * * * * * * * * * * * * * * * * * * * * * * * * * *
          1     INSTRUCTIONS FOR DATA INPUT
          2     OPTIMIZE THE DATA ALREADY ENTERED
          3     PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
          4     PRINT THE COST MATRIX
          5     CHANGE THE NUMBER OF SOURCES
          6     CHANGE THE NUMBER OF DESTINATIONS
          7     CHANGE THE CAPACITY OF A SOURCE
          8     CHANGE THE REQUIREMENT OF A DESTINATION
          9     CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINTION
```

FINAL DISTRIBUTION

SOURCE	DESTINATION	UNITS
1	13	1604.
2	14	546
3	2	331
3	3	253
3	4	211
3	5	182
3	6	154
3	7	135
3	8	112
3	10	103
3	11	43
3	12	80
3	13	546
4	1	397
4	9	106
4	11	43
4	14	1604

TOTAL COST = $ 396062

WOULD YOU LIKE TO MODIFY THE CURRENT DATA AND/OR RUN AGAIN?
=>
WHAT OPTION? (999 FOR OPTION LIST)?
10

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
3

JUST RE-TYPE THE LINE NUMBER WHICH YOU WISH TO CHANGE OR USE STANDARD CMS EDIT
COMMANDS. WHEN YOU'RE FINISHED WITH ALL CHANGES TYPE 'FILE'.
EDIT:
500 DATA 500,500,500,500,500,500,500,500,500,500,500,500,33,32
600 DATA 500,500,500,500,500,500,500,500,500,500,500,500,82,39
700 DATA 141,89,22,344,326,321,83,114,71,322,152,22,0,46
800 DATA 128,63,21,374,367,352,128,113,39,363,158,61,46,0
FILE

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
1

A BASIC TRANSPORTATION PROGRAM

THROUGHOUT THE PROGRAM, YOU MAY ISSUE ONE OF THE
FOLLOWING CODE NUMBERS TO CONTROL EXECUTION OPTIONS:

* *

1 INSTRUCTIONS FOR DATA INPUT
2 OPTIMIZE THE DATA ALREADY ENTERED
3 PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
4 PRINT THE COST MATRIX
5 CHANGE THE NUMBER OF SOURCES

```
                    10      STOP
WHICH OPTION DO YOU WANT?
  2

   FINAL DISTRIBUTION

SOURCE DESTINATION    UNITS

  1          13          951
  1          14          653
  2          14          546
  3          4           211
  3          5           182
  3          6           154
  3          7           135
  3          10          103
  3          11          86
  3          12          80
  3          13          1199
  4          1           397
  4          2           331
  4          3           253
  4          8           112
  4          9           106
  4          14          951

TOTAL COST = $ 407898


WOULD YOU LIKE TO MODIFY THE CURRENT DATA AND/OR RUN AGAIN?
 =!>
WHAT OPTION? (999 FOR OPTION LIST)?


ENTER THE SOURCE ID,DESTINATION ID, AND NEW COST VALUE SEPARATED
BY COMMAS (M,N,C)?

ICD457 LINE  3020: TOO LITTLE DATA..RETRY
  10
ICD457 LINE  3020: TOO LITTLE DATA..RETRY
  LOG
ICD458 LINE  3020: INVALID DATA..RETRY
  QUIT
ICD458 LINE  3020: INVALID DATA..RETRY
  LOGOFF
ICD458 LINE  3020: INVALID DATA..RETRY

ICD457 LINE  3020: TOO LITTLE DATA..RETRY
  .CP
  B
  BUSRUN TRANSPO
ICD458 LINE  3020: INVALID DATA..RETRY
  .CP I CMS
CPU TIME ALLOCATED     0.01.00, USED     0.00016 -  26.66%
OUTPUT TO BUSINESS INSTALLATION
CMS BSE 6.04 - 12/27/79
```

```
UNKNOWN CP/CMS COMMAND
  BUSRUN TRANSPO
UNKNOWN CP/CMS COMMAND
  BUSLIB BYPASS
R (193) R/O
R; T=0.01/0.04 16:17:39
DMKMSG045E ASBSLB01 NOT LOGGED ON

 SINCE YOU ARE ON A IBM 3277 TELEVISION TERMINAL (ALSO CALLED TUBE OR CRT)
 I'M WONDERING WHETHER YOU WANT A HARD PAPER COPY OF THE TERMINAL SESSION.
 PLEASE ANSWER WITH A YES OR NO. IF YOU DON'T REALLY NEED IT HOW ABOUT
 CONSERVING RESOURCES. NOW YES OR NO??
  YES

 AT WHICH COMPUTER FACILITY DO YOU WANT TO PICK UP YOUR OUTPUT?

          0 = TODD HALL (FOR LARGE OUTPUTS. SEE CONSULTANT FIRST!!!)
          2 = BUSINESS BLDG.  LP 406
          3 = CUSHWA, ROOM 3090
          4 = ENGINEERING, ROOM 223

 ENTER NUMBER:
  2
OUTPUT TO BUSINESS INSTALLATION

>> YOUR DISTRIBUTION CODE IS: I0026734

PLEASE BE CAREFUL AND MAKE SURE THAT YOU PICK UP THE RIGHT PRINTOUT .
HIT ENTER TO CONTINUE
> YOUR MAILBOX IS EMPTY

NOW ISSUE YOUR NEXT BUSLIB COMMAND ???
(EITHER: BUSRUN, BUSINDEX, RENEW, SAVEFILE, QUIT, LOG)
R; T=0.21/0.44 16:18:02
  BUSRUN TRANSPO

DO YOU WISH TO REVIEW A TUTORIAL FOR TRANSPO ? ( YES OR NO )
  NO

HAVE YOU CREATED YOUR DATA STATEMENTS YET? (YES,NO, OR HALT)
  YES

WHAT IS THE REFERENCE NAME OF THE ORIGINAL DATA STATEMENTS?
  WAREHOUSE

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
  10

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
  3

JUST RE-TYPE THE LINE NUMBER WHICH YOU WISH TO CHANGE OR USE STANDARD CMS EDIT
COMMANDS. WHEN YOU'RE FINISHED WITH ALL CHANGES TYPE 'FILE'.
EDIT:
  500 DATA 500,500,500,500,500,500,500,500,500,500,500,500,33,67
  600 DATA 500,500,500,500,500,500,500,500,500,500,500,500,82,70
  700 DATA 141,89,22,344,326,321,83,114,71,322,152,22,0,46
```

```
                    A BASIC TRANSPORTATION PROGRAM

THROUGHOUT THE PROGRAM, YOU MAY ISSUE ONE OF THE
FOLLOWING CODE NUMBERS TO CONTROL EXECUTION OPTIONS:

    * * * * * * * * * * * * * * * * * * * * * * * * * * * *
        1     INSTRUCTIONS FOR DATA INPUT
        2     OPTIMIZE THE DATA ALREADY ENTERED
        3     PRINT SOURCE CAPACITIES & DESTINATION REQUIREMENTS
        4     PRINT THE COST MATRIX
        5     CHANGE THE NUMBER OF SOURCES
        6     CHANGE THE NUMBER OF DESTINATIONS
        7     CHANGE THE CAPACITY OF A SOURCE
        8     CHANGE THE REQUIREMENT OF A DESTINATION
        9     CHANGE THE UNIT COST BETWEEN A SOURCE & DESTINTION
       10     STOP
WHICH OPTION DO YOU WANT?
  2

  FINAL DISTRIBUTION

SOURCE DESTINATION    UNITS

  1          13          1604
  2          14          546
  3          2           331
  3          3           253
  3          4           211
  3          5           182
  3          6           91
  3          7           135
  3          8           112
  3          9           106
  3          10          103
  3          12          80
  3          13          546
  4          1           397
  4          6           63
  4          11          86
  4          14          1604

TOTAL COST = $ 420697


WOULD YOU LIKE TO MODIFY THE CURRENT DATA AND/OR RUN AGAIN?
  NO

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
  HELP
THE FOLLOWING OPTIONS ARE AVAILABLE:
1 EXECUTE TRANSPO USING WAREHOUS
2 PRINT THE CONTENTS OF WAREHOUS
3 CHANGE THE CONTENTS OF WAREHOUS
4 START FROM THE BEGINNING
```

```
 PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
  HELP
THE FOLLOWING OPTIONS ARE AVAILABLE:
1 EXECUTE TRANSPO USING WAREHOUS
2 PRINT THE CONTENTS OF WAREHOUS
3 CHANGE THE CONTENTS OF WAREHOUS
4 START FROM THE BEGINNING
9 STOP EXECUTION

PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
  2

  100 DATA 4
  200 DATA 14
  300 DATA 1604,546,2150,2150
  400 DATA 397,331,253,211,182,154,135,112,106,103,86,80,2150,2150
  500 DATA 500,500,500,500,500,500,500,500,500,500,500,500,33,67
  600 DATA 500,500,500,500,500,500,500,500,500,500,500,500,82,70
  700 DATA 141,89,22,344,326,321,83,114,71,322,152,22,0,46
  800 DATA 98,115,48,324,328,298,97,156,69,319,108,43,46,0


PLEASE ENTER THE NUMBER OF YOUR OPTION 1,2,3,4,9 OR HELP?
  9

 NOW PLEASE SPECIFY YOUR NEXT BUSLIB COMMAND?????
(EITHER: BUSRUN, BUSINDEX, RENEW, SAVEFILE, QUIT, LOG)
R: T=1.01/2.29 16:23:38
  LOG
RUN FILE 7315  TO  ASBSLB01 COPY 01 NOHOLD
    YOU HAVE CREATED THE FOLLOWING FILES/PROGRAMS THIS SESSION.

FILENAME  FILETYPE
--------  --------
WAREHOUS VSBASIC  A2

 D I R E C T I O N S:
    AS EACH FILE IS LISTED, ENTER 'YES' TO SAVE THE FILE FOR TWO WEEKS----
    ENTER 'NO' OR 'N' IF YOU DONT WANT TO SAVE THE FILE. IF YOU DO SAVE A
    FILE, MAKE A NOTE OF THE FILENAME & TODAYS DATE FOR FUTURE REFERENCE!!!

TODAY IS 04/11/80 . IN TWO WEEKS, THESE FILES WILL BE ERASED UNLESS YOU
ISSUE THE 'RENEW' COMMAND FOR EACH FILE TO RENEW.

    NOW.........  ENTER     YES  OR  NO     AS EACH FILENAME APPEARS.
WAREHOUS VSBASIC  A2
  NO

    GOODBYE, IT'S BEEN NICE WORKING WITH YOU.

CONNECT= 00:29:43 VIRTCPU= 000:03.85 TOTCPU= 000:08.70
LOGOFF AT 16:23:53 EST FRIDAY 04/11/80
```

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