COSTS OF PUBLIC TRANSPORTATION IN TEXAS, 1973-1977

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16. Abstract

Public transit operations in Texas were analyzed to explore transit costs and changes from 1973 through 1977. Fifteen transit systems were examined to determine what cost components are causing cost escalation. The results showed that as transit systems decrease in size, their cost increases over time become greater, particularly their administrative costs. Operational costs are increasing at a greater rate for medium and small systems, and maintenance is increasing faster for large systems. The most significant factors identified as causing cost increases are employee costs, depreciation, insurance, parts, and fuel.

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Technical Report 1060-1
Technical Study Number 2-10-79-1060
"Effects of Maintenance, Rehabilitation and Operations Cost Escalation on Transit Systems"

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The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Urban Mass Transportation Administration or the Texas Department of Highways and Public Transportation. The report does not constitute a standard, a specification, or a regulation.

IMPLEMENTATION STATEMENT

As the costs of operating transit increase, the need to improve transit operations becomes more acute. In order to contain costs, there is a critical dependence upon knowledge of what costs are increasing, how much, and why.

This report consists of documented information pertaining to cost and cost changes in the operation of Texas transit systems. This information will enable transit providers to assess their costs relative to others in the state, and more importantly, to allocate dollars while fully cognizant of the details of cost escalation. The final result should be improved transit performance.

EXECUTIVE SUMMARY

The technical study "Effects of Maintenance, Rehabilitation and Operations Cost Escalation on Transit Systems" is an analysis of transit costs in Texas from 1973 through 1977. The focus is on rising costs at the cost item level and their effect upon operations, maintenance, and administrative expenditures.

Each system in the state was classified small, medium, or large, according to the population size of the area served. The results show that costs are increasing at a greater rate for smaller systems. Smaller systems also tend to have proportionally higher administrative costs and proportionally lower operational costs. Approximately the same proportion of the budget is spent on maintenance for each system class. Operational costs are decreasing over time as a percentage of total cost in large systems, but are increasing for medium and small systems. Additionally, a trend toward a proportionate increase in maintenance for large systems and a proportionate decrease for medium systems has occurred.

Transit systems, overall, report the greatest increase in cost in 1977. Medium and large systems' costs were more variable but increased 18.0 and 16.5 percent, respectively, in 1977. Costs in small systems rose more than eight percent annually throughout the analysis period.

Cost items that are most influential in affecting total transit cost increases are normally those of the greatest dollar magnitude. These items are employee costs, depreciation, parts, fuel, and insurance. Although each of these expenses is responsible for observed cost increases, depreciation, insurance, and parts have increased in greater proportion. Thus, rising employee and fuel costs may not constitute as grave a cost escalation problem

as commonly perceived; moreover, depreciation, insurance, and parts have proven to be more influential in their gains than might be expected.

The cost data were utilized to compute cost ratios. In relation to national averages, Texas' costs per vehicle-mile and per passenger are lower but appear to be increasing more rapidly. In current dollars, the statewide total cost per vehicle-mile has increased $.57 from 1973 through 1977 and total cost per passenger has increased $.27.

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I. INTRODUCTION

Problem Statement and Objectives

Transit cost escalation is of growing concern as persistent inflation and the scarcity of public funds threaten the ability of communities to support continued and improved transit service. As a result of the growing acceptance of transit as an essential public service, greater demands have been placed on transit to serve a much wider and diversified market. These increased services have led to increased costs which have risen at a much greater rate than revenues associated with the services.

Information concerning trends of cost escalation are useful in making policy decisions, realizing improvements, and, ideally, containing costs. Public officials who determine community policy and who are responsible for resource allocation, as well as those immediately involved in the transit industry, should be cognizant of the important factors associated with this costly service. National averages and numerous local case studies that are particularly prolific in the northern United States are lacking in their applicability to the unknown, composite transportation cost picture for this state.

The specific objectives of this study were:

(1) To collect available cost data for five previous years from all transit systems in Texas,

(2) To classify and analyze the several generalized costs and cost categories and identify the specific cost categories with the highest escalation rates,

(3) To study the relationships between escalation rates and system sizes,

(4) To identify, where possible, causative factors for the escalation rates,

(5) To document the results of the study in the form of a published report.

Related Studies

Cost studies and reports of national trends are useful as a basis for comparing Texas data reported in this study. A "rough-grained picture" of the nationwide trends was provided in the publication of the "Proceedings of the First National Conference on Transit Performance" which was held in 1977. It was reported that:

> "between 1970 and 1976 the cost of providing public transportation service increased 103 percent, from $1.89 billion to $3.84 billion. Fifty-one percent of this increase is attributable to general inflation and 32 percent to higher labor costs. The remaining 17 percent is attributable to factors such as service expansion and increases in fuel and insurance costs" (Proceedings, 1977).

Texas is consistent with other parts of the nation in that its transportation services are highly labor intensive. Wages, salaries, and employee benefits are the largest component of operating costs, and this cost varies only somewhat nationwide. In "Proceedings" (1977), wages and fringe benefits were reported to comprise 70 to 80 percent of all operating costs nationwide. In the background paper prepared for the First National Conference on Transit Performance, the following points were made concerning wage increases:

> Wage increases in recent years have been greater than during the last years of private operation, where increases were often restrained by tight budgets and rapidly diminishing profits. As a result, many view recent increases as greater than appropriate. Because labor costs impact so directly on total operating costs, there have been attempts to link wage increases to improvements in productivity.

Negotiation attempts concerning wages have been brought about more frequently in recent years due to the decreasing number of private operations and

to more affiliations with labor unions. This has been the case in Texas, where in 1977 the last private bus company in the state went public. The majority of systems' drivers in the state now belong to a union.

In the search for comparative literature, an interesting set of statistics was discovered that almost thirty years ago detailed costs for a European transit firm. The firm studied had an operating staff of 3,500, a fleet of 1,300 vehicles, and averaged more than 45 million car miles per year. Its percentage composition of total expenses in 1951 were:

A. Vehicle operating--62%

   (wages, clothing and national insurance of drivers, fuel and lube, tires and tubes)

B. Maintenance and depreciation--20%

   (vehicles, plant and equipment, largely vehicular)

C. Other traffic costs--10%

   (wages of traffic staff, bus cleaning, tickets, miscellaneous expenses, and insurance)

D. Maintenance and renewal of structures--2%

E. Vehicle licenses--3%

F. General expenses--3%

   (grouping of salaries, office expenses, rent, rates, publicity, and insurance).

The operational costs (categories A, B, C, and E) presented for this system appear to be only slightly higher percentages of total cost compared to contemporary, American systems. A conclusion of this 1951 study has recently been substantiated. Johnston, in 1951, maintains:

> With regard to the long-term relationship between costs and output, there is a fairly substantial dispersion in costs at any given output level, but nevertheless there does appear to be a tendency for costs

> to fall at first with increases in output and then to stabilize so that for outputs of 200,000 car miles or more, no further economies of scale accrue (Johnston, 1951: 214).

In 1970, Miller further concluded that scale economies are realized only by systems with extremely small operations.

Studies that specifically analyze changes over time of selected transit cost items for states or regions are few in number. Although escalation rates pertaining to specific cost items are mentioned occasionally, the thrust of the majority of work wherein cost data are analyzed is generally toward productivity analysis. A survey of the literature yielded some cost information for specific systems in various parts of the country.

In the 1964-1965 fiscal year of the Florida Metropolitan Dade County Transit Authority the largest single item of cost was transportation personnel salaries. Transportation expenses (operations) dominated overall costs at about 55 percent of the total. Maintenance accounted for 15 percent of the total, general and miscellaneous (administration) 11 percent, garage expenses 10 percent, and insurance costs accounted for seven percent of overall costs (Ferreri, 1969).

Analysis of public transit operations in New York State in 1977 showed that "employee costs constitute 70 to 90 percent of all operating costs, and that increases in employee costs are almost entirely responsible for past increases in operating costs" (Holthoff, 1978: 15). This study also revealed that the cost of fuel during 1973-1974 increased by about 100 percent. This was, however, only a one percent increase in its percentage of operating costs. The authors maintained that "even drastic increases in the costs of power, fuel, and materials and supplies [had] little effect on the percentage that other costs represent of the total operating costs" (Holthoff, 1978: 15).

Finally, in the development of a rural transportation cost model three points were made that provide a starting point for examination of the transit operation in Texas (Ceglowski, et al., 1978).

(1) Total operating costs per vehicle mile are highest in the Northeast and Pacific Coast states.

(2) In rural transit operations, the bulk of the total system costs are directly attributable to drivers'wages, overhead costs, and vehicle capital costs.

(3) Economies of scale are not obvious in rural transportation operations.

II. STUDY METHOD

The primary objectives of this study are to determine costs involved in the operation of transit in Texas, to determine what costs are increasing, how much and why. In order to provide information useful in containing costs,it was desirable to collect and analyze operating cost data for all Texas transit systems for a five year period from 1973 through 1977.

For a complete overview of transit cost in the state, it was determined that data would be collected from each of the 17 systems for the five-year period, using the F.A.R.E. (Financial, Accounting, and Reporting Elements) system of accounting as a basis for categorization of the data. Each system manager was initially contacted by written correspondence, wherein the purpose of the study was described. This initial contact was followed by a personal visit to each system, during which the exact nature and format of the data desired were discussed. Subsequently, cost information was either mailed to the study staff or a second trip to the system was used to collect data firsthand.

Description of the Data Base Design

F.A.R.E. is an industry developed program that was set up to fulfill part of the requirements of Section 15 of the Urban Mass Transportation Act of 1964.* Section 15 directs the Secretary of Transportation to prescribe a uniform system of accounts, records, and reports of financial and operating information to be produced by transit operators. The structure within this system is basically a two-dimensional classification of expenses. One dimension is the type of

*For a detailed description of F.A.R.E., see the Federal Register, Vol. 42, No. 13, January 19, 1977, Title 49, Chapter VI, part 630.

expenditure (object classes), and the second dimension is the functions or activities performed. There are three functions or activities--operations, maintenance, and general administration--and 13 expense object classes that are subject to the Section 15 reporting requirements. (See Table 1.)

Three levels of detail for functional categories were developed by UMTA to aid reporting by systems of various sizes. Level A is the most detailed and is recommended for large, complex systems. Level C is least detailed and is recommended for small systems with less specialized activities. The required expense object classes and functions given in Table 1 are for level C, and this amount of detail is the minimum requirement. Therefore, comparisons across all systems at C-level are possible.

The intended data base for this study consisted of all data included in level C account reporting from every public transit system in Texas. For analysis purposes, the seventeen systems were divided into three categories* as follows:

CATEGORY A - cities of greater than 500,000 population

Dallas

Houston

San Antonio

CATEGORY B - cities of 200,000 to 500,000 population

Austin

Corpus Christi

El Paso

Fort Worth

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*Categories are defined as used by the Texas State Department of Highways and Public Transportation.

Table 1. Required Expense Object Classes and Functions

Object Classes	Functional Categories			
	010 Operations	040 Maintenance	100 General Administration	Total All Functions
501 Labor				
01 Operators' salaries & wages	x	x	x	
02 Other salaries & wages	x	x	x	
502 Fringe benefits	x	x	x	
503 Services	x	x	x	
504 Materials & supplies consumed				
01 Fuel & lubricant	x	x		
02 Tires and tubes	x			
99 Other materials & supplies	x	x	x	
505 Utilities	x	x	x	
506 Casualty & liability costs	x			
507 Taxes	x			
508 Purchased transportation service				
509 Miscellaneous expense	x	x	x	
510 Expense transfers				
511 Interest expense	x			
512 Leases and rentals	x	x		
513 Depreciation and Amortization	x			
TOTAL EXPENSE				

From Federal Register, Vol. 42, No. 13, January 19, 1977.

CATEGORY C - cities of less than 200,000 population

Abilene

Amarillo

Beaumont

Brownsville

Galveston

Laredo

Lubbock

San Angelo

Waco

Wichita Falls

In addition, cost data were collected regarding numbers of passengers and vehicle miles for each system. This information was subsequently used in calculating measures of efficiency.

Description of Data Base Used

The F.A.R.E. system of accounting and reporting was to be implemented beginning fiscal year 1977. Some systems used this technique of accounting and reporting prior to 1977, but others did not. However, all systems in this study were requested to report their cost data in as much detail and in the exact form that F.A.R.E. prescribes for level C systems.

The functional positions of the expense class objects examined in this study are denoted by the x's in Table 1. Purchased transportation service and expense transfers were discovered so infrequently that when they did appear, they were classified as miscellaneous operating expenses.

In addition to the cost categories listed, depreciation was divided into two parts in the data collection phase--one class object for vehicle depreciation under operations, and another class object for all other depreciations under operations. Also, management fees were extracted from administrative services and listed as a separate administration expense item. Thus, thirty-two cost categories distributed in a two-dimensional array formed the instrument with which data were collected.

Because not all systems used categories specified in the instrument for some or all years, in some cases the level of detail required could not be obtained. Therefore, it was necessary to combine some class objects after the data were collected. Operators' salaries and wages; other salaries and wages; and fringe benefits were combined in the analysis stage for all systems. Operations' utilities and maintenance's utilities were combined for A- and B-systems; and operations, maintenance, and administration utilities were combined for C-systems.

Taxes and licenses could be separated out only for A-systems. In B- and C-systems, they were combined with miscellaneous operating expenses and interest expense (and leases and rentals in C-systems) to form a miscellaneous operating expense category. This category for A-systems consisted of interest expense, leases and rentals, and other miscellaneous operating expenses.

A miscellaneous maintenance expense category was designated for B-systems to include maintenance services, maintenance leases and rentals, and other miscellaneous maintenance items. For C-systems this category also included maintenance vehicles' fuel and lube.

For A-systems, operations and maintenance materials and supplies were combined. Finally, for all systems miscellaneous administration consisted of the

combined expenses of management fees and other miscellaneous administrative cost items.

Aside from the unavailability of cost data for every class object at the desired detailed level, there were also limiting factors in obtaining data from each of the seventeen Texas systems. Altogether, five-year data was collected from thirteen systems.* It was possible to estimate some missing data, so that the data presented in this report represent costs for fifteen systems for the five years of 1973 through 1977.

Passenger and vehicle mile data were not particularly problematic to obtain, due to the fact that these are regularly reported statistics. However, in systems where records were lacking for past years, these data were also estimated.

Study Limitations

Several limitations have been mentioned concerning the collection of data for this study: lack of detail desired, unavailability of information from two systems, and missing information in some cases. It should also be pointed out that components of each expense class object were described so that each should be consistent. However, it is difficult to control the definition of specific items given by the information sources. Where data was obtained directly from records by the study staff, this problem was minimized. Also, the problem was reduced by combining categories or objects within functions to insure

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*Detailed data was not available from San Antonio. Galveston was unable to release cost information due to pending litigation with the city. Laredo and Waco provided available information but lack of records precluded a full five-year accounting.

consistency. This limitation will be eliminated for future studies when the F.A.R.E. system is fully implemented by all systems in the State.

An inherent problem with a study of this nature is the reliability of the data obtained. Data reported are sometimes found to be in error. In many cases the information reported was unaudited; and in cases where both audited and unaudited data were available, they sometimes differed. However, every attempt was made to acquire and utilize the information that was most reliable and consistent.

Data Analysis Technique

To perform the analysis on the fifteen systems for which data were collected, the first step was to arrange the data into its appropriate thirty-two categories. Then, all fiscal year data were converted to calendar year data, so that the five years beginning January 1973 and ending December 1977 would be the time frame for all systems. Next, the cost data were deflated to 1972 dollars. 1972 dollars were calculated by dividing yearly figures by the following constants:

$$1973 \div 1.058$$

$$1974 \div 1.16$$

$$1975 \div 1.272$$

$$1976 \div 1.339$$

$$1977 \div 1.413$$

Therefore, cost increases reported herein are increases over and above the effects of inflation. The deflator used throughout is the "Gross National Product Deflator," calculated and reported by the U.S. Department of Commerce, which shows the rate of price increase of all items included in the Gross National Product.

According to the three transit classifications (A, B, C) described above, each system of similar size was combined. Therefore, an average total for all variables was given for each transit size. Expense object classes were analyzed by system size. Comparisons by function were made for all systems. The results are given in tabular and graphic form. In tables where percentages are given, percentages were calculated prior to the rounding of the data. The Appendix consists of graphic illustrations of all costs for each system class by year.

III. TOTAL TRANSIT COST IN TEXAS

A-Systems

The total cost of operating large city transit (A-systems) in Texas increased by 20.5 percent from 1973 through 1977. In dollar terms, this is an average increase per system of $2,600,000. As shown in Table 2, costs actually decreased in 1974 and 1976 by 8.8 percent and 1.3 percent, respectively. This was offset by larger increases in 1974 and 1977 of 14.9 percent and 16.5 percent, respectively.

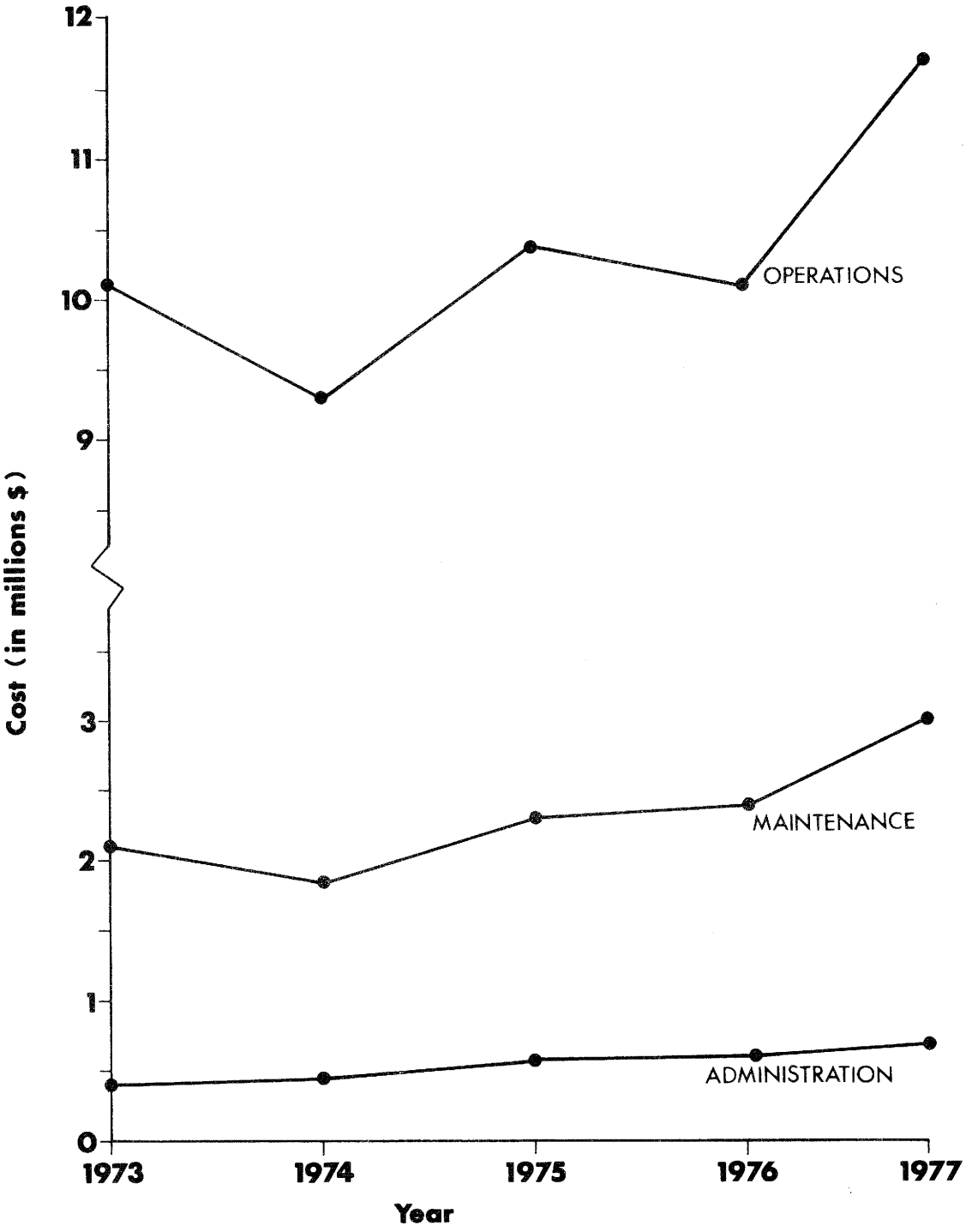
Table 2. Large City Transit Cost

Year	Dollar Cost* (in millions)	Percent Change From Previous Year
1973	$12.7	
1974	$11.6	-8.8
1975	$13.3	+14.9
1976	$13.1	-1.3
1977	$15.3	+16.5

*Average cost in 1972 dollars, rounded to nearest $100,000.

Of the three functional categories, maintenance showed the greatest percentage increase during the five-year period, with an overall increase of 43.1 percent. The administrative function increased by 25 percent, and the operation function increased by 15.5 percent. As depicted by Figure 1, operating expense increased from 10.1 million dollars to 11.7 million dollars. Maintenance

Figure 1. A-Systems Cost by Function



increased from 2.1 million dollars to three million dollars; and administration increased by $540,000.

As a percentage of total cost, the operational cost for A-systems declined steadily from approximately 80 percent in 1973 and 1974 to 76.4 percent in 1977. This is a decrease of 3.4 percentage points. As operational cost decreased as a percentage of the total cost, maintenance share of the total increased. In 1973 maintenance was 16.4 percent of the total A-system cost; while in 1977 maintenance rose to 19.6 percent of the total cost; an increase of 3.2 percentage points. Administrative cost as a share of total cost remained fairly stable over the five-year period at approximately four percent (see Table 3).

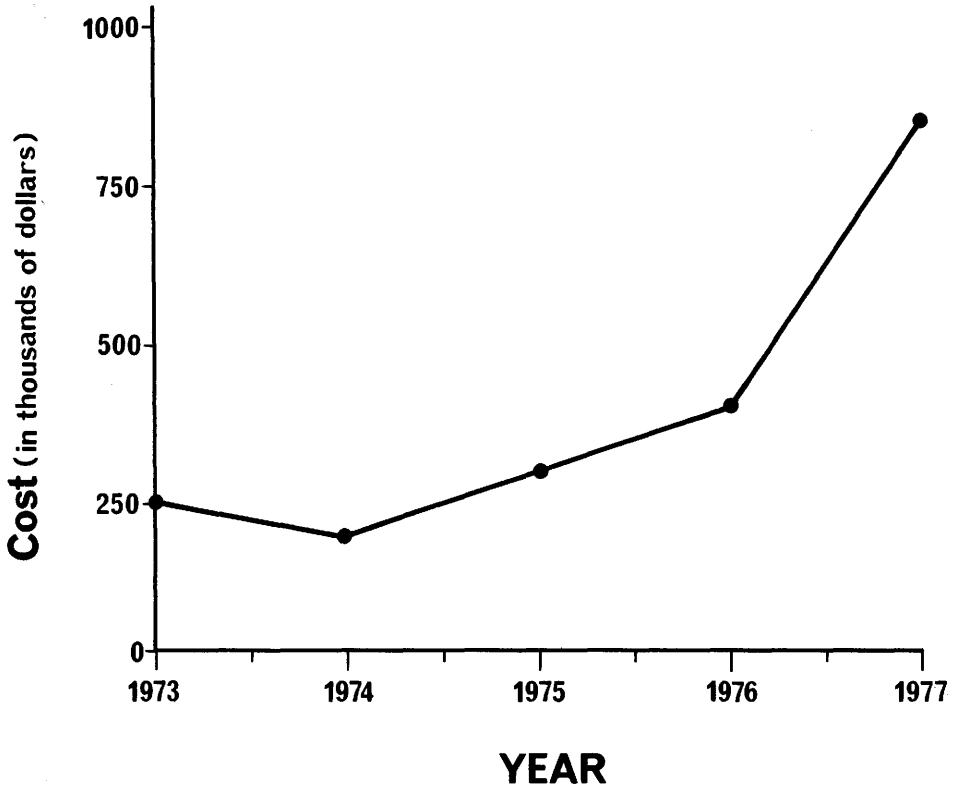
Table 3. Percent of Total Cost by Function for A-Systems

Year	Operations	Maintenance	Administration
1973	79.8	16.4	3.8
1974	79.9	16.0	4.1
1975	78.5	17.5	4.0
1976	77.2	18.6	4.2
1977	76.4	19.6	4.0

Operations

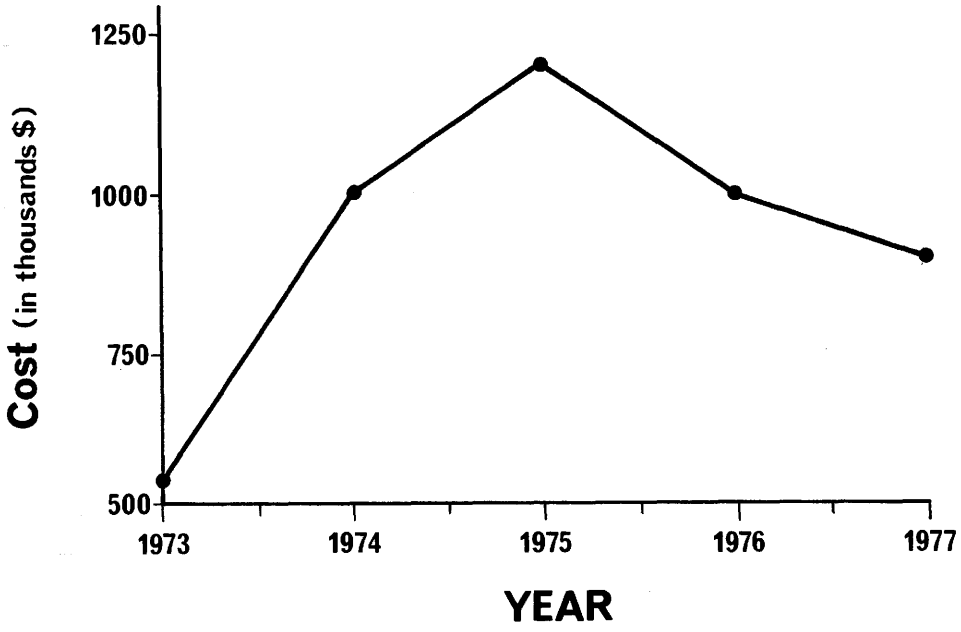
Two factors were largely responsible for the 15.5 percent increase in operational cost--insurance and depreciation. As shown in Figures 2 and 3, insurance increased 272.8 percent and depreciation increased 63.7 percent. Average insurance cost for A-systems declined slightly in 1974, but increased

Figure 2. A-Systems Insurance Cost by Year



- Average insurance cost for A-systems has increased 273 percent from 1973 through 1977.
- Average insurance cost for A-systems more than doubled from 1976 to 1977.
- Insurance cost has increased as a share of total transit costs from two percent in 1973 to six percent in 1977.

Figure 3. Average Total Depreciation By Year For A-Systems



- Average total depreciation cost for A-systems increased 64 percent from 1973 through 1977.
- Depreciation as a share of total transit cost rose from four percent in 1973 to almost nine percent in 1975, and fell to almost six percent in 1977.
- The rise in depreciation cost through 1975 may be attributed to purchases of capital equipment during that period.

thereafter, and more than doubled from 1976 to 1977. As a share of total transit cost, insurance increased from 1.8 percent in 1973 to 5.7 percent in 1977. Depreciation climbed to an average $1.2 million per system in 1975, then dropped 3 percent to $910,000 in 1977, possibly a result of acquisition of capital equipment through 1975. Depreciation as a share of total transit cost rose from four percent in 1973 to almost nine percent in 1975, and fell to almost six percent in 1977, for a net increase of 1.5 percentage points, as seen in Table 7.

Other factors affecting the increase in operations cost were increases in the expense categories of fuel and lube, utilities, and operational wages and benefits. (See Table 4.) The cost of fuel and lube steadily increased 56 percent overall during the study period. Table 7 shows that this cost, however, decreased as a percent of total transit cost by 1.6 percentage points. Utility costs more than doubled in five years. The average cost of utilities for A-systems went from near $38,000 per year in 1973 to over $88,000 per year in 1977. However, this cost represents only .3 percent of total cost in 1973 and .6 percent of total cost in 1977 (see Table 7). Finally, drivers' and supervisors' salaries, wages, and fringe benefits increased 9.4 percent. This increase, however, has not kept pace with overall transit cost, and has declined as a percentage by five points. Concomitantly, wages have decreased in their share of the operational cost function by 3.7 percentage points, as seen in Table 4.

The cost of tires and tubes, operational services, taxes and licenses, and other miscellaneous operational categories (such as interest and leases and rentals) declined from 1973 to 1977. Tires and tubes decreased four percent; services decreased 15.1 percent; taxes and licenses decreased 30.1 percent; and miscellaneous operational expenses decreased 53.7 percent. As percentages of

total cost, these category decreases represent a 5.5 percentage point reduction (see Table 7).

Table 4. Operation Expense Class Object Changes for A-Systems

Cost Category	1973 Cost (in 1972 dollars)*	1977 Cost (in 1972 dollars)*	Percentage Change (1973-77)	Percentage Point Change as Share of Operation Total
Salaries, wages and fringe benefits	$7,020,000	$7,680,000	+9.4	-3.7
Bus fuel and lube	700,000	1,090,000	+56.0	+4.8
Tires and tubes	320,000	300,000	-4.0	-0.5
Services	100,000	87,000	-15.1	-0.3
Utilities	38,000	88,000	+132.4	+0.4
Insurance	230,000	870,000	+272.8	+5.2
Taxes and licenses	820,000	570,000	-30.1	+3.2
Miscellaneous operating expense	470,000	220,000	-53.7	-2.8
Depreciation	550,000	910,000	+63.7	+2.31

*Rounded to nearest $10,000.

Maintenance

Two cost categories comprise the maintenance function for A-systems, and both increased from 1973 through 1977 by more than 40 percent. Maintenance salaries, wages, and fringe benefits increased 41.6 percent, which, as seen in Table 7, is a 1.8 percentage point increase in the share of total cost. Parts and maintenance materials and supplies increased 45.5 percent, which is a 1.4

percentage point increase in the share of total cost. (See Table 7.) The increased cost of maintenance salaries, wages, and fringe benefits was the primary factor in the 14.5 percent total wage increase for A-systems, although a decrease of .6 percentage points in its share of maintenance expense was observed (see Table 5).

Table 5. Maintenance Expense Class Object Changes for A-Systems

Cost Category	1973 Cost (in 1972 dollars)*	1977 Cost (in 1972 dollars)*	Percentage Change (1973-77)	Percentage Point Change As a Share of Maintenance Total
Salaries, wages, and fringe benefits	1,330,000	1,880,000	+41.6	-0.6
Parts and supplies	780,000	1,140,000	+45.5	+0.6

*Rounded to nearest $10,000.

Administration

As mentioned above, total administrative cost increased by 25 percent over the five-year study period. The most notable increase in terms of total cost impact was salaries, wages, and fringe benefits. (See Table 6.) This cost category increased 14.7 percent and contributes approximately two percent of the total transit cost. Miscellaneous administration, which includes miscellaneous administrative expenses and management fees, increased by over 400 percent in cost and rose as a proportion of the administrative function by 17 percentage points. Thus, as seen in Table 6, miscellaneous administration was most influential within the administrative function for A-systems. This cost category, however, is not a major contributor to overall cost. In 1973 it contributed

only .2 percent, but in 1975 and 1976 the contribution by miscellaneous administration was one percent, and in 1974 and 1977 its share of total cost was .9 percent.

There were decreases in the cost categories of administrative services and administrative materials and supplies of 39.5 percent and 23.7 percent, respectively. Both of these cost categories are relatively minor portions of the overall transit cost for A-systems.

Table 6. Administration Expense Class Object Changes for A-Systems

Cost Category	1973 Cost (in 1972 dollars)*	1977 Cost (in 1972 dollars)*	Percentage Change (1973-77)	Percentage Point Change as Share of Administration Total
Salaries, wages and fringe benefits	291,000	333,000	+14.7	-5.0
Services	43,000	26,000	-39.5	-4.6
Materials and supplies	96,000	74,000	-23.7	-7.8
Phone	26,000	34,000	+31.0	+0.2
Miscellaneous	25,000	136,000	+432.4	+17.2

*Rounded to nearest $1,000.

In looking at the A-systems' cost variations, it is observed that:

(1) Depreciation and insurance are the most important items involved in cost escalation.

(2) The decrease in the drivers' and supervisors' wages and salaries share of transit cost implies that higher wages may not constitute the grave cost escalation problem that many transit providers maintain.

Table 7. Expense Class Object Changes For A-Systems

Cost Category	Percent Change (1973-1977)	Percentage Point Change as Share of Total
Operations		
Operations wages and benefits	+9.4	-5.0
Bus fuel and lube	+56.0	-1.6
Tires and tubes	-4.0	-.3
Operations services	-15.1	-.2
Utilities	+132.4	+.3
Insurance	+272.8	+3.9
Taxes and licenses	-30.1	-2.7
Miscellaneous operating expense	-53.7	-2.3
Depreciation	+63.7	+1.5
Maintenance		
Maintenance wages and benefits	+41.6	+1.8
Parts and maintenance supplies	+45.5	+1.4
Administration		
Administrative wages and benefits	+14.7	-.1
Administrative services	-39.5	-.1
Administrative materials and supplies	-23.7	-.3
Phone	+31.0	0
Miscellaneous administration	+432.4	+.7

(3) Maintenance cost is escalating at a greater rate than operational or administrative costs, with both wages and parts increasing over time.

(4) Employee costs and management fees are responsible for the increased administrative costs for A-systems.

B-Systems

Transit operations in medium size cities (B-systems) in Texas experienced a 24.6 percent greater cost in 1977 than in 1973. As shown Table 8, most of this increase occurred in 1977. The average cost to operate a medium size transit company from 1973 through 1977 was $1.9 million.

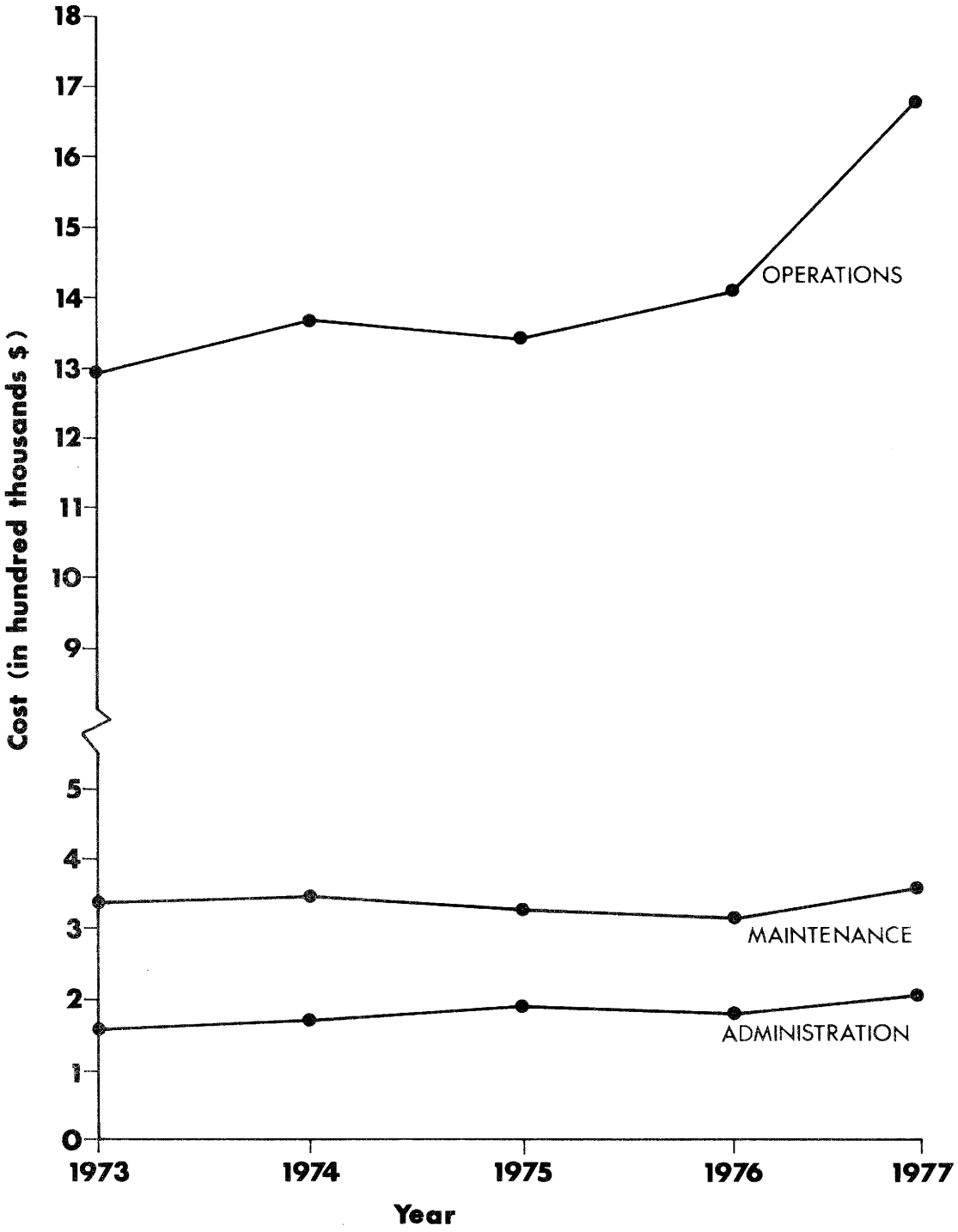
Table 8. Medium Size City Transit Cost

Year	Cost*	Percent Change From Previous Year
1973	$1,800,000	
1974	1,890,000	+4.7
1975	1,870,000	-1.0
1976	1,900,000	+2.0
1977	2,250,000	+18.0

*Average cost in 1972 dollars, rounded to nearest $10,000.

With regard to the three functional categories, all increased in cost from 1973 to 1977. Administration increased by 30.7 percent; operations by 29.1 percent; and maintenance by 4.5 percent. Again, within functional categories, the greatest percentage increases occurred in 1977 (see Figure 4). In fact,

Figure 4. B-Systems Cost by Function



operations and maintenance experienced relatively small fluctuations until the calendar year 1977. Administration experienced comparatively greater increases and decreases from 1973 through 1976, but likewise showed a substantial increase in 1977.

In 1973 the operational function constituted 72 percent of all costs, maintenance 19 percent, and administration 9 percent. Operations and administration percentages increased over time, while the maintenance percentage of total cost declined, despite a 4.5 percent increase in dollar cost. Percentages of total cost by function for B-systems are given in Table 9.

Table 9. Percent of Total Cost by Function for B-Systems

Year	Operations	Maintenance	Administration
1973	72.0	19.0	9.0
1974	72.2	18.6	9.2
1975	71.8	17.9	10.3
1976	73.9	16.6	9.5
1977	74.7	15.9	9.5

Operations

As shown in Table 13, only two components of the operations function declined in cost--leases and rentals and miscellaneous operating expense--representing a combined two percentage point decrease in their proportions of total transit cost from three percent to one percent. All other components of

the operational function increased in cost from 1973 to 1977, thus the overall 29.1 percent increase in operations cost (see Table 10).

Table 10. Operation Expense Class Object Changes for B-Systems

Cost Category	1973 Cost (in 1972 dollars)*	1977 Cost (in 1972 dollars)*	Percentage Change	Percentage Point Change as Share of Operation Total
Salaries, wages and fringe benefits	820,000	999,000	+17.2	-6.1
Bus fuel and lube	190,000	220,000	+15.8	-1.5
Tires and tubes	23,000	32,000	+36.5	+0.1
Services	8,000	13,000	+69.4	+0.2
Materials and supplies	25,000	98,000	+286.1	+3.9
Utilities	13,000	18,000	+44.8	+0.1
Insurance	85,000	154,000	+82.1	+2.7
Miscellaneous	40,000	20,000	-49.7	-1.9
Leases and rentals	13,000	1,600	-88.0	-0.9
Depreciation	51,000	123,000	+141.6	+3.4

*Rounded to nearest $1,000.

Depreciation and insurance showed significant gains in cost that affected the total transit cost. Depreciation increased 141.6 percent from 1973 to 1977. In 1973 its share of total transit cost was 2.8 percent. In 1976, 6.2 percent and in 1977, 5.4 percent of total cost was attributed to depreciation. As Table 13 shows, the net gain in percentage points from 1973 to 1977 was 2.6. Insurance increased 82 percent from an average cost of $85,000 in 1973 to $154,000

in 1977. This increase resulted in a 2.2 percentage point greater share of the total transit cost, which means that insurance comprised 6.9 percent in 1977 compared to 4.7 percent in 1973 of the total transit cost for B-systems.

Considering percentages alone, the greatest incremental change occurred for operations materials and supplies, which increased 286.1 percent from 1973 to 1977. This component is a fairly small one in the overall system. Nevertheless, an additional three percentage point increase of the total resulted, making operations materials and supplies 4.4 percent of the total cost in 1977 (see Table 13).

Utilities, operations services, and tires and tubes each showed increases in cost after the effects of inflation were taken out. Utilities increased steadily throughout the five-year period. Services slumped in 1975 but increased thereafter. Tires and tubes reached peaks in cost in both 1974 and 1977.

As would be expected, fuel increased in 1974. However, decreases of 7.6 and 1.0 percent were observed in 1975 and 1976, respectively. An 8.3 percent increase was observed in 1977, making the average cost of fuel and lube $220,000, or 15.7 percent higher than the 1973 average of $190,000. In 1973 fuel was a major contributor to total transit cost, contributing 10.5 percent of the total as a single item. This proportion grew to 11.7 percent in 1974, and then steadily declined to 9.8 percent in 1977. Fuel had a direct impact on raising transit cost in 1974 and lowering transit cost in 1975. Thereafter, its impact lessened relative to other costs.

The same dilution of effect can also be observed in the operations' salaries, wages, and fringe benefits component. Although increasing by 17 percent-from 1973 to 1977, as a share of total transit cost employee costs were reduced

from 47.2 percent in 1973 to 44.4 percent in 1977 (see Table 13). By far, the biggest increase in employee costs occurred in 1977; yet it was this year that its proportion of total cost decreased by more than 1.5 percentage points. Therefore, it can be said for B-systems that, like fuel, operations' employee costs, although increasing in cost, do not represent any proportional increase relative to other costs.

Maintenance

Approximately 90 percent of the maintenance function is composed of employee costs and parts and supplies--roughly 70 percent of the former and 20 percent of the latter. These two object classes both increased from 1973 to 1977, while the remaining two object classes within the maintenance function decreased in cost. (See Table 11.) Actually, maintenance salaries, wages, and fringe benefits increased in 1974, then decreased the following two years, and increased again in 1977 to almost the same level as 1974. As a proportion of total transit cost, in 1974 at its highest dollar cost, maintenance employee costs constituted 13.4 percent. In 1977 this share was reduced to 11.2 percent (see Table 13).

Parts and maintenance supplies increased 35 percent from 1973 to 1977. Following a small decline in 1976, a significant increase of 31.5 percent occurred in 1977. This cost category contained 3.4 percent of the total transit cost in 1973 and 3.7 percent in 1977, and was the only maintenance item to increase as a share of the total cost (see Table 13).

Miscellaneous maintenance (which includes maintenance services, leases and rentals, and other miscellaneous expenses) and maintenance fuel and lube decreased in cost by 49 percent and 33 percent, respectively, after the effects

of inflation were taken out. These cost categories combined comprised 2.2 percent of the total cost in 1973 and 1.0 percent in 1977 (see Table 13).

Although miscellaneous maintenance expense declined steadily from 1973 through 1977, due to the inclusion of maintenance services and other miscellaneous costs, it is the type of cost that would be likely to fluctuate greatly with catastrophic events. For instance, in the event that air conditioning systems had to be replaced, this would require maintenance work to be contracted out, probably at a high cost. The acquisition of newer vehicles could have the effect of lowering this cost category over time. Maintenance fuel and lube is also a variable cost, and was in fact for B-systems. This cost would vary with the number of road service calls required per year.

Table 11. Maintenance Expense Class Object Changes for B-Systems

	1973 Cost (in 1972 dollars)*	1977 Cost (in 1972 dollars)*	Percentage Change (1973-77)	Percentage Point Change as Share of Maintenance Total
Salaries, wages and fringe benefits	240,000	252,000	+4.9	+0.2
Miscellaneous	26,000	13,000	-49.1	-3.9
Maintenance fuel and lube	15,000	10,000	-32.8	-1.5
Parts and supplies	61,000	83,000	+35.0	+5.2

*Rounded to nearest $1,000.

Administration

With one exception, every cost category within the administrative function increased in cost from 1973 to 1977, as seen in Table 12. The one exception was miscellaneous administration, which includes management fees and other miscellaneous expenses. This expense object decreased by 5.7 percent during the five-year study period, and declined as a proportion of total transit cost from 2.1 percent in 1973 to 1.6 percent in 1977 (see Table 13).

With regard to percentage gains, administrative materials and supplies had the highest escalation rate within the administrative function, increasing by 152 percent from 1973 to 1977. This is a very small portion of the total transit cost, however (0.3 percent in 1977). Having a more significant effect (and the most effect on increasing administration and its share of total costs) was administrative salaries, wages, and fringe benefits. Administrative employee costs increased 50.4 percent from 1973 to 1977. The greatest change occurred in 1977 when costs increased by 28 percent. This cost category constituted 3.9 percent of the total transit cost in 1973 and 4.8 percent in 1977.

Administrative services and phone costs increased by 21.5 percent and 40.4 percent, respectively. Services represent nearly one-third of all administrative costs and about 2.5 percent of all costs. Phone costs remained constant at 0.3 percent of total transit cost from year to year despite its steady increase in dollars of 40.4 percent.

Table 12. Administration Expense Class Object Changes for B-Systems

Cost Category	1973 Cost (in 1972 dollars)*	1977 Cost (in 1972 dollars)*	Percentage Change (1973-77)	Percentage Point Change as Share of Administration Total
Salaries, wages and fringe benefits	70,900	106,600	+50.4	+6.5
Services	46,000	55,600	+21.5	-2.0
Materials and supplies	3,000	7,600	+151.8	+1.7
Phone	5,100	7,200	+40.4	+0.2
Miscellaneous	38,000	35,900	-5.7	-6.5

*Rounded to nearest $100.

Notable changes in B-system transit costs include the following:

(1) Total cost increased most significantly in 1977.

(2) Increased employee costs had the greatest impact within the administrative function, and are not observed to be escalating in relation to other costs in the maintenance and operations functions.

(3) Insurance, depreciation, and maintenance parts are three components that contributed most to overall cost increases.

Table 13. Expense Class Object Changes For B-Systems

Cost Category	Percent Change	Percent Change As Share of Total Transit Cost
Operations		
Operations wages and benefits	+17.2	-2.8
Bus fuel and lube	+15.8	-0.7
Tires and tubes	+36.5	+0.1
Operations services	+69.4	+0.2
Operations materials and supplies	+286.1	+3.0
Utilities	+44.8	+0.2
Insurance	+82.1	+2.2
Miscellaneous operating expense	-49.7	-1.4
Leases and rentals	-88.0	-0.6
Depreciation	+141.6	+2.6
Maintenance		
Maintenance wages and benefits	+4.9	-2.1
Miscellaneous maintenance	-49.1	-0.8
Maintenance fuel and lube	-32.8	-0.4
Parts and maintenance supplies	+35.0	+0.3
Administration		
Administrative wages and benefits	+50.4	+0.9
Administrative services	+21.5	0
Administrative materials and supplies	+151.8	+0.1
Phone	+40.4	0
Miscellaneous administration	-5.7	-0.5

C-Systems

The total cost of operating small transit systems (C-systems) in Texas increased by 50.6 percent from 1973 through 1977, or an increase per system of $150,000 (see Table 14). With the exception of miscellaneous maintenance expense and administrative wages and salaries, every cost category showed an increase during the five-year study period.

Table 14. Small City Transit Cost

Year	Cost*	Percent Change From Previous Year
1973	$295,000	
1974	321,000	+8.6
1975	353,000	+10.1
1976	389,000	+10.1
1977	445,000	+14.5

*Average cost in 1972 dollars, rounded to the nearest $1,000.

Operational expenses increased for C-systems at a higher rate than maintenance or administrative costs. (See Figure 5.) Administrative, maintenance, and operational expenses increased 27, 41, and 58 percent, respectively. Of the three expense functions, operations showed the only increase in its proportion of total transit cost. Although more funds were spent in maintenance and administrative functions over the study time frame, these expenditures decreased in their contribution to the total cost. (See Table 15.)

Figure 5. C-Systesm Cost by Function

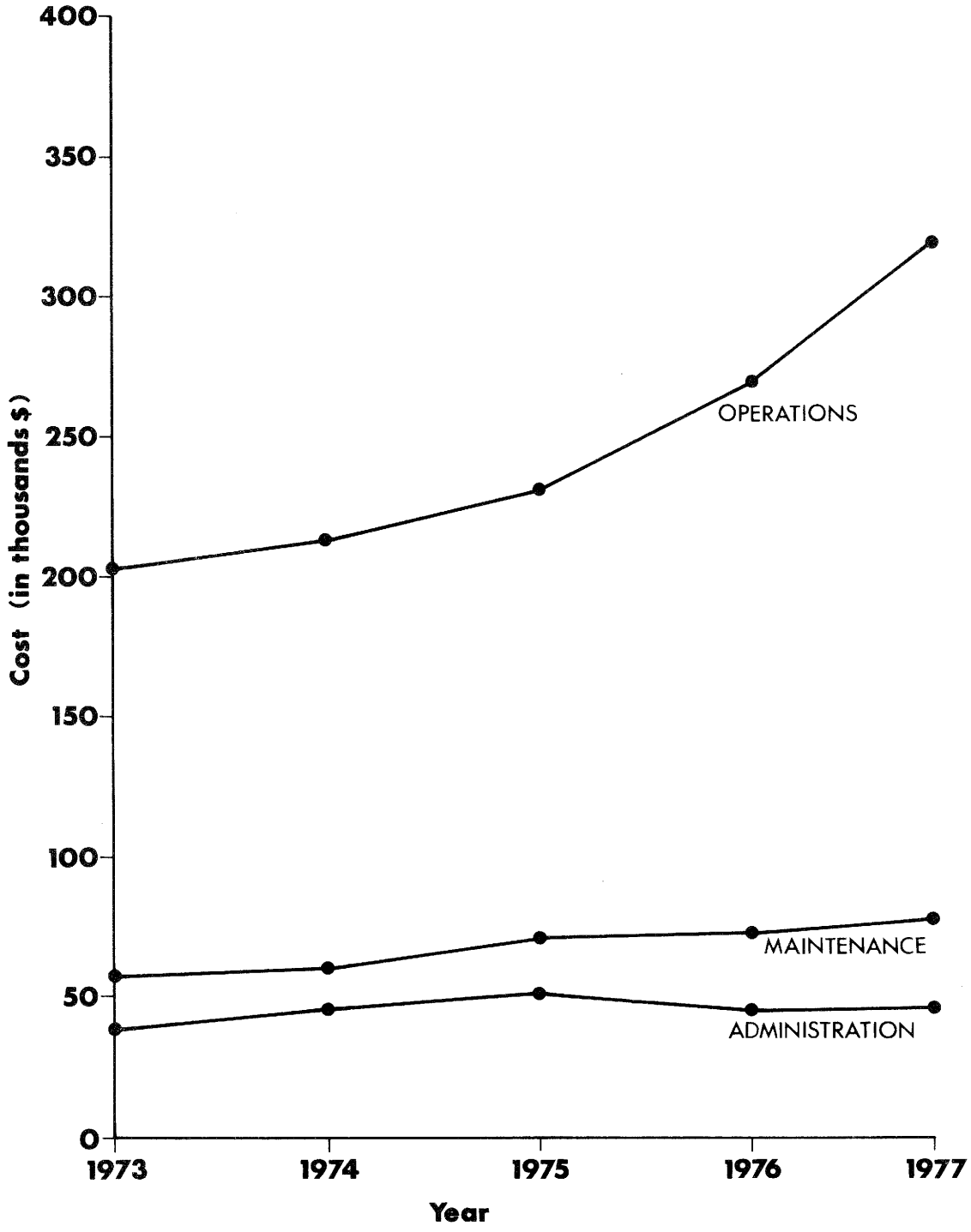


Table 15. Percent of Total Cost by Function for C-Systems

Year	Operations	Maintenance	Administration
1973	68.7	18.5	12.8
1974	66.5	18.5	15.0
1975	66.1	19.9	14.0
1976	69.5	18.9	11.6
1977	72.0	17.3	10.7

Operations

Every expense category within the operations function experienced an increase in cost from 1973 through 1977. (See Table 16.) Again, the two most significant increases were in depreciation and insurance. Depreciation doubled within the five-year period, and increased its percentage share of the total cost by 2.1 percentage points, while increasing its proportion of operations cost by 2.5 percentage points. Depreciation went from an average cost per system of $19,200 in 1973 to $38,300 in 1977. Insurance increased by 171 percent, and took an additional 3.7 percentage point share of the total cost. In 1973, the cost of insurance for C-systems required 4.5 percent of the total budget, while in 1977 insurance cost escalated to the degree that 8.2 percent of the total budget was required. Insurance, on the average, cost $13,400 in 1973. In 1974 insurance cost dropped very slightly to $13,300. However, in 1975 a dramatic increase occurred and continued, so that in 1977, insurance cost per C-system was $36,300 (see Figure 6).

Figure 6. Insurance and Depreciation Cost: Two Primary Factors in Escalated Operating Expense

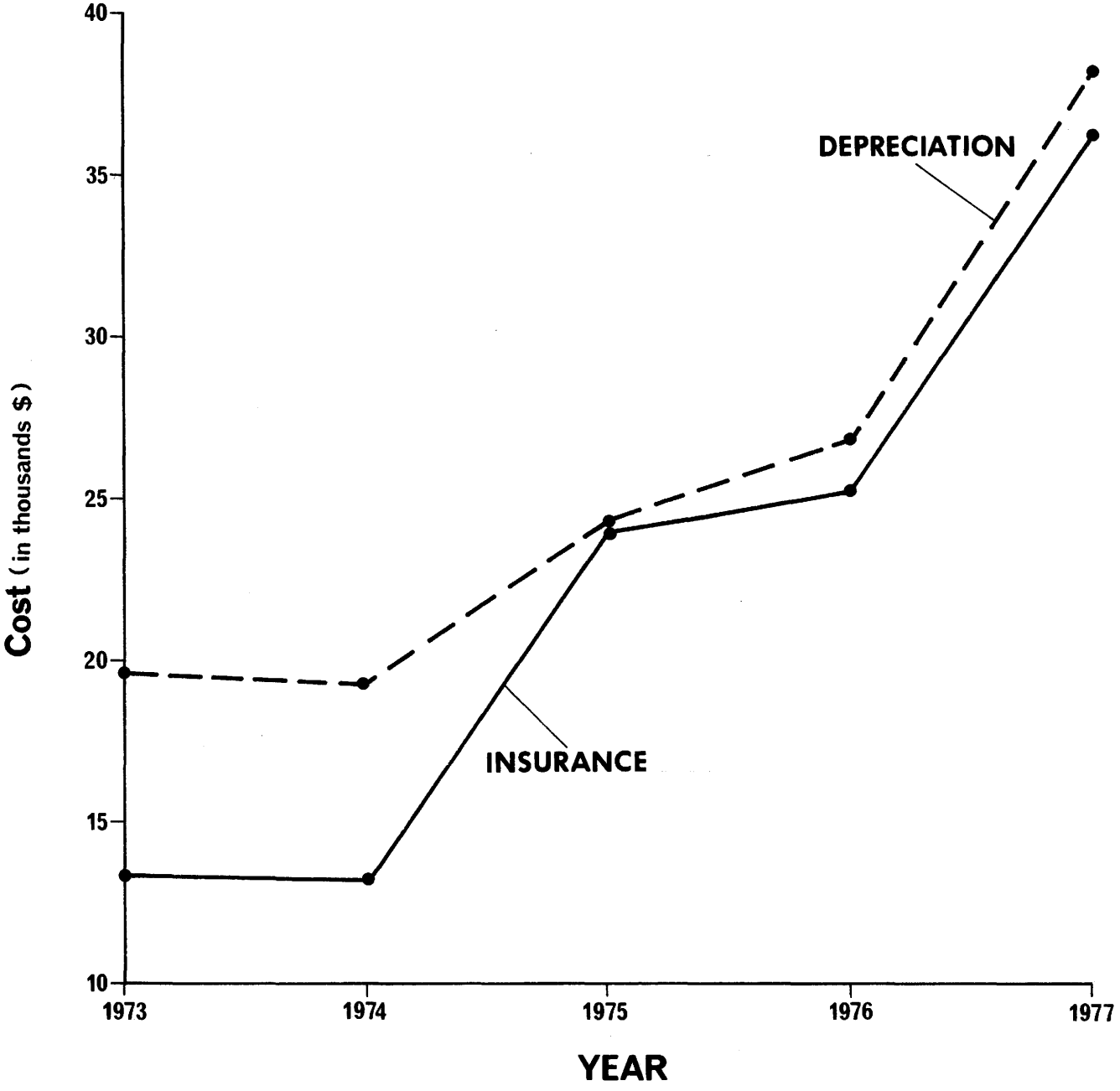


Table 16. Operation Expense Class Object Changes for C-Systems

Cost Category	1973 Cost (in 1972 dollars)*	1977 Cost (in 1972 dollars)*	Percentage Change (1973-77)	Percentage Point Change as Share of Operation Total
Salaries, wages and fringe benefits	$115,300	$159,900	+38.6	-6.9
Bus fuel and lube	21,400	33,500	+56.6	-0.08
Tires and tubes	2,900	4,400	+51.9	-0.05
Services	1,500	6,100	+296.4	+1.1
Utilities	2,000	4,000	+95.1	+0.2
Insurance	13,400	36,300	+170.9	+4.7
Miscellaneous	12,500	14,400	+14.7	-1.7
Depreciation	19,200	38,300	+99.7	+2.5

*Rounded to nearest $100.

Other operational expense class objects that increased in proportion to total cost as well as in dollars over time include fuel and lube, services, and utilities. Fuel and lube increased 57 percent and, as seen in Table 19, gained .3 percentage points of the total cost in 1977. Average fuel and lube cost for C-systems steadily increased from $21,400 in 1973 to $33,500 in 1977 (see

Figure 7. Average Fuel and Lube Cost, C-Systems

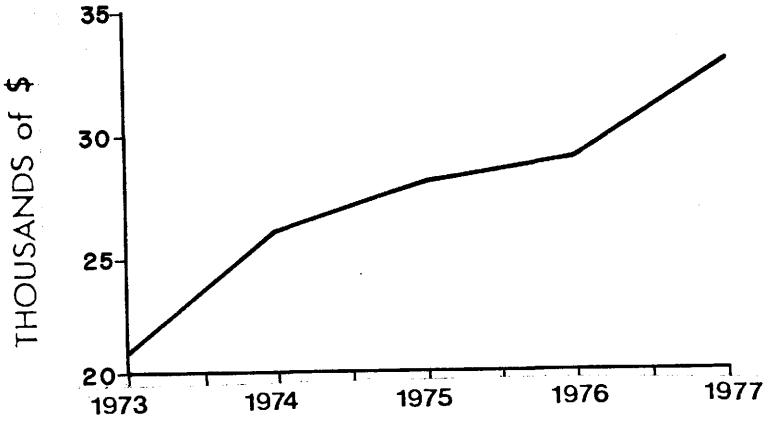


Figure 7). Services increased by 296 percent, or a .9 percentage point increase in its share of total cost (see Table 19). Most of this increase occurred in 1976 and 1977. In 1976, cost of operational services doubled, and in 1977 this expense increased by 68 percent. The cost of utilities also rose in 1976 and 1977 to produce an overall doubling after a slight decline in 1974 and 1975.

Tires and tubes rose steadily in cost four of the five years. However, a notable jump was evidenced in 1976 in which the average cost of tires and tubes was $6,100. Then in 1977, tires and tubes cost receded to an average $4,400 per system, which was more in line with its steady progression in cost of 52 percent during the five-year period.

Miscellaneous operating expense increased 15 percent but lost one share of the percent of total cost over five years (see Table 19), and lost 1.7 percentage points of the operation function (see Table 16). For C-systems this expense category includes taxes and licenses, miscellaneous operational expenses, interest expense, and leases and rentals.

In the small transit systems operations' salaries, wages, and benefits increased by 38.6 percent. This cost category represented 43.8 percent of the total transit cost and 63.7 percent of the total operational cost in 1973. However, in 1977 40.8 percent of the total transit cost and 56.7 percent of the total operational cost was absorbed by operational employee costs. This indicates that although salaries, wages, and fringe benefits are increasing in cost, the increase does not dominate other rising costs. In 1973 average operational employee cost for C-systems was $115,000 while in 1977 the cost was $160,000.

Maintenance

Within the maintenance function for the C-system transit class, three expense object classes were designated, (see Table 17). These are (1) employee costs, (2) parts and supplies, and (3) miscellaneous, which includes maintenance services, fuel and lube, utilities, leases and rentals, and other miscellaneous maintenance items. As stated above, the total maintenance function increased 41 percent during the study time period. Of the three class objects, maintenance salaries, wages, and benefits had the most demonstrable increase in cost. This cost category, which represented 7.6 percent of the total transit cost in 1973, increased 83 percent by 1977 and took 9.3 percent of the total transit cost (see Table 19). Maintenance employee costs peaked in relation to all other costs in 1975, taking 10.2 percent of the total budget, and costing $35,900 average per system. In 1973 maintenance salaries, wages, and fringe benefits cost on the average $22,500 per system, and by 1977 this cost had risen to $41,200, and had increased as a share of total maintenance cost by 12.3 percentage points (see Table 17).

Also increasing in cost for C-systems was parts and maintenance supplies. In 1973 parts and supplies cost an average of $29,200 or 10 percent of the total transit budget. In 1977 the average cost of parts and supplies was $34,000; however, this amount was 7.6 percent of the total cost (see Table 19). Although parts and supplies increased in cost every year (with the exception of 1974), their cost relative to all other costs actually decreased.

Miscellaneous maintenance expense decreased in cost over the five-year study period by one-third. This consolidation of various maintenance expenses does not comprise a very significant portion of the total C-system cost, but as shown in Table 19, it did drop from one percent of the total cost to .4 percent, a decrease of .6 percentage points.

Table 17. Maintenance Expense Class Object Changes for C-Systems

Cost Category	1973 Cost (in 1972 dollars)*	1977 Cost (in 1972 dollars)*	Percentage Change (1973-77)	Percentage Point Change as Share of Maintenance Total
Salaries, wages and fringe benefits	$22,500	$41,200	+83.0	+12.3
Parts and supplies	29,300	34,000	+16.0	+9.5
Miscellaneous	2,900	1,900	-33.3	-2.8

*Rounded to nearest $100.

Administration

The functional category that increased least for small systems was administration, which increased by 26.9 percent. Two most contributory factors involved in this increase were administrative services and miscellaneous administrative expenses. Both of these class objects increased more than threefold. Services, which increased 293.1 percent, went from an average of $2,000 in 1973 to $7,800 in 1977, and a corresponding one percentage point increase in its share of the total cost was also evidenced (see Table 18). Miscellaneous administration (includes management fees as well as other administrative miscellaneous items) increased in cost by 206.4 percent. This expense object took 1.4 percent of the total transit cost in 1973. In 1977 its share had increased 1.5 percentage points for a 2.9 percentage take of the total (see Table 19). A dramatic leap in 1974 and again in 1977 resulted in the change from an average cost of $4,200 in 1973 to $12,800 in 1977. As seen in Table 18, miscellaneous costs had the highest increase as a proportion of administrative costs. Also increasing in cost was administrative materials and supplies which showed a 63.6 percent gain in cost.

A significant portion of administrative costs experienced a decline in percentage points. Administrative employee costs decreased by 17.8 percent. In 1973 average administrative employee costs per C-system were $30,000 and in 1977 these costs equalled $24,600. This drop occurred after a 22 percent increase in 1974. Administrative employee costs claimed 10.1 percent of the total transit budget in 1973, but in 1977 only 5.5 percent of the total budget was used for administrative personnel (see Table 19). Administrative wages were the only decreasing employee costs found in the C-system class. Maintenance salaries,

wages, and fringe benefits proved to be escalating at the highest rate. Administrative cost category changes can be seen in Table 18.

Table 18. Administration Expense Class Object Changes for C-Systems

Cost Category	1973 Cost (in 1972 dollars)*	1977 Cost (in 1972 dollars)*	Percentage Change (1973-77)	Percentage Point Change as Share of Administration Total
Salaries, wages and fringe benefits	$29,900	$24,600	-17.8	-27.9
Services	2,000	7,800	+293.1	+11.0
Materials and supplies	1,700	2,700	+63.6	+1.3
Miscellaneous	4,200	12,800	+206.4	+15.7

*Rounded to nearest $100.

Analysis has revealed the following about C-system transit costs:

(1) Operational costs are escalating at a greater rate than maintenance or administrative costs.

(2) Insurance, depreciation, and services are the three expense object classes most responsible for escalating operational cost.

(3) Drivers' and supervisors' salaries, wages, and fringe benefits are increasing in cost; however, the increase loses potency relative to other rising costs, as evidenced by the overall decrease in its proportion of operational and total costs.

(4) Increased employee costs have the greatest cost effect on the maintenance function.

Table 19. Expense Object Changes For C-Systems

Cost Category	Percent Change (1973-1977)	Percent Change As Share of Total
Operations		
Operations wages and benefits	+38.6	-3.0
Bus fuel and lube	+56.6	+.3
Tires and tubes	+51.9	0
Operations services	+206.4	+.9
Utilities	+95.1	+.2
Insurance	+170.9	+3.7
Miscellaneous operating expense	+14.7	-1.0
Depreciation	+99.7	+2.1
Maintenance		
Maintenance wages and benefits	+83.0	+1.7
Parts and maintenance supplies	+16.0	-2.3
Miscellaneous maintenance	-33.3	-.6
Administration		
Administrative wages and benefits	-17.8	-4.6
Administrative services	+293.1	+1.0
Administrative materials and supplies	+63.6	0
Miscellaneous administration	+206.4	+1.5

(5) Services and miscellaneous expense have the greatest effect on administrative costs.

(6) Administrative employee costs are the only administrative or employee costs to experience a decline over the five-year study period.

Analysis of Transit Cost in Texas: Overview

Total System Costs

Table 20 is a summary table of total transit cost in Texas from 1973 through 1977. It is demonstrated in this table that as transit systems decrease in size, their cost increases over time become greater. Small systems' cost from 1973 to 1977 increased at twice the rate of medium systems'. It is also important to note that small systems' cost increased by eight percent or more each year, while medium and large systems demonstrated more variable changes from year to year. B-systems experienced least dramatic changes until 1977, when they showed the highest percentage increase. A-systems demonstrated the greatest degree of fluctuation over the five-year period.

The greatest amount of change statewide occurred in 1977. When the effects of inflation were taken out, decreases in total cost were noted in 1974 and 1976 for A-systems and in 1975 for B-systems.

Functional Costs

In looking at the three functional cost categories, the magnitude of the operational function is apparent for all system sizes. However, it should be pointed out that *as transit systems decrease in size, so do their operational costs relative to other functions*. Maintenance costs require similar proportions of the total cost (approximately 18 percent) for all systems. Relative to the other functions, *administration costs increase as transit systems decrease*

Table 20. Summary of Annual Average Transit Cost

Year	Cost by System					
	A		B		C	
1973	$12.690		$1.805		$.295	
% Change		(-8.8)		(+4.7)		(+8.6)
1974	11.577		1.890		.321	
% Change		(+14.9)		(-1.0)		(+10.1)
1975	13.299		1.871		.353	
% Change		(-1.3)		(+2.0)		(+10.1)
1976	13.125		1.908		.389	
% Change		(+16.5)		(+18.0)		(+14.5)
1977	15.125		2.249		.445	
Overall Percent Change		+20.5		+24.6		+50.7

*Cost in 1972 dollars, in millions. Percentage changes were computed prior to rounding.

in size. These proportions of total cost by function can be seen more clearly in Table 21.

Table 21 also illustrates the following:

(1) In general, operational costs are *decreasing* in their contribution to total cost in *large* systems, but are *increasing* for *medium* and *small* systems.

(2) A trend toward a proportionate *increase* in maintenance for *large* systems, and a proportionate *decrease* for *medium* systems is evidenced.

Expense Class Objects

The causes of functional categories increasing and decreasing can best be explained by examining the effects of the expense class objects. The most significant cost incurred by all transit systems is employee costs. Salaries, wages, and fringe benefits for all employees took more than 50 percent of the total budget for each size system every year. The one exception was in 1977 with large systems where employee costs were 49 percent of total cost (see Table 22). Therefore, increases or decreases in this cost category should have strong potential as a single cost category to influence total cost. If, for instance, employee costs rose, total transit cost rose, and employee costs' contribution to the total cost also rose, then this cost category could be delineated as an influential factor in escalating transit costs. The results show that this was indeed the case, that as employee costs rose and fell, so did total transit cost. However, employee cost did not always rise and fall in its proportion of total cost in conjunction with its increase or decrease in dollar cost. This

Table 21. Percent of Total By Function For All Systems

Year	A-System			B-System			C-System		
	Operations	Maintenance	Administration	Operations	Maintenance	Administration	Operations	Maintenance	Administration
1973	79.8	16.4	3.8	72.0	19.0	9.0	68.7	18.5	12.8
1974	79.9	16.0	4.1	72.2	18.6	9.2	66.5	18.5	15.0
1975	78.5	17.5	4.0	71.8	17.9	10.3	66.1	19.9	14.0
1976	77.2	18.6	4.2	73.9	16.6	9.5	69.5	18.9	11.6
1977	76.4	19.6	4.0	74.7	15.9	9.5	72.0	17.3	10.7

Table 22. Employee Costs as a Percentage of Total Cost

System Size	Year				
	1973	1974	1975	1976	1977
A	53.8	54.4	51.1	51.8	49.0
B	64.4	62.5	61.9	62.4	60.3
C	61.5	62.0	58.9	59.1	55.6

indicates that employee cost increases and decreases, although influential, were often diluted somewhat by changes of greater magnitude in other categories.

To be specific, the following is a summary of changes by year and the most responsible cost categories in order of their contribution to the change in total cost. Figures 8, 9, and 10 provide a graphical illustration of the changes in major costs.

Figure 8. Major Costs For A-Systems

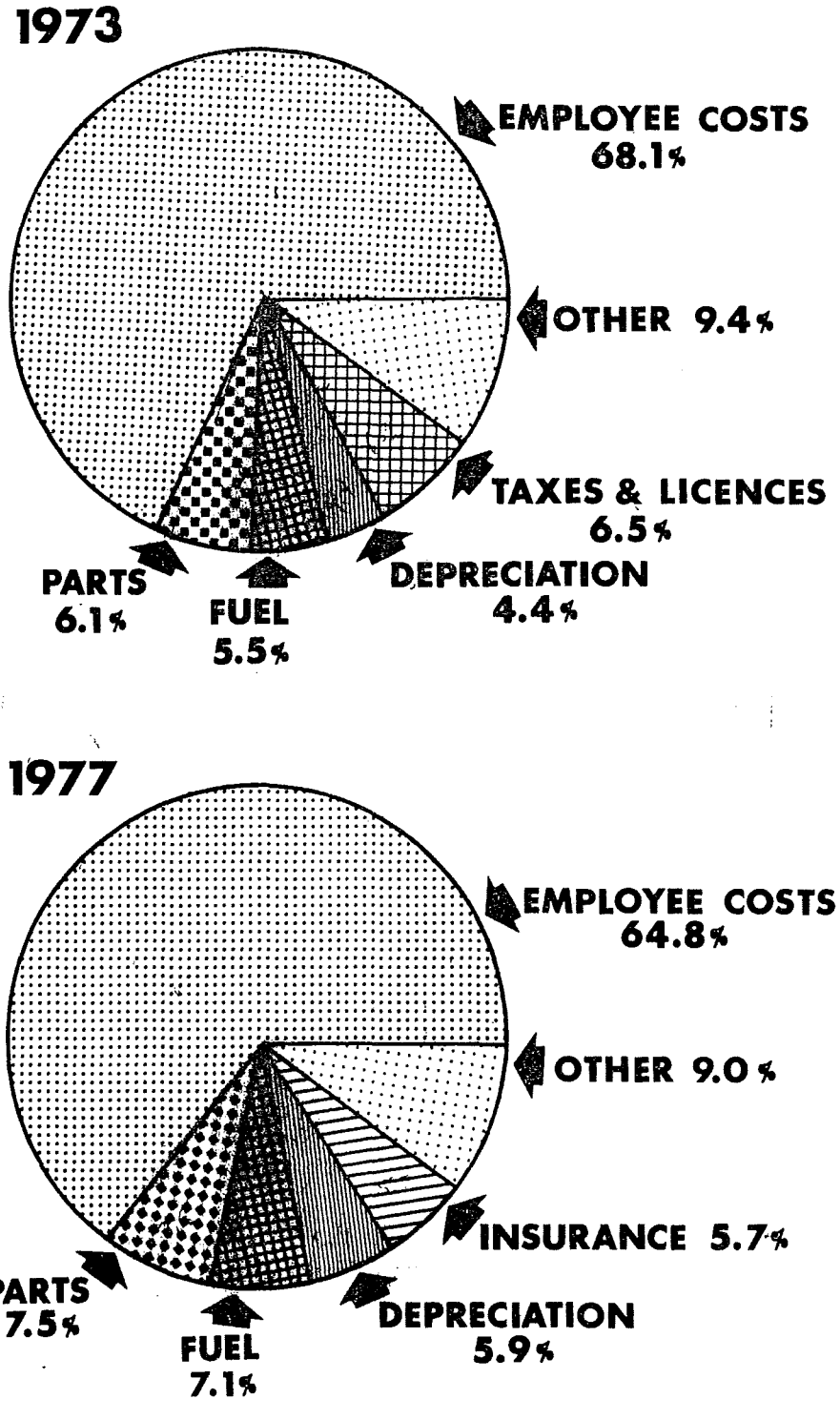


Figure 9. Major Costs For B-Systems

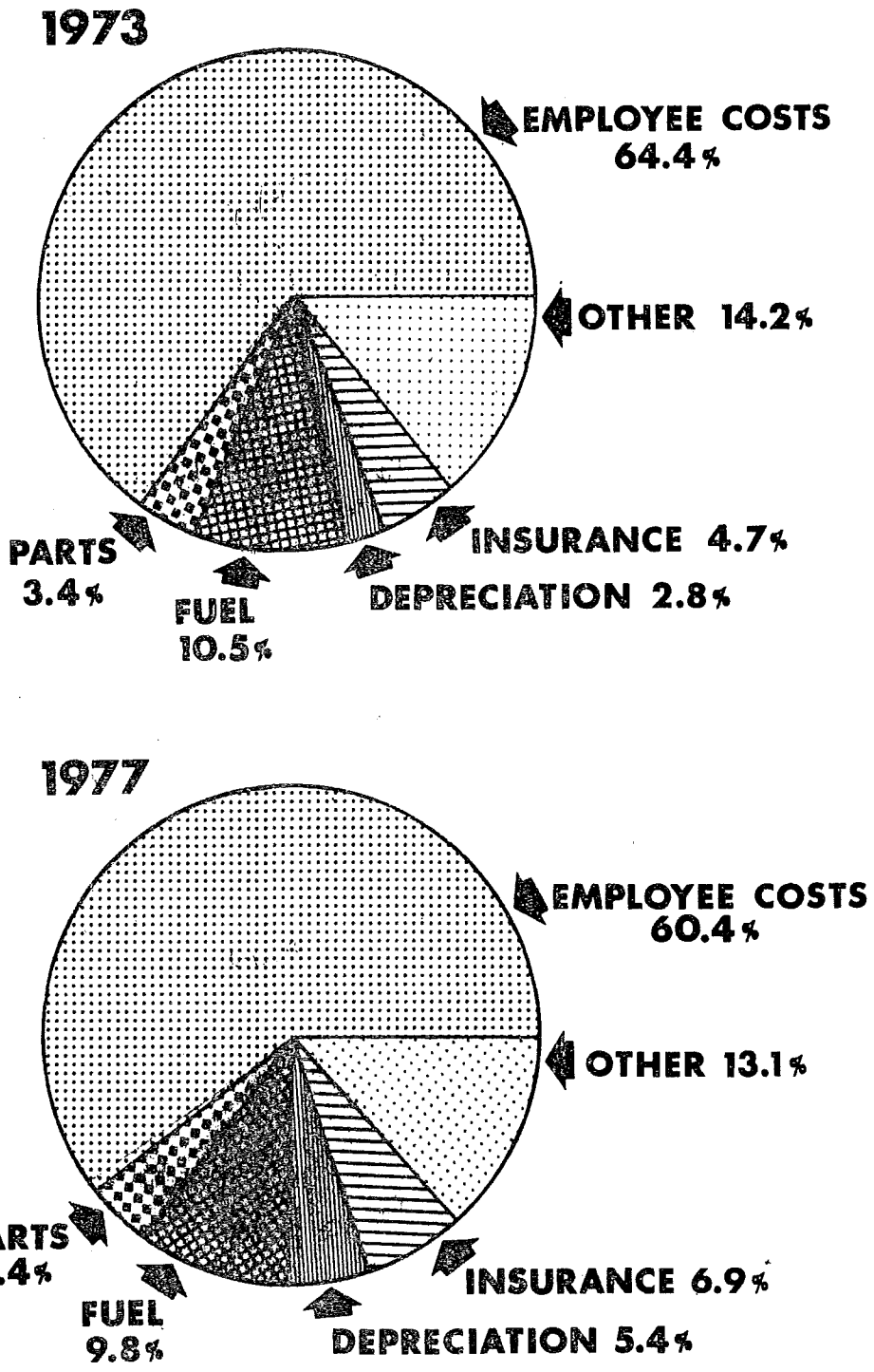
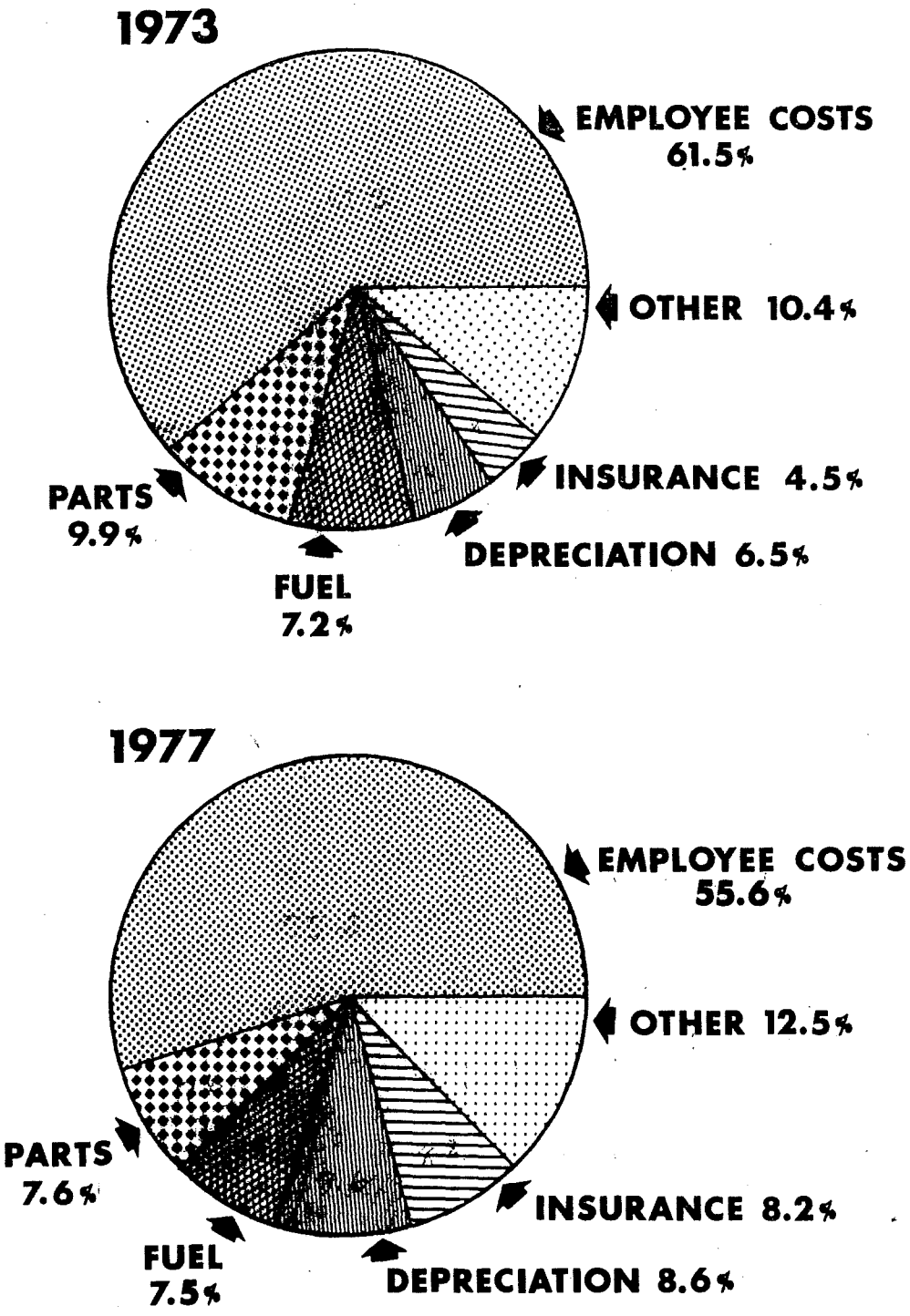


Figure 10. Major Costs For C-Systems



- In 1974, total cost for A-systems decreased. The most responsible items were:

  employee costs

  parts, maintenance materials and supplies

  taxes and licenses

- In 1975, total cost for A-systems increased. The most responsible items were:

  depreciation

  employee costs

  fuel

  parts

  taxes and licenses

- In 1976, again A-system total cost decreased. Important items also decreasing that year were:

  employee costs

  depreciation

  taxes and licenses

- In 1977, a substantial increase in total cost for A-systems was evidenced. Primary factors were:

  insurance

  parts

  employee costs

  fuel

- An increase in total cost for B-systems in 1974 was primarily the result of increases in:

  depreciation

  fuel

  insurance

  parts

  employee costs

- The decrease in total cost that occurred for B-systems in 1975 was due to significant decreases in the two cost categories of fuel and employee costs.
- Three factors were most influential in the increased total B-system cost in 1976. They were:

  depreciation

  insurance

  employee costs

- In 1977, total cost for B-systems increased mainly as a result of a dramatic increase in insurance costs and an escalation in the cost of operations' materials and supplies.
- Increases in C-systems' total cost in 1974, 1975, and 1976 were primarily due to increases in the following cost categories listed in order of their impact from year to year:

  depreciation

  insurance

  employee costs, primarily administrative

  parts

  fuel

- In 1977, significant increases in depreciation and insurance were critical factors responsible for the total cost increase for C-systems. Additional factors were fuel, parts, and employee costs.

The ten points listed above draw attention to the largest cost categories that from year to year affected total cost. To complete the profile of escalation effects, other items need to be included. They do not represent large proportions of total cost so that their cost impact is not great on the whole. Yet, they cannot be omitted as items of cost escalation.

- During the five-year period from 1973 through 1977, miscellaneous administrative costs increased by 432.4 percent for A-systems and 206.4 percent for C-systems.
- Utility costs rose 132.4 percent for A-systems over the five-year period.
- Administrative materials and supplies increased 151.8 percent for B-systems from 1973 to 1977.
- Services for C-systems increased at a very high rate--206.4 percent for operational services, and 293.1 percent for administrative services.

Discussion of Causes

It is difficult to avoid oversimplification when giving reasons for the increases in transit costs presented here. Yet, it is even more difficult to thoroughly investigate every cause for each expense increase or decrease. Based on some general events that occurred during the study time period throughout the transit industry, some causes are proposed.

For A-systems, operations costs increased but at a slower rate than for B and C-systems, and maintenance expenses also increased proportionally greater. The largest systems in the state were experiencing a high growth rate in terms of system use and miles covered during the years that A-system costs increased. Among the specific items responsible for the increases are employee costs, parts, fuel, depreciation, and insurance. During this time period (1973-1977), A-systems were not acquiring capital equipment at the same rate they were growing. Consequently, the fleets of the time were put to maximum use, and greater volumes of parts and maintenance supplies were needed. Also, greater numbers of employees and more fuel were required. Some vehicles were acquired for A-systems during this period, thus increasing depreciation and insurance, which are both major expense items.

Note that for B- and C-systems operations and administration increased at a greater rate than maintenance. From 1973 through 1977 capital assistance grants were made more available by UMTA for smaller systems. This resulted in the acquisition of more vehicles and capital equipment by many smaller transit systems. New buses have a tremendous effect on depreciation, causing very high costs initially that diminish with time. Additionally, a growing fleet size is highly correlated with greater insurance costs. It was these two cost categories, depreciation and insurance, that were identified as most influential in the overall cost increase experienced by smaller systems.

Employee costs were also listed as a factor significantly affecting total cost. During the 1970's more and more systems have become unionized (especially smaller ones) which generally results in a higher pay scale. Increased employee costs for smaller systems may be accounted for, in part, by this unionizaton of drivers.

Fuel expense for all systems was instrumental in changing costs. The oil embargo of 1973 obviously had an effect on the cost of fuel for transit systems during the ensuing years.

IV. MEASURES OF EFFICIENCY

The cost data and analysis presented in the previous chapter take on a new and enlightening dimension when they are used to determine cost ratios. Measures of efficiency are useful in gauging transit performance. Transit operators use measures of efficiency to determine how successful they have been in achieving their goals. It is not the purpose of this research to evaluate the success or failure of the transit systems in Texas. In the first place, the desired goals of each of the operations, or even of the entire State transit industry are not known. Caution and criticism have been levied against using aggregative data to "derive penetrating widsom" (Gambaccini, 1977) regarding transit performance:

> There are many treacheries using overall data on a single system, much less trying to construct an industry wide profile of what the efficiency or effectiveness of transit really is.
>
> I can, in my more passive moments, accept such attempts as harmless exercises. But, unfortunately, the results are more often used to heap abuse on transit than anything else.

With this in mind, this phase of the study has been included strictly to provide cost ratio information. It is not merely an exercise, nor is it intended to be used as an evaluation of statewide transit performance. Primarily, it is seen as a salient component in the study of transportation costs over time.

The following two ratios appear to be most appropriate in measuring unit costs:

(1) Total cost per vehicle-mile operated

$$\frac{TC}{VM}$$

(2) Total cost per passenger carried

$$\frac{TC}{P}$$

Table 23 gives cost ratio information in time series for the state.

Table 23. Statewide Transportation Cost Ratios[a]

Year	Total[b] Cost (TC)	Total[c] Passengers (P)	Total[d] Miles (VM)	$\frac{TC}{VM}$ (1972 $)	$\frac{TC}{VM}$ (current $)	$\frac{TC}{P}$ (1972 $)	$\frac{TC}{P}$ (current $)	$\frac{P}{VM}$
1973	33.3	91.7	43.7	$.76	$ .80	$.36	$.38	2.09
1974	31.3	82.4	41.5	.75	.87	.38	.44	1.98
1975	34.7	86.3	42.9	.81	1.03	.40	.51	2.01
1976	34.9	85.0	40.6	.86	1.15	.41	.55	2.09
1977	40.4	87.3	42.2	.96	1.37	.46	.65	2.07

[a]Excluded from this analysis are data from Austin, San Antonio, Galveston, and Laredo.
[b]In 1972 dollars, in millions
[c]In millions
[d]Total million miles include passenger and deadhead miles.

In current dollars, the statewide total cost per vehicle-mile has increased $.57 from 1973 through 1977, total cost per passenger has increased $.27, while passengers per mile have remained fairly constant at two. In relation to national averages, Texas' costs are lower but appear to be increasing more rapidly. A steady upward trend for the nation from 1970 to the present has occurred. In 1976, the national average cost per passenger was $.63 compared to $.55 for Texas. The average cost per mile for the nation in 1976 was $1.41 compared to Texas' $1.15. Texas transit systems also have a slightly lower passenger-mile ratio--2.09 in 1976 compared to 2.62 for the nation.* Texas has experienced a decrease in total passengers over time--91.7 million in 1973 was the highest number in the five year analysis period.

*Source: APTA Transit Operating Report, 1976.

Cost ratios by system size are shown in Table 24. Larger systems in Texas had greater expenditures per vehicle mile for all years. Size and cost per passenger were also directly related, with the exception of B-system cost per passenger in 1973. This ratio was low relative to other size systems and also compared to other B-system years. The higher than usual passenger per mile ratio was responsible for the lower cost per passenger.

Table 24. Cost Ratios by System Size*

Ratio	System Class	1973	1974	1975	1976	1977
$\frac{\text{Total Cost}}{\text{Vehicle-Miles}}$	A	$ .85	$ .81	$ .88	$ .94	$1.04
	B	.60	.66	.66	.68	.79
	C	.52	.55	.62	.68	.72
$\frac{\text{Total Costs}}{\text{Passengers}}$	A	.40	.39	.43	.42	.47
	B	.27	.37	.35	.38	.45
	C	.31	.30	.31	.35	.42
Passengers per Mile	A	2.11	2.07	2.06	2.21	2.20
	B	2.23	1.79	1.87	1.79	1.77
	C	1.67	1.83	1.97	1.94	1.72

*All cost ratios are in 1972 dollars.

It is evident that operating costs by vehicle-miles are increasing every year for each system. Cost per passenger has also increased on the whole. Longer trip lengths due to migration to the suburbs and lower transit usage are

often held responsible for higher operating costs per passenger trip. Although in most cases there appears to be a relationship between higher passenger per mile ratios and lower cost per passenger, in some cases the number of passengers per mile has not increased at the same rate as has cost. It is clear that in 1977, not only did overall costs increase dramatically, but cost ratios also rose sharply in every case.

To supplement the ratios given above, passenger and mileage data by system are presented in Table 25.

Table 25. Passengers and Miles by System Size*

	SYSTEMS					
	A		B		C	
Year	Passengers	Miles	Passengers	Miles	Passengers	Miles
1973	63.1	29.9	22.2	9.96	6.35	3.80
1974	59.0	28.5	16.3	9.09	7.05	3.85
1975	62.4	30.3	16.4	8.81	7.52	3.81
1976	61.8	28.0	15.7	8.76	7.49	3.87
1977	64.8	29.4	15.1	8.54	7.34	4.26

*In millions.

Note that for A-systems miles and passengers fluctuated together. Years in which decreases occurred in ridership and miles were also years in which total cost for A-systems also decreased.

Ridership and miles for B-systems have declined over time. Nevertheless, cost per mile and cost per passenger have increased fairly consistently over time.

It is obvious that C-systems have been growing from 1973 through 1977, adding more miles and more passengers until 1976 when ridership began to taper off. C-systems' costs have also grown from year to year.

V. SUMMARY

The technical study on which this report is based, "Effects of Maintenance, Rehabilitation and Operations Cost Escalation on Transit Systems," was undertaken to analyze detailed cost information of Texas' transit systems. The primary objectives of the study were to determine the levels of cost involved in the operation of transit in Texas and to determine which costs are increasing, how much, and why.

Data were collected from 15 Texas transit systems for the five year period from 1973 through 1977 using the F.A.R.E. (Financial, Accounting, and Reporting Elements) system of accounting as a basis for categorizing the data. Thirty-two expense class objects were delineated that contribute to a functional aspect of the total cost. Operations, maintenance, and administration are the three functions comprising total costs.

For the analysis, the fifteen systems were divided into three categories--large (A), medium (B), and small (C). This classification was based on the population size of the area served by each operation. An average total cost for all variables was calculated for each system classification (A, B, and C) in 1972 dollars.

The results show that the total cost of operating large city transit (A-systems) in Texas increased by 20.5 percent from 1973 to 1977. The total cost of operating medium size city transit (B-systems) increased by 24.6 percent; and the total cost of operating small city transit (C-systems) increased by 50.7 percent. A-system's total cost decreased in 1974 and 1976 by 8.8 and 1.3 percent, respectively, and increased in 1975 and 1977 by 14.9 and 16.5 percent, respectively. B-systems' total cost increased by 18 percent in 1977. Much lower percentage changes were observed in the previous years--an increase

of 4.7 percent in 1974, a one percent decrease in 1975, and a two percent increase in 1976. C-systems' total cost increased by 8.6 percent in 1974, 10.1 percent in 1975, 10.1 percent in 1976, and 14.5 percent in 1977. The greatest percentage increases for all system classifications were in 1977.

The data specific to A-systems' cost variations over time revealed the following:

(1) Depreciation and insurance were important items involved in cost escalation.

(2) Although drivers' and supervisors' wages, salaries, and fringe benefits demonstrated an overall increase in dollars, a decrease in their proportion of total transit cost indicates a relatively less important contribution to overall cost increases.

(3) Maintenance cost was escalating at a greater rate than operational or administrative costs, with both wages and parts increasing over time.

(4) Employee costs and management fees were responsible for the increased administrative costs for A-systems.

Notable changes in B-system transit costs included the following:

(1) Insurance, depreciation, and maintenance parts were three components that contributed significantly to overall cost increases over time.

(2) The dramatic increase that occurred in 1977 was primarily the result of escalations in the costs of insurance and operations' materials and supplies.

(3) Increased employee costs had the greatest impact within the administrative function; however, they were not observed to be escalating in relation to other costs in the maintenance and operations functions.

Analysis revealed the following about C-system transit costs:

(1) Operational costs were escalating at a greater rate than maintenance or administrative costs.

(2) Insurance, depreciation, and services were three expense object classes responsible for increasing operational costs.

(3) Drivers' and supervisors' salaries, wages, and fringe benefits increased in cost; yet an overall decrease in their proportion of total cost was observed.

(4) Within the maintenance function, increased employee costs had the greatest effect.

(5) Services and miscellaneous expenses had the greatest effect on administrative costs.

(6) Administrative employee costs were the only administrative or employee costs to decrease for C-systems.

In general, the analysis of expense class objects revealed that those most influential in affecting total transit cost increases were normally of the greatest dollar magnitude. These items were employee costs, depreciation, parts, fuel, and insurance. Depreciation and insurance were found to be increasing most in percentage points of the total transit cost.

Other specific items were found to be increasing substantially, although their proportions of total cost were not significantly influential. During the five-year period from 1973 through 1977, miscellaneous administrative costs increased by 432.4 percent for A-systems and 206.4 percent for C-systems. Utility costs rose 132.4 percent for A-systems over the five-year period. Administrative materials and supplies increased 151.8 percent for B-systems from 1973 to 1977. Services for C-systems increased at a very high rate--206.4 percent for operational services and 293.1 percent for administrative services.

Comparisons by function were made for all systems. The analysis revealed that smaller systems tend to have proportionally higher administrative costs. Roughly the same proportion of the budget for each system class was spent on maintenance, and the smaller the system, the less spent on operations, relative to the other two functions. However, it was discovered that, in general, operational costs decreased over time in their contribution to total cost in large systems, but increased for medium and small systems. Additionally, a trend toward a proportionate increase in maintenance for large systems, and a proportionate decrease for medium systems was observed.

The cost data were utilized to compute cost ratios. In relation to national averages, Texas' costs per vehicle-mile and per passenger are lower but appear to be increasing more rapidly. In current dollars, the statewide total cost per vehicle-mile has increased $.57 (1973-1977) to $1.37 and total cost per passenger has increased $.27 to $.65; passengers per mile have remained fairly constant.

LIST OF REFERENCES

American Public Transit Association
1977 Transit Operating Report for Calendar/Fiscal Year 1976. Washington, D.C.

Ceglowski, Kenneth P., Armando M. Lago, and Jon E. Burkhardt.
1978 "Rural Transportation Costs." Transportation Research Record No. 661. Washington, D.C.: Transportation Research Board of the National Academy of Sciences.

Ferreri, Michael G.
1969 "Development of a Transit Cost Allocation Formula." Highway Research Record No. 285. Washington, D.C.: Highway Research Board of the National Research Council.

Gambaccini, Louis J.
1977 "Evaluating Transit Performance: Purposes and Pitfalls." Paper presented at the First National Conference on Transit Performance, Norfolk, Virginia, September.

Holthoff, William C. and Robert G. Knighton.
1977 "Cost Increases, Cost Differences, and Productivity of Transit Operations in New York State." Transportation Research Record No. 625. Washington, D.C.: Transportation Research Board of the National Academy of Sciences.

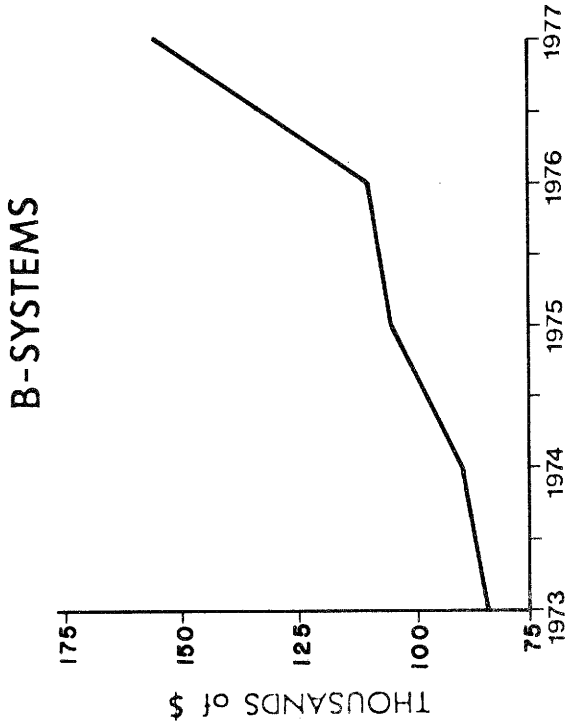
Johnston, J.
1951 "Scale, Costs and Profitability in Road Passenger Transport." The Journal of Industrial Economics IV (June): 207-223.

Miller, David R.
1970 "Differences Among Cities, Differences Among Firms, and Costs of Urban Bus Transport." The Journal of Industrial Economics XVIX, No. 1, (November): 22-32.

Urban Mass Transportation Administration.
1977 Proceedings of the First National Conference on Transit Performance. UMTA-DC-06-0184-77-1.

U.S. Department of Transportation.
1977 "Uniform System of Accounts and Records: Implementation." Federal Register, Vol. 43, No. 13, January 19.

APPENDIX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THOUSANDS of $
175
150
125
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75
1973
1974
1975
1976
1977


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30
20
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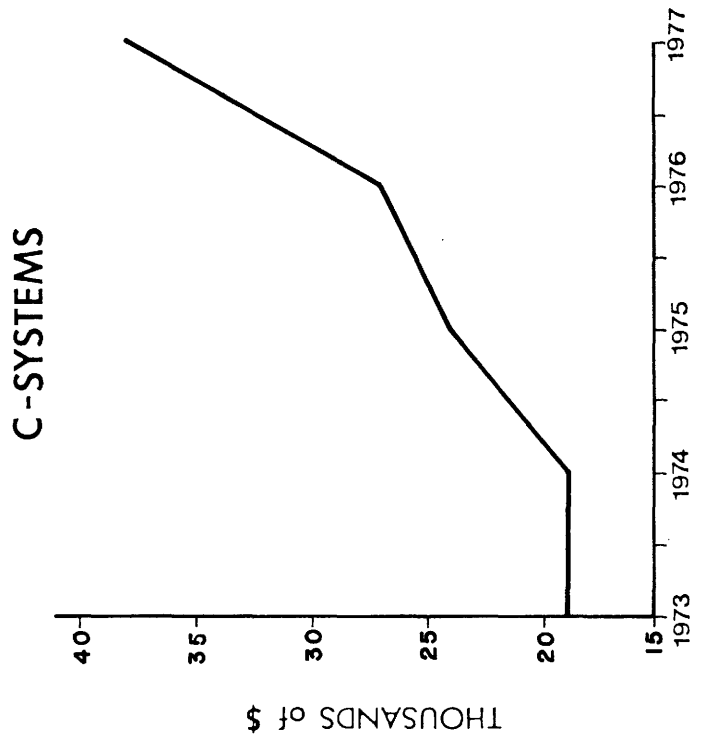
1973
1974
1975
1976
1977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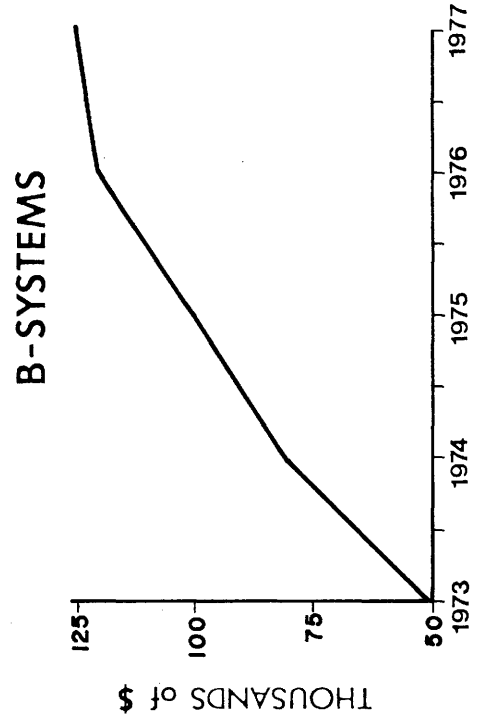
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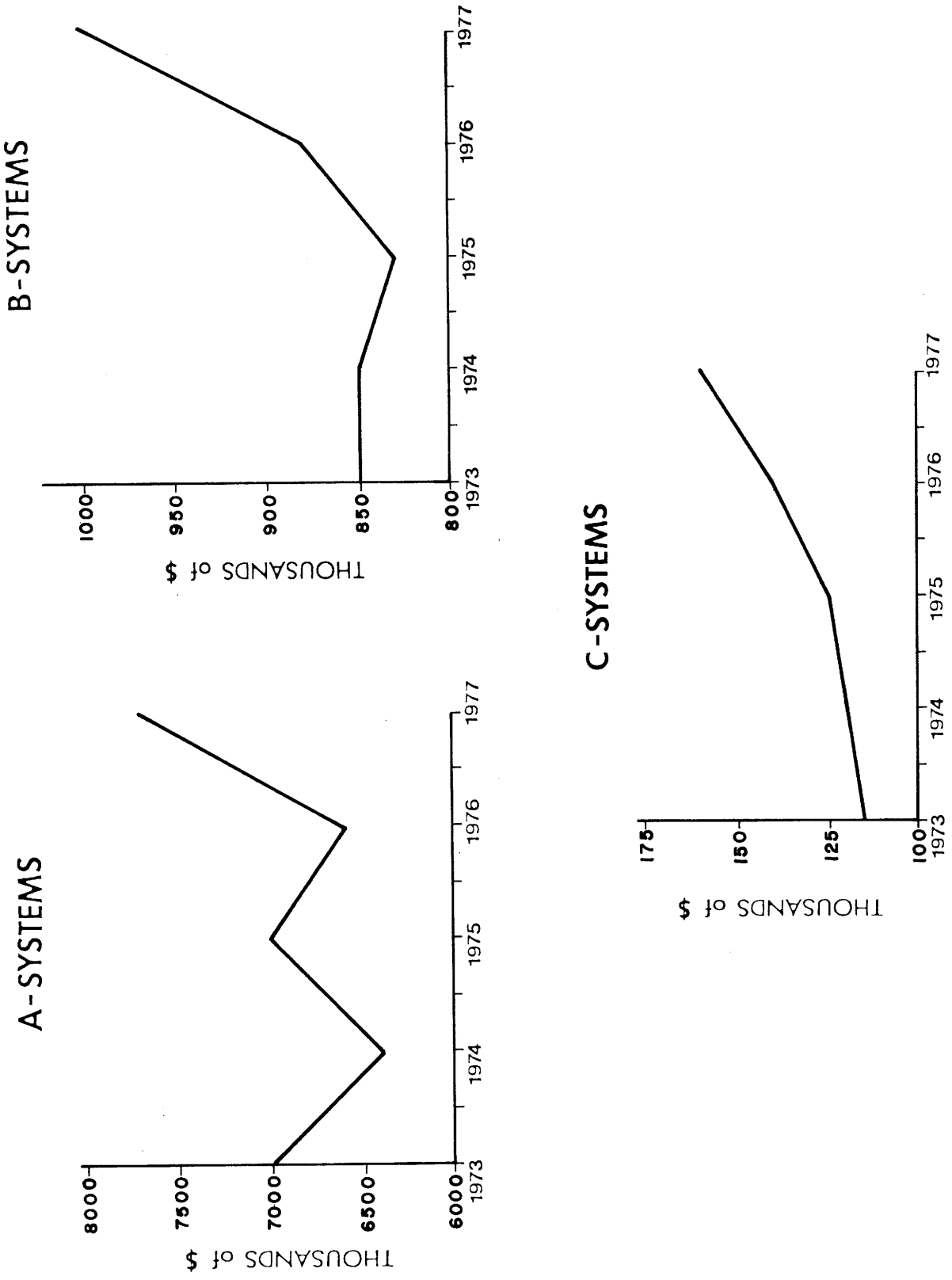
1977

DRIVER AND SUPERVISOR WAGES AND BENEFITS



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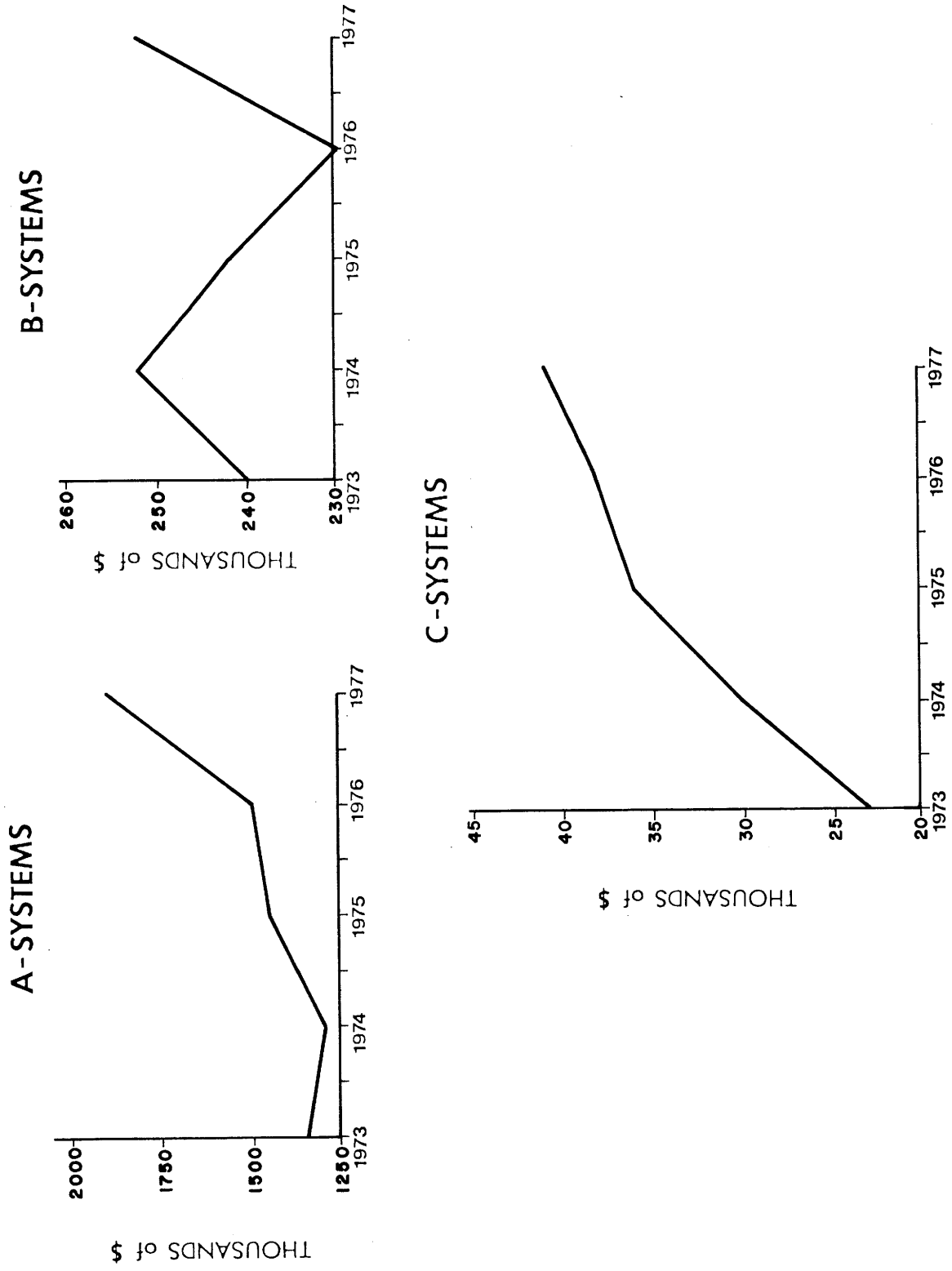

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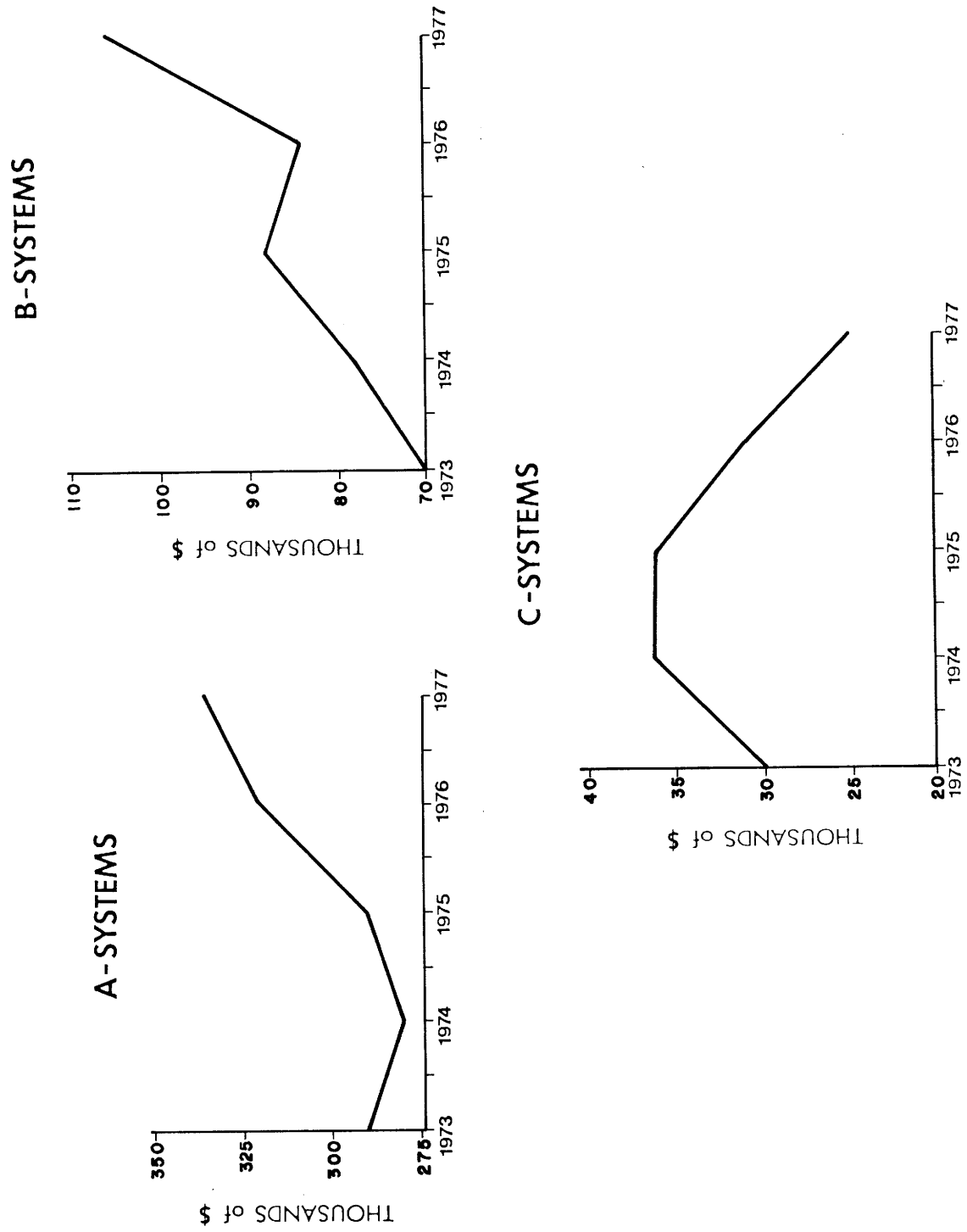

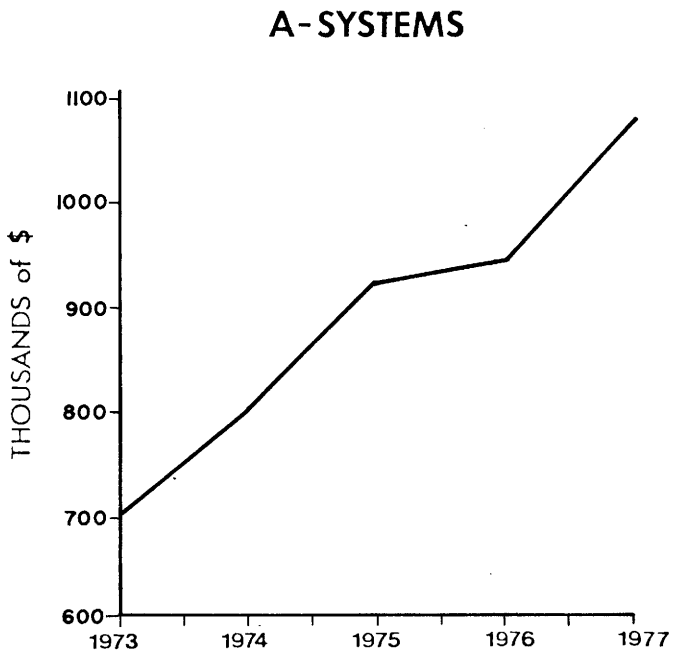
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800
700
600
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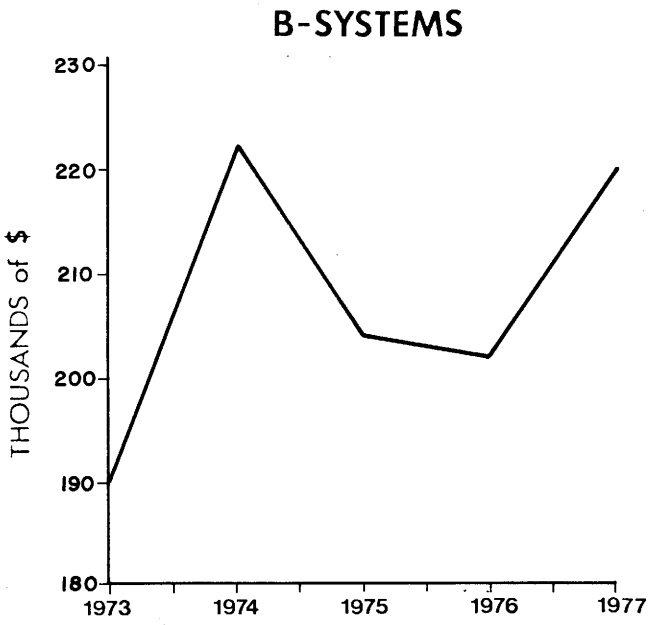
1974
1975
1976
1977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1974
1975
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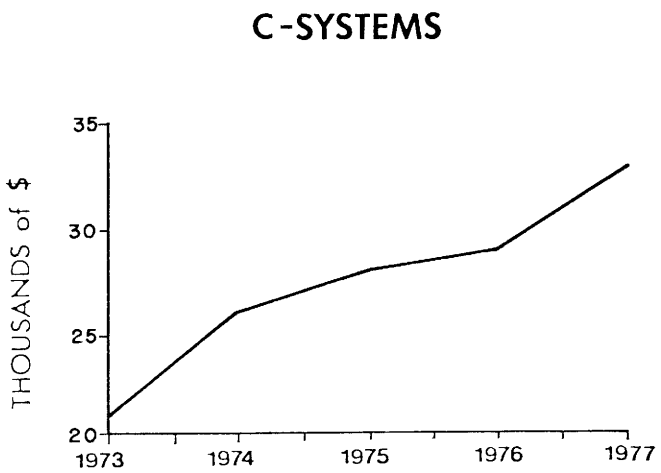
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1974
1975
1976
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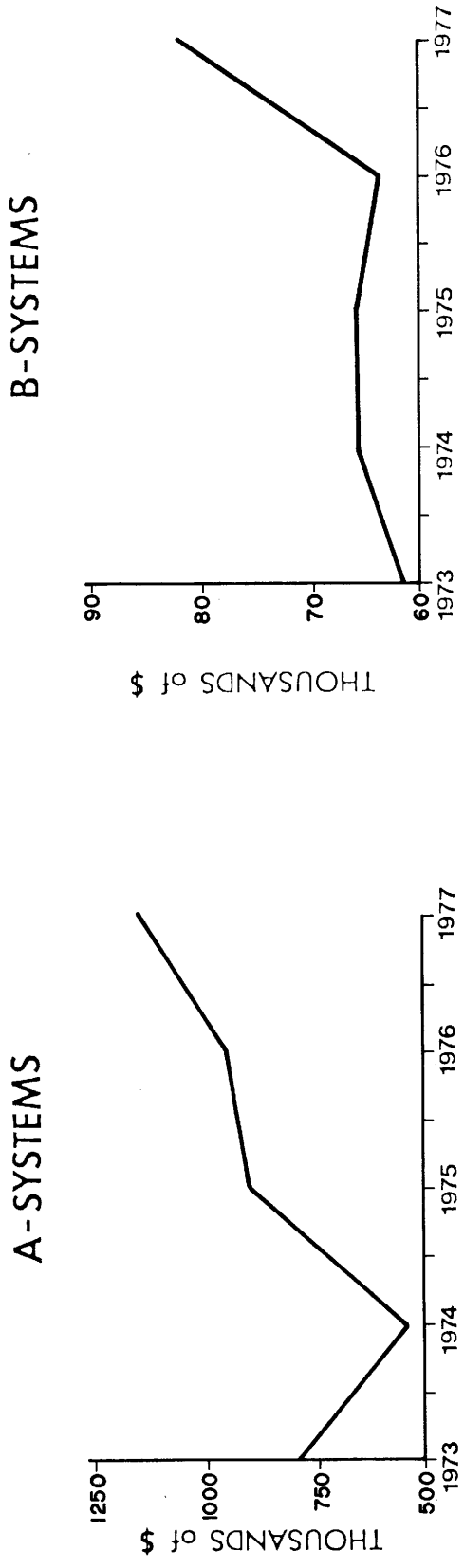
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THOUSANDS of $
90
80
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60
1973
1974
1975
1976
1977

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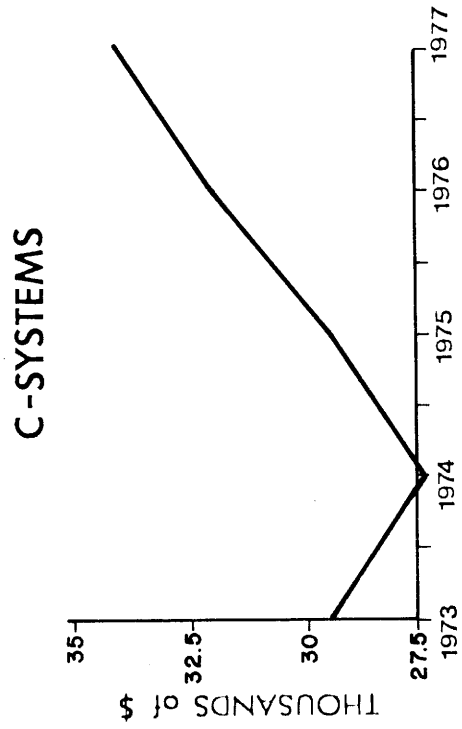
750
500
1973
1974
1975
1976
1977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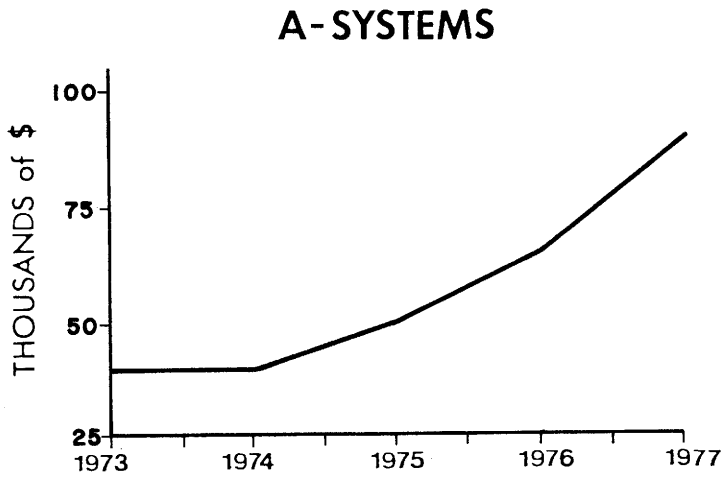
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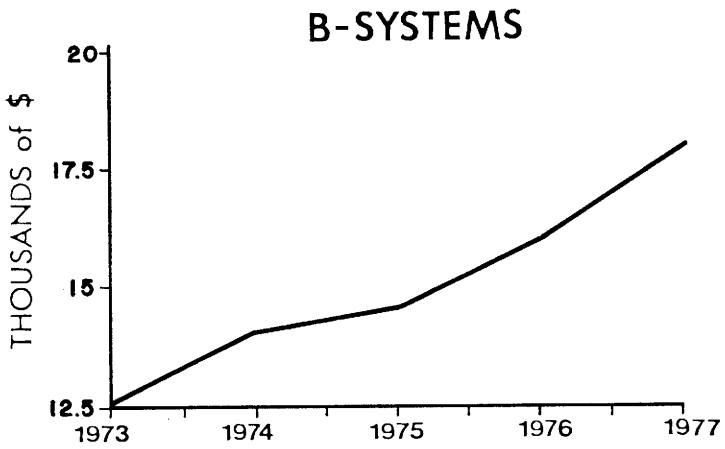
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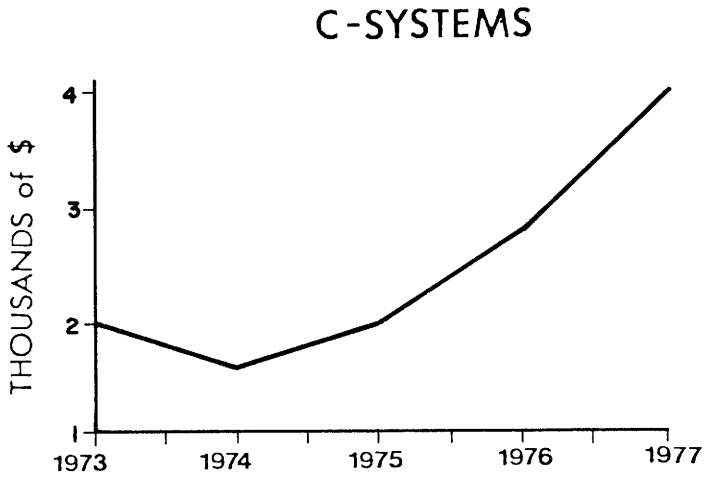
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3
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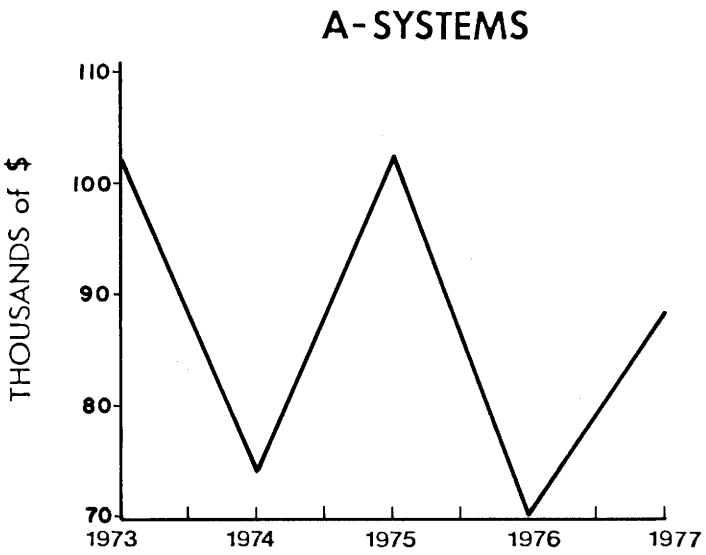
1
1973
1974
1975
1976
1977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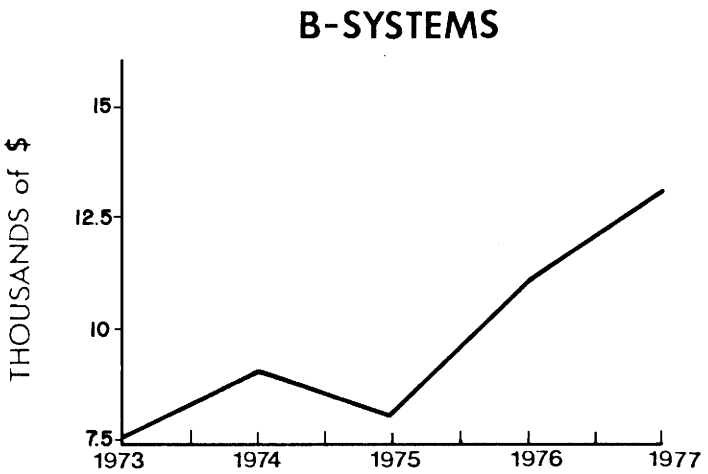
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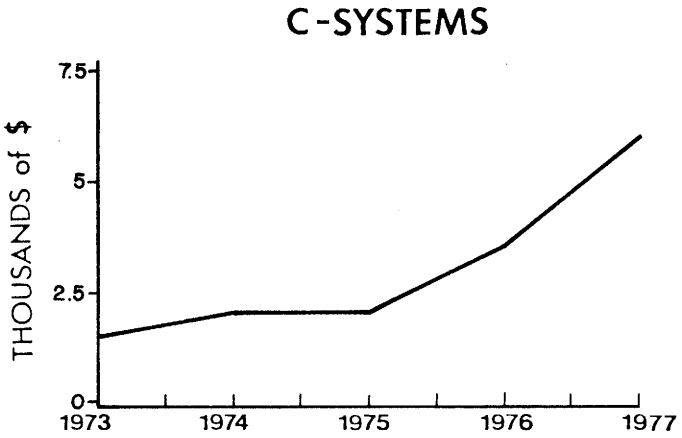
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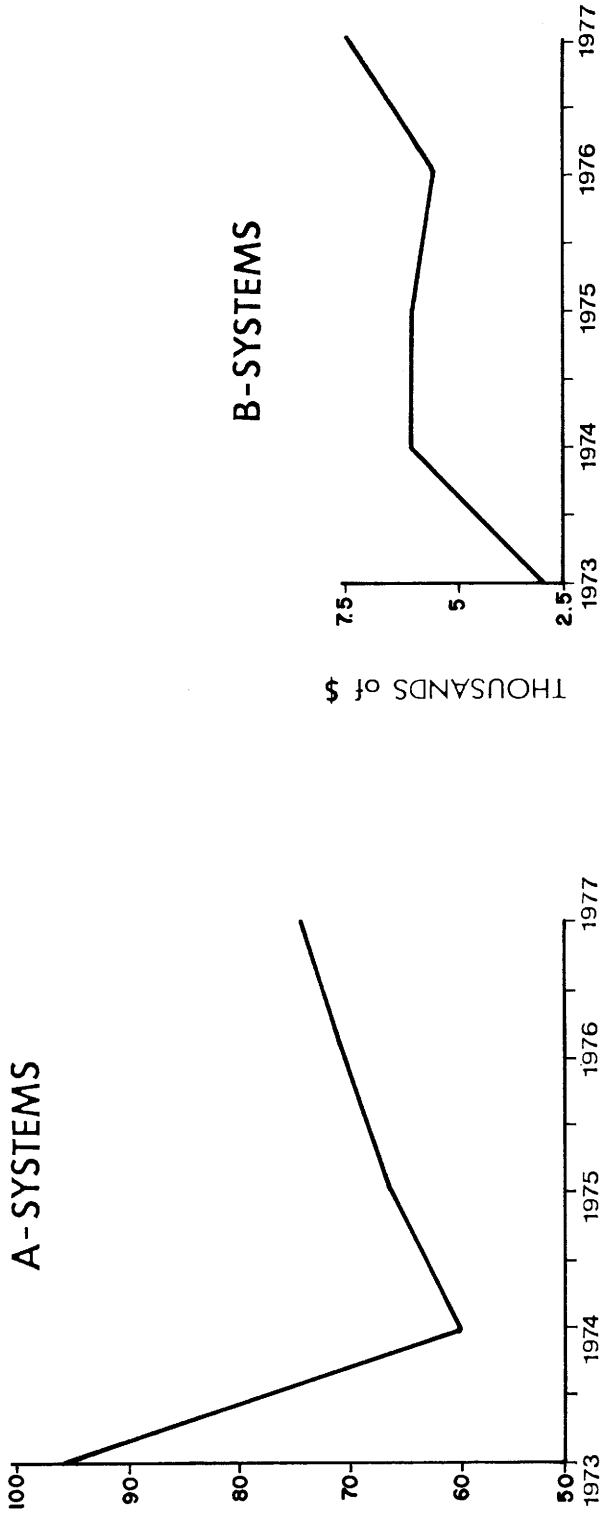
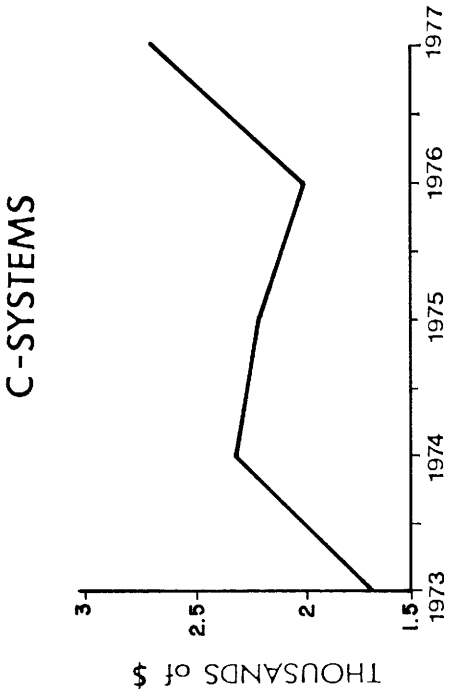
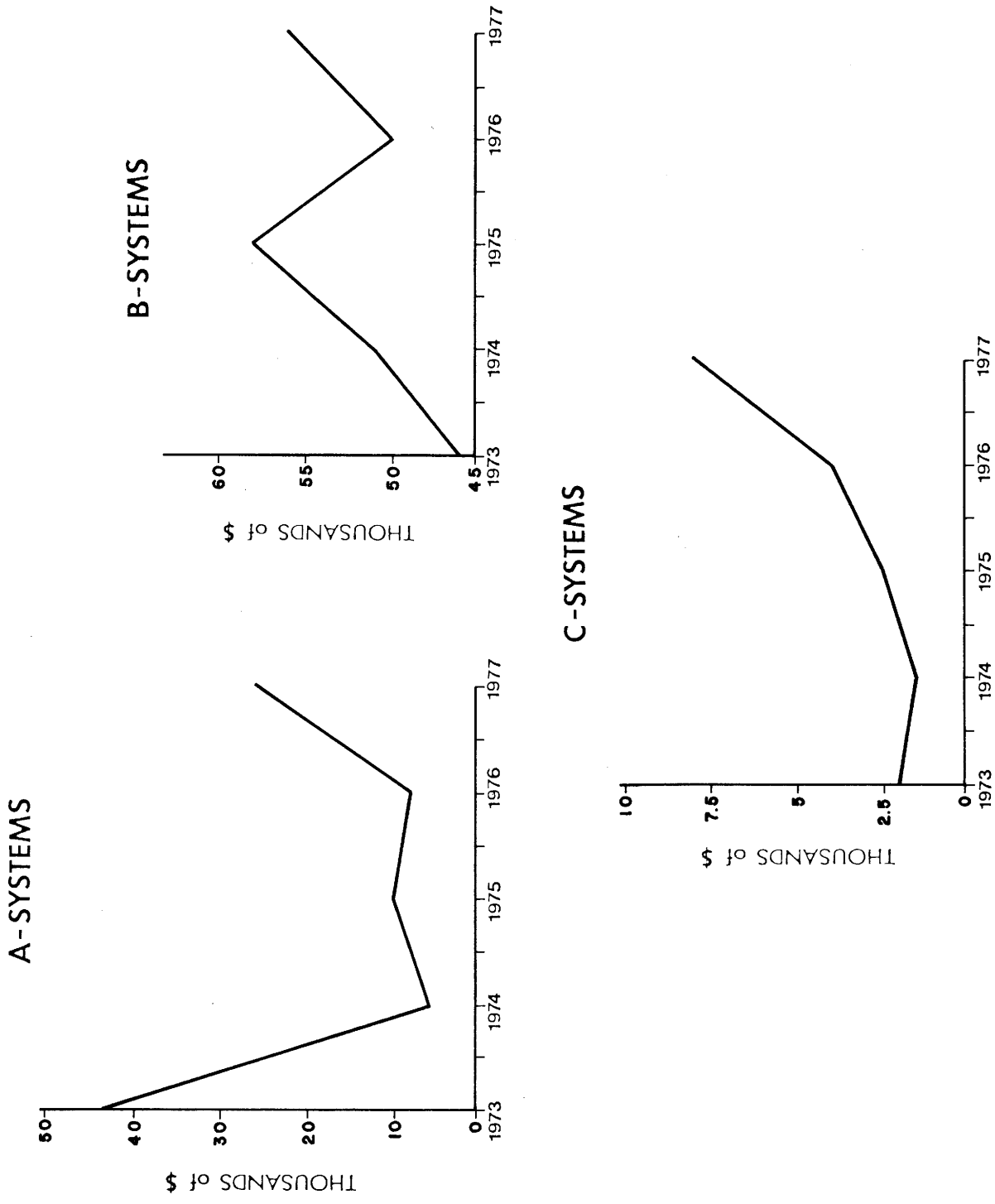
1973
1974
1975
1976
1977

ADMINISTRATIVE MATERIALS AND SUPPLIES



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55
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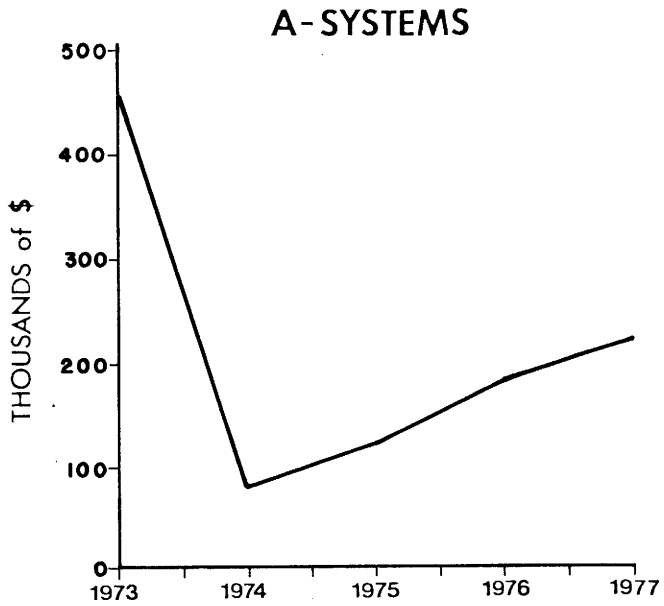
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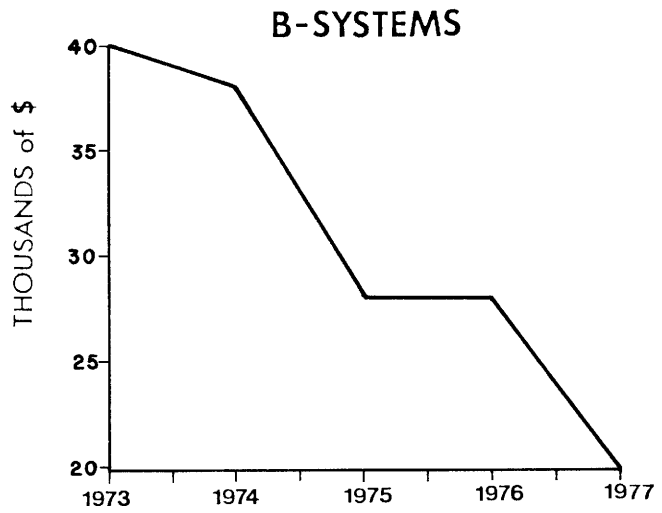
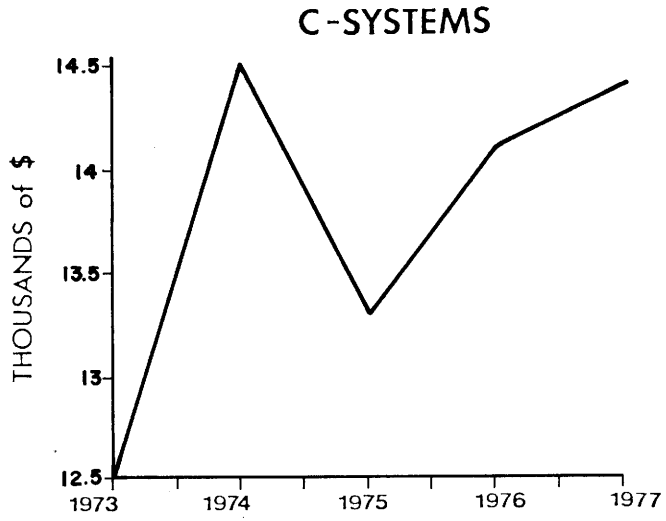
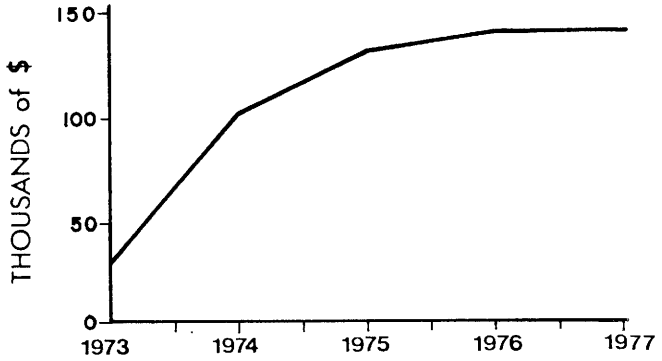
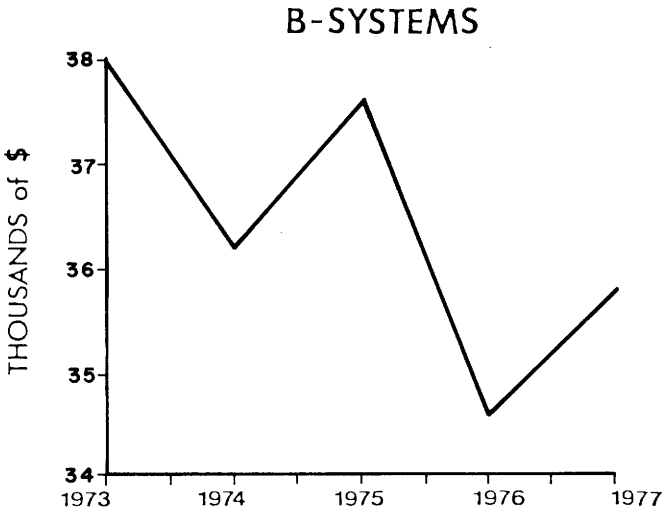
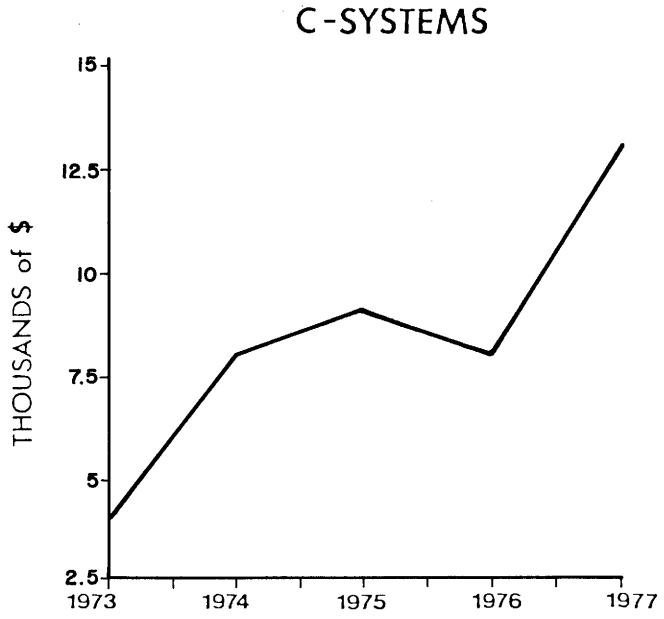
1973
1974
1975
1976
1977


B-SYSTEMS
THOUSANDS of $
40
35
30
25
20
1973
1974
1975
1976
1977


C-SYSTEMS
THOUSANDS of $
14.5
14
13.5
13
12.5
1973
1974
1975
1976
1977


A-SYSTEMS
THOUSANDS of $
150
100
50
0
1973
1974
1975
1976
1977


B-SYSTEMS
THOUSANDS of $
38
37
36
35
34
1973
1974
1975
1976
1977


C-SYSTEMS
THOUSANDS of $
15
12.5
10
7.5
5
2.5
1973
1974
1975
1976
1977