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16. Abstract

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METRIC CONVERSION FACTORS

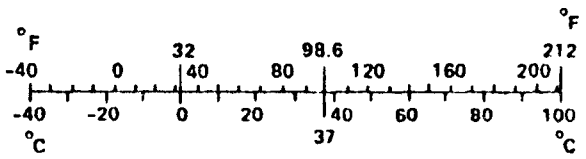
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

* 1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



EVALUATION OF

SELECTED HUMAN SERVICES TRANSPORTATION PROVIDERS

IN TEXAS

by

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Technical Report 1065-1

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DISCLAIMER

This report was prepared by the Texas Transportation Institute for the Texas State Department of Highways and Public Transportation in cooperation with the U.S. Department of Transportation, Urban Mass Transportation Administration.

The contents of this report reflect the views of the authors who are responsible for the opinions, findings and conclusions presented herein. The contents do not necessarily reflect the official views or policies of the sponsors. This report does not constitute a standard, specification or regulation.

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Capital Area Rural Transportation System - Austin

Dorothy S. Sessions, Program Director for Medical Transportation for Region 10, Texas Department of Human Resources - Nacogdoches

Kenneth L. Grantham, Transportation Coordinator
Texas Panhandle Community Action Corporation

ABSTRACT

Although considerable research has been done in the area of elderly and handicapped transportation, very little factual data exist concerning how human services transportation providers operate or what their services actually cost. In light of this fact, three providers of human services transportation were selected for in-depth evaluation. Both cost and operating data were collected and analyzed for each provider. This report presents the results of this data collection and evaluation effort.

Because of the limited data available, only tentative conclusions can be reached. It was therefore recommended that a data monitoring system be developed which would allow a more complete and in-depth analysis of all human services transportation providers across the state.

Key Words: Human Services Transportation, Unit Cost, Performance and Productivity Measure.

SUMMARY

In recent years the area of elderly and handicapped transportation has received wide-spread attention and has been the focus of considerable research. Yet, much remains to be learned concerning how human services transportation providers operate and what their services really cost. In order to gain a better understanding of human services transportation across the state, the following three providers were selected for in-depth evaluation.

Texas Panhandle Community Action Corporation Transportation Program - Amarillo

Capital Area Rural Transportation System - Austin

Texas Department of Human Resources Medical Transportation Program for Region 10 - Nacogdoches

Both financial and operational data were collected and analyzed for each of the three agencies. Due to the limited nature of the data, only tentative conclusions could be reached. It was therefore recommended that a data monitoring system be developed which would include both a uniform accounting system with common line items and definitions and a uniform data reporting system for financial and operational information. Such a system would not only allow for more complete and in-depth evaluations of all human services transportation providers across the state, but it would also assist providers in developing more cost-effective and efficient total transportation systems.

IMPLEMENTATION STATEMENT

In an effort to assist human services transportation providers in developing more efficient total transportation systems, appropriate financial and operating data were collected and analyzed from three selected providers. Due to the limited amount of information available for analysis purposes, it was recommended that a data monitoring system be developed for use by all human services transportation providers. Such a system (to be developed during the second year of this study) would include a uniform accounting system and a uniform data reporting system for both financial and operating information. The proposed system would be useful to both the providers and the SDHPT in evaluating the efficiency of a system, in comparing its service to that provided by other agencies, and in deciding if purchased or coordinated services are warranted. In order for this system to be of value, however, it must be implemented. Therefore, an implementation plan utilizing the experience gained in the project will also be developed as part of the next year's study effort.

TABLE OF CONTENTS

I. INTRODUCTION

During the past few years, vast amounts of public funds have been expended on the provision of human services transportation in Texas. In addition, considerable research has been done in the area of elderly and handicapped transportation. Yet, very little factual data exist (or have been gathered) on how human services transportation providers across the state operate or what their services actually cost. In fact, many providers have only a rough idea of their total cost for transportation and have absolutely no idea of how their operation compares to others across the state. Examples of difficulties include:

- Varying accounting systems and accounting definitions making project comparisons difficult;
- Insufficient cost or operating data that would permit evaluation and monitoring of system operations; and
- The exclusion of some transportation costs or the inlcusion of non-transportation costs into transportation cost accounts.

In addition, there is also difficulty in making comparisons between human services transportation providers across the state because of:

- Differences in time covered by data and accounts (i.e., due to inflation or other time cost differences);
- Length of operating experience may differ so that system averages may not be typical or representative;
- The markets areas served may vary (i.e., rural vs. urban, etc.);
- The type of service or service mix may vary; and
- The vehicle types and vehicle mix may differ between projects.

Other problems can occur when the transportation services provided by an agency represent only a support program that enables the agency to deliver other primary services. Transportation accounts then frequently become captive to the cost accounts of other programs, and some transportation expenditures

are placed in nontransportation accounts and vice versa, so that the "real" cost of transport is not fully identified. However, if contractual or shared transportation services by human services agencies are to be developed, the agencies must have a clear understanding of what their costs are. Cost data are also important as a basis for estimating budgets for upcoming years, for evaluating the system's performance, and for developing alternate ways of providing service.

Objectives of the Study

The overall objective of this research project is to evaluate the current transportation services provided by human services agencies in order to assist them in developing a more cost-effective and efficient total transportation system. In order to achieve this objective, the following specific tasks will be addressed during the two-year study effort:

1. Collect available cost and service data from a selected sample of human services transportation providers;
2. Evaluate the cost and service data by system type;
3. Develop an evaluation procedure for use by all human services agencies in identifying and costing alternative transportation systems;
4. Develop a system for monitoring existing systems which provides the necessary feedback for ongoing evaluation;
5. Develop an implementation plan for all human services providers to evaluate alternatives and to monitor ongoing operations; and
6. Document the results of the study.

This report, which presents the results of Study Tasks 1 and 2 listed above, is the first of two reports that will address the evaluation of human services transportation providers in Texas. As such, it is divided into four major sections. This section presents the objectives of the study. The second section defines the type of cost and operating data that was collected from each

of the agencies providing human services transportation and presents the actual data collected from each agency. The third section evaluates the data collected by system type. The final section documents certain conclusions.

A subsequent report will present an evaluation procedure (including a uniform accounting system with common line items and definitions) and a system for monitoring existing operations. In addition, an implementation plan for providers of human services transportation to implement the recommended procedures of the study will also be developed and presented.

II. DATA COLLECTION

One of the first tasks in this research effort was to select key locations around the state for in-depth analysis. Originally, it was suggested that data would be collected from providers in one large, one medium and one small urban area. In addition, two nonurban areas would also be studied. Preliminary investigations, however, revealed that most of the human services transportation providers in the state's larger cities have already undergone various types of inventories and/or evaluations in recent months and therefore were not very receptive to yet another evaluation. (A review of the information collected in the previous research efforts, indicated that the data were not of sufficient detail to perform the type of in-depth analysis called for in this study.)

On the other hand, providers of transportation services in many of the smaller urban areas and the rural areas have not been studied to any extent. Furthermore, agencies in these areas demonstrated not only a willingness to cooperate, but also an eagerness to learn how their services compare to other systems across the state. It was therefore decided to concentrate research efforts on providers of human services transportation in one small urban area and in two rural areas. The Texas Panhandle Community Action Corporation Transportation Program (TPCAC) in Amarillo was selected as the human services transportation provider in a small urban area while the Capital Area Rural Transportation System (CARTS) in Austin and the Texas Department of Human Resources (DHR) Medical Transportation Program for Region 10 in Nacogdoches were chosen to represent agencies providing transportation in rural areas.

Data collected from these three agencies included both transportation cost data and operating data. In some cases, certain costs had to be estimated. For example, the Amarillo Senior Citzens Association donated three vehicles to the

Transportation Program of the TPCAC and also agreed to pay the insurance and registration fees for both vehicles. While the TPCAC did not actually pay for these items out of its transportation budget, these expenses are nevertheless a part of the real cost of operating the system and therefore were included into the total cost of providing transportation services.

Transportation Cost Data

In collecting the appropriate transportation cost data from each of the three agencies, costs were categorized as either Direct/Variable or Indirect/Fixed. The following outline describes the types of information which were included in each of the two categories.

1. Direct/Variable Costs - Those costs incurred while performing such services as actual vehicle operation, servicing, maintenance and maintenance support. These are considered to be direct or out-of-pocket expenses.

    a. Vehicle Operations - Those costs related to the routine operation of the vehicles for specified transportation services.

        1) Salaries for Drivers, Attendents, Schedulers and Dispatchers - Salaries and/or wages paid those personnel which are directly responsible for vehicle operations, dispatch and network control.

        2) Fringe Benefits for Drivers, Attendents, Schedulers and Dispatchers - Expenses which may include FICA, FICA match, pension plans, retirement, medical services, meal allowances and travel expenses for the drivers, attendents, schedulers, and dispatchers.

        3) Fuel, Lubricants, Tires, Etc. - Cost of all consumable items such as fuel, oil and lubricants used in the daily transport services function.

        4) Insurance Liabilities on Vehicular and Personal Damage - Refers to the insurance premiums paid to cover vehicular accident damage and also the premiums paid to cover passengers and/or drivers during the service function.

        5) Technical Services - Represents costs incurred for training programs such as Defensive Driving, First Aid, etc. for drivers, attendants and other personnel.

6) Purchased Transportation Services - Refers to expenses paid to third party transportation providers such as taxi operators, bus companies and individuals using private vehicles.

7) Materials for Dispatch and Network Control - Include the cost of radio control systems, electronic equipment, etc. which are owned by the agency.

8) Purchased Technical Services - Include the cost of radio control systems, Watts lines, etc. which are leased by the agency.

b. Vehicle Servicing and Maintenance - Those costs incurred in keeping the vehicles in operating condition.

1) Contracted Repair Service - The cost of servicing, maintaining and repairing the vehicle which is done out-of-shop. (Note: All repairs for the three agencies studied were contracted.)

2) Washing/Cleaning Vehicles - The cost of washing and/or cleaning the interior and exterior of the vehicles at regular intervals.

3) Inspection of Vehicles - Refers to the cost of routine inspection activity of vehicles and the cost of annual state inspections required by law.

4) Storage of Vehicles - Expense incurred for off-street storage of vehicles when not in use for transportation service.

2. Indirect/Fixed Costs - Basic monthly administration costs and items such as insurance which are paid in advance on a yearly basis.

a. Administrative and General Costs - Refers to those costs incurred in the general administration and supervision of the transportation and supervision of the transportation program operations.

1) Salaries for Administrative Personnel - Salaries and/or wages paid to the director/manager of the transportation program, secretarial, clerical and other office suppport personnel involved in the administrative operations.

2) Fringe Benefits for Administrative Personnel - May include FICA, FICA match, pension plans, retirement, medical services, and travel expenses paid to administrative personnel.

3) Marketing, Advertising, Public Relations Costs - Expenses incurred to publicize the transportation program.

4) Office Rent - Expenses paid for leased office space and such other space necessary for the administrative function.

5) Utilities - Expenses paid for electricity, water, gas, and other such services necessary (which are not included as part of the office rent).

6) Telephone - Expenses paid for telephone equipment and/or bills and any other communication devices (such as paging systems) necessary for the administrative functions.

7) Office Support - Refers to those expenses such as custodial and extermination services, repairs, maintenance, remodeling, etc. to the administrative area.

8) Office Supplies and Miscellaneous Expenses - Includes such consumable items as paper, pens, pencils, tape, staples, etc. Also includes expenses associated with xeroxing and reproduction of drivers' log forms, monthly recap forms, etc.

b. Taxes, Tolls and Penalties - Include such items of expense adjunct to ownership of property and use of taxable items. (For most publicly funded transportation programs, taxes do not apply.)

1) Fuel and Oil Taxes - Taxes paid, if any, for petroleum related products.

2) Vehicle Licenses - Expenses paid, if any, for vehicle licenses and registration.

3) Tolls - Include tariffs paid, if any, on toll bridges, roads, etc.

4) Penalties and Fines - Expenses paid for traffic and parking violations.

c. Depreciation - Includes charges that reflect loss in service value.

1) Vehicles - Depreciation on vehicles owned by the system used in the transport service.

2) Support Equipment - Depreciation charges on special equipment (such as radios) owned by the transportation system.

3) Buildings - Depreciation expenses on buildings which are owned (not rented) by the transportation system.

The main consideration in collecting this cost information was to include all appropriate costs related to the transportation operation regardless of how they are charged or budgeted. Calculating the total cost of operation, the system enables an agency to estimate budget requirements for the upcoming year, evaluate the system and identify problem areas, and compare the system to alternate ways of providing service.

Transportation Operating Data

Other data collected from the TPCAC, CARTS and the DHR included transportation operating data (which consisted of passenger-trips, vehicle mileage, and vehicle time data) as outlined below.

1. Passenger-Trips - The number of one-way trips made by persons using the system. Each client or passenger counts as an individual trip even if there is group boarding or alighting at common points.

2. Vehicle-Miles - The total number of miles driven on a vehicle used to provide transportation service, including mileage accumulated for driver's lunch and coffee breaks, trips to garage, gas station and repair shops, as well as trips to pick up or deliver passengers. Vehicle-miles may be categorized as either loaded vehicle-miles or deadhead miles.

   a. Loaded Vehicle-Miles - The total number of miles driven by a vehicle when there is at least one passenger on board.

   b. Deadhead Miles - The total number of miles traveled by a vehicle when no passengers were on board. This includes trips to the gas station, repair shop, etc., or trips to pick up a passenger when there is not already another passenger on board and trips back to the garage after the last passenger of the day is delivered to his/her destination.

3. Vehicle-Hours - The total number of hours a vehicle is in service with a driver on board. Vehicle-hours can be categorized as either layover hours or loaded vehicle hours.

   a. Loaded Vehicle-Hours - The total number of hours a vehicle has at least one passenger on board.

   b. Layover Hours (or Deadhead Time) - The total number of hours a vehicle is out of the garage, but does not have a passenger on board. This includes trips to the gas station, garage, lunch etc. and trips to pick up a passenger when there is not already another passenger on board and trips back to the garage after the last passenger has been delivered to his/her destination.

4. Passenger-Miles - The total number of person-miles of travel by all passengers (e.g., 8 passengers riding together for 1 mile equals 8 passenger-miles).

Other operating data collected from each of the three agencies included the following.

1. Passenger Classification Data

    a. Nonambulatory (Wheelchair)
    b. Semiambulatory
    c. Ambulatory
    d. Elderly
    e. Nonelderly

2. Trip Purpose Data

    a. Medical/Dental
    b. Work
    c. School/Educational
    d. Post Office
    e. Welfare
    f. Grocery Shopping
    g. Other Shopping
    h. Social/Recreation
    i. Senior Centers
    j. Nutrition Sites
    k. Business
    l. Other

3. Transportation Service Type Data

    a. Fixed Route
    b. Modified-Fixed Route
    c. Subscription Service
    d. Demand-Responsive with advanced Reservations
    e. Demand-Responsive

Finally, information was collected as to length of time the transportation program had been in operation, normal hours of service during the week, and funding sources.

In collecting the appropriate data from each of the three agencies studied, a "typical" or "average" month was constructed. In most cases, data for the year of 1979 was totaled and then divided by 12 to arrive at an average figure. However, because of the detailed nature of some data, this method of arriving at an average was not always practical. In some of these instances, data from the month of November 1979 was used to represent the typical month. In a few

other cases, data from the week of November 5-9 was expanded to get a monthly figure.

Texas Panhandle Community Action Corporation Transportation Program - Amarillo

The Texas Panhandle Community Action Corporation (TPCAC) Transportation Program administered by Kenneth L. Grantham has been serving the City of Amarillo since August 1976. The system's normal hours of operation are from 8:00 a.m. to 5:00 p.m., Monday through Friday. During the last few school years , however, the TPCAC has also transported school children for two Amarillo School Districts from 7:00 to 8:30 a.m. The TPCAC Transportation Program offers every type of service: fixed-route, demand-responsive, advanced reservations, etc. and is funded by Title III-b, Title III-c, Title XIX, Head Start, the Amarillo Independent School District and the Riverroad Independent School District funds.

Ten vehicles (2 stationwagons, 6 vans and 2 buses) which are used to provide transportation services can carry a total of 114 passengers at any given time. Table 1 describes each of the vehicles in greater detail.

The staff of the TPCAC Transportation Program includes a transportation coordinator, a secretary/receptionist, a supervising driver, a data technician, 1 data aid/driver and 6 full-time drivers.

The cost of operating the Transportation Program averages about $13,616 per month (Table 2). Of this total, approximately $8,496 or 62.4 percent represents expenses related to vehicle operations. The remaining $5,120 or 37.6 percent can be categorized as administration and general expenses.

Salaries and fringe benefits for the Transportation Program personnel account for approximately 64.4 percent of the total monthly budget. The cost of fuel, oil, tires and other consumable items represents 12.2 percent of the total.

Table 1: TPCAC Transportation Program Fleet Description

Vehicle Make and Model	Passenger Capacity	Wheelchair Lift	Two Way Radio
1979 Ford Super Van	15 seated	no	yes
1978 Chevelle Stationwagon	4 seated	no	yes
1978 Chevelle Stationwagon	4 seated	no	yes
1978 Chevrolet Van	12 seated	no	yes
1976 Ford Van	6 seated 2 wheelchair tie-downs	yes	yes
1977 Dodge B-300 Van	8 seated 1 wheelchair tie-down	yes	yes
1977 Dodge B-300 Van	6 seated 2 wheelchair tie-downs	yes	yes
1977 GMC Van	12 seated	no	yes
1968 Ford Flexette	21 seated	no	no
1968 Ford Flexette	21 seated	no	no

Transportation operating data collected from the TPCAC revealed that on the average, the transportation system logged over 18,146 miles while serving more than 5,130 one-way passenger trips each month (Table 3).

Of the 5,130 estimated one-way passenger trips each month, approximately 3,478 or 67.8 percent were categorized as handicapped, while 1,652 or 32.2 percent were listed as elderly (Table 4).

Trip purpose data collected revealed that the most common trip purpose (excluding trips "home") was education which accounted for approximately 66 percent, followed by medical trips (13.1 percent) and trips to nutrition sites which comprised 12.7 percent of the total.

Table 2: TPCAC Transportation Program Average Monthly Cost Breakdown

Type of Expense	Average Month	Percent of Total
Vehicle Operations		
Salaries for Drivers/Dispatchers/Schedulers	$ 5,119	37.6
Fringe Benefits for Drivers/Dispatchers/Schedulers	744	5.5
Fuel, Oil, Tires, Etc.[1]	1,659	12.2
Insurance	208	1.5
Training & Licenses	13	.1
Purchased Transportation	-	-
Materials for Dispatch/Network Control	115	.9
Purchased Technical Service	-	
Contracted Repairs	603	4.4
Washing/Cleaning of Vehicles	included in fuel	
Inspection of Vehicles	5	
Storage of Vehicles	30	.2
Subtotal - Vehicle Operations	$ 8,496	62.4
Administrative and General		
Salaries for Administrative Personnel	$ 2,536	18.6
Fringe Benefits for Administrative Personnel	374	2.7
Marketing/Advertising	-	-
Office Rent	200	1.4
Utilities	125	.9
Telephone	160	1.2
Office Support	225	1.7
Office Supplies	108	.8
Fuel & Oil Taxes Rebate	-128	-.9
Vehicle Licenses and Registration Fees	78	.6
Depreciation on Vehicles,[2] Special Equipment, Etc.[3]	1,442	10.6
Subtotal-Administrative and General	$ 5,120	37.6
TOTAL	$13,616	100.0

[1]Figure represents average of last 6 months of 1979
[2]Straight-line depreciation over service life of vehicles
[3]Includes $300/month for stationwagon leases

Table 3: TPCAC Transportation Program Operating Data for the Average Month

Operating Characteristic	Monthly Average
One-Way Passenger-Trips	5,130
Vehicle-Miles	
Loaded Vehicle-Miles	11,911
Deadhead Miles	6,235
Total Vehicle-Miles	18,146
Vehicle-Hours	
Loaded Vehicle-Hours	*
Layover Hours	**
Total Vehicle-Hours	935
Passenger-Miles	39,239

* Information available not consistant with study definition for loaded vehicle-hours.
** Information not available

Table 4: TPCAC Transportation Program Passenger Classification Data

Passenger Classification			Percent of Total	
Elderly				
Ambulatory	1,431		27.9	
Nonambulatory	221		4.3	
Subtotal		1,652		32.2
Handicapped				
Ambulatory	3,155		61.5	
Nonambulatory	323		6.3	
Subtotal		3,478		67.8
TOTAL		5,130		100.0

Capital Area Rural Transportation System - Austin

The Capital Area Rural Transportation System (CARTS) in Austin is a federal demonstration project funded under Section 147 of the Federal Highway Act. CARTS has been in operation since July 1979 and currently provides transportation service to a 7-county region which includes Burnet, Travis, Hays, Caldwell, Bastrop, Lee and Fayette counties. In addition, Yellow Cab Company subcontracts with CARTS to provide rural transportation service to Medicaid clients in Travis County. Priority for service is given to the elderly, the handicapped, and the economically disadvantaged. Clients are required to make reservations at least 24 hours in advance through local community and senior citizen centers in the various counties.

By the end of 1979, CARTS was operating a total of 8 vans Monday through Friday from 8:00 a.m. to 5:00 p.m. Table 5 describes each of those vehicles.

The staff of CARTS includes Wanda Dyer, Project Manager; an administrative assistant; a dispatcher; 5 full-time drivers and 1 substitute driver. In addition, two other drivers employed by Combined Community Action (CCA) operate two CARTS vehicles in Bastrop, Lee and Fayette counties on a contractual reimbursement basis.

During the first 6 months of operation (July-December 1979) the cost of providing transportation services averaged about $9,865 per month with approximately $5,250 (53.2 percent) for administration and general expenses and $4,615 (46.8 percent) expended toward vehicle operations (Table 6). Salaries and fringe benefits for administration and vehicle operations personnel accounted for the largest expenditure - $5,992 or 60.8 percent of the total monthly budget.

Operating data collected for the first 6 months of operation indicated that on the average, the CARTS vehicles logged more than 7,500 miles while

Table 5: CARTS Fleet Description

Vehicle Make and Model	Passenger Capacity	Wheelchair Lift	Two-Way Radio
1979 Chevrolet Van	14 seated	no	no
1979 Chevrolet Van	12 seated 1 wheelchair tie-down	yes	no
1979 Chevrolet Van	14 seated	no	no
1978 Dodge Van	15 seated	no	no
1978 Plymouth Van	15 seated	no	no
1975 Dodge Van	12 seated	no	no
1975 Plymouth Van	15 seated	no	no
1978 Dodge Van	15 seated	no	no

serving approximately 1830 one-way passenger trips each month (Table 7). Approximately 1,429 trips can be categorized as elderly trips and 290 as handicapped trips (Note: If a passenger was both elderly and handicapped then he or she was counted twice).

Trip purpose data collected is presented in Table 8. The most common trip destination (excluding trips "home") was to nutrition sites. These trips accounted for approximately 19.7 percent of the total. Trips to senior centers ranked as the second most common trip purpose with 13.8 percent, followed by shopping trips (other than grocery shopping) which accounted for about 9.8 percent of the total trip destination.

Department of Human Resources Medical Transportation Program Region 10 - Nacogdoches

The Department of Human Resources (DHR) Medical Transportation Program for Region 10 (Beaumont) is operated out of the DHR office in Nacogdoches. The Medical Transportation Program received its first vehicle in September 1975 and has .

Table 6: CARTS Average Monthly Cost Breakdown

Type of Expense	Average Month	Percent of Total
Vehicle Operations		
Salaries for Drivers/Dispatchers/Schedulers	$3,125	31.7
Fringe Benefits for Drivers/Dispatchers/Schedulers	included in salaries	
Fuel, Oil, Tires, Etc.	741	7.5
Insurance	190	2.0
Training & Licenses	13	.1
Purchased Transportation	-	-
Materials for Dispatch/Network Control	-	-
Purchased Technical Service	21	.2
Contracted Repairs	435	4.4
Washing/Cleaning of Vehicles	60	.6
Inspection of Vehicles	included in repairs	
Storage of Vehicles	30	.3
Subtotal - Vehicle Operations	$4,615	46.8
Administrative and General		
Salaries for Administrative Personnel	$2,867	29.1
Fringe Benefits for Administrative Personnel	included in salaries	
Marketing/Advertising	34	.3
Office Rent	150	1.5
Utilities	645	6.5
Telephone		
Office Support		
Office Supplies		
Fuel & Oil Taxes Rebate	-73	-.7
Vehicle Licenses and Registration Fees	exempt	
Depreciation on Vehicles[1], Special Equipment, Etc.	1,627	16.5
Subtotal - Administrative and General	$5,250	53.2
TOTAL	$9,865	100.0

[1]Straight-line depreciation over service life of vehicles

Table 7: CARTS Operating Data for Average Month

Operating Characteristic	Monthly Average
One-Way Passenger Trips	1,845
Vehicle-Miles:	
Loaded Vehicle-Miles	5,593
Deadhead Miles	1,936
Total Vehicle-Miles	7,529
Vehicle Hours:	
Loaded Vehicle-Hours	*
Layover Hours	*
Total Vehicle-Hours	*
Passenger-Miles	27,774

*Information not available

Table 8: CARTS Trip Purpose Data

Trip Purpose	Number of Trips	Percent of Total
Work	6	.3
Grocery Shopping	66	3.6
Other Shopping	179	9.8
Medical/Dental	62	3.4
Social/Recreation	159	8.7
Welfare/Foodstamps	9	.5
Senior Centers	253	13.8
Nutrition Sites	361	19.7
Civic/Comm. Action	9	.5
School/Education	32	1.8
Deliver Meal	154	8.4
Home	503	27.5
Miscellaneous	37	2.0
TOTAL	1830	100.0

been providing nonemergency medical transportation for Title XIX (Medicaid) recipients who reside in Angelina, Hardin, Houston, Jasper, Jefferson, Nacogdoches, Newton, Orange, Polk, Sabine, San Augustine, San Jacinto, Shelby, Trinity, and Tyler counties. Clients travel to various medical services in the home locale, neighboring cities and outside the 15-county region to such locations as Houston, Galveston and Tyler. Normal operating hours are from 8:00 a.m. to 5:00 p.m., weekdays. Clients make reservations in advance by calling the DHR using a toll-free Watts line.

Five stationwagons and one van with a total passenger carrying capacity of 36 serve an 11-county area which includes: Angelina, Houston, Jasper, Nacogdoches, Newton, Polk, San Augustine, San Jacinto, Shelby, Trinity, and Tyler counties. Descriptions of the six vehicles are presented in Table 9.

Table 9: DHR Medical Transportation Program Fleet Description

Vehicle Make and Model	Passenger Capacity	Wheelchair Lift	Two-Way Radio
1976 Matador Stationwagon	5 seated	no	no
1976 Matador Stationwagon	5 seated	no	no
1975 Dodge Van	8 seated 2 wheelchair tie-downs	yes	no
1977 Volare Stationwagon	5 seated	no	no
1977 Volare Stationwagon	5 seated	no	no
1978 Volare Stationwagon	5 seated	no	no

In addition, the DHR contracts with 5 other providers:

1. Tri-County Community Action (TCCA) which provides transportation in Shelby, San Augustine and Sabine counties;

2. Home Health-Home Care (HHHC) #5 which provides service in Tyler, Jasper, and Newton counties;

3. Community Action Nacogdoches (CAN) which transports clients in Nacogdoche

4. Home Health-Home Care (HHHC) #8 which serves Hardin, Orange and Jefferson counties;

5. Checker Cab - which provides transportation in Angelina County.

The DHR Medical Transportation Program also contracts with individual providers in several counties and purchases bus tickets for those clients which they are unable to serve either by their own vehicles or by contracted transportation.

The staff of the DHR Medical Transportation Program includes: Dorothy Sessions, Director of Medical Transportation, who devotes approximately 50 percent of her time to this program and 50 percent to the Early and Periodic Screening and Diagnostic Treatment (EPSDT) Program; a secretary who devotes approximately 75 percent of her time to Medical Transportation and 25 percent to EPSDT; a scheduler/dispatcher/driver; and 4 full-time drivers who devote 100 percent of their time to the Medical Transportation Program.

The cost of providing medical transportation averaged about $20,099 per month during 1979 (Table 10). Approximately $17,063 or 84.9 percent represents costs incurred for vehicle operations with the remaining $3,036 or 15.1 percent related to administrative and general expenses. Purchased transportation costs account for the single largest expense - $10,326 (51.4 percent) of the total monthly budget -- with salaries and fringe benefits for Medical Transportation Program personnel accounting for $6,132 or 30.5 percent of the total. Table 11 details the expenses associated with the purchased transportation.

A review of transportation operating data revealed that on the average, the DHR Medical Transportation Program served approximately 3,080 one-way passenger trips and logged a total of 40,637 vehicle-miles each month. Table 12

Table 10: DHR Medical Transportation Program Average Monthly Cost Breakdown

Type of Expense	Average Month	Percent of Total
Vehicle Operations		
Salaries for Drivers/Dispatchers/Schedulers	$ 3,988	19.8
Fringe Benefits for Drivers/Dispatchers/Schedulers	659	3.3
Fuel,Oil, Tires, Etc.[1]	826	4.1
Insurance	50	.2
Training & Licenses	13	.1
Purchased Transportation	10,326	51.4
Materials for Dispatch/Network Control	-	-
Purchased Technical Service	850	4.2
Contracted Repairs	333	1.7
Washing/Cleaning of Vehicles	18	.1
Inspection of Vehicles	included in repairs	
Storage of Vehicles	-	-
Subtotal - Vehicle Operations	$17,063	84.9
Administrative and General		
Salaries for Administrative Personnel	$ 1,363	6.8
Fringe Benefits for Administrative Personnel	122	.6
Marketing/Advertising	-	-
Office Rent		
Utilities		
Telephone	700	3.5
Office Support		
Office Supplies		
Fuel & Oil Taxes Rebate	-74	-.4
Vehicle Licenses and Registration Fees	exempt	
Depreciation on Vehicles[2], Special Equipment, Etc.	925	4.6
Subtotal - Administration and General	$ 3,036	15.1
TOTAL	$20,099	100.0

[1]Figure represents average of last 6 months of 1979
[2]Straight-line depreciation over service life of vehicles

Table 11: Average Monthly Cost Breakdown for DHR Medical Transportation Program Contracted Providers

Provider	Average Month	Percent of Total
Home Health-Home Care #8	$ 4,500	43.6
Tri-County Community Action	2,339	22.7
Checker Cab	854	8.3
Home Health-Home Care #5	1,296	12.6
Community Action Nacogdoches	315	3.0
Continental Trailways	811	7.8
Individual Providers	211	2.0
TOTAL	$10,326	100.0

Table 12: DHR Medical Transportation Program Average Monthly Passenger Trips and Vehicle-Miles Data

Provider	One-Way Passenger Trips	Total Vehicle-Miles
Department of Human Resources	536	13,465
Home Health-Home Care #8	1,316	10,599
Tri-County Community Action	410	10,646
Checker Cab	447	*
Home Health-Home Care #5	126	3,293
Community Action Nacogdoches	145	1,375
Continental Trailways	80	*
Individual Providers	20	1,259
TOTAL	3,080	40,637

*Information not available

Note: Loaded vehicle-mileage, deadhead-mileage and vehicle-hour information was not available.

presents a passenger trip and vehicle mileage breakdown for the 6 DHR vehicles as well as the 7 other contracted transportation providers. One-way passenger trips for the 6 DHR vehicles averaged 536 or 17.4% of the total, while the number of vehicle-miles traveled averaged 13,465 or 33% of the total, indicating that the DHR vehicles made most of the longer trips.

Of the 3,080 one-way passenger trips each month, approximately 64% of these are categorized as Supplemental Security Income (SSI) clients and 36% as Aid for Dependent Children (AFDC) clients. Trips purposes for all of these clients are medically related (i.e., doctor, dentist, EPSDT, hospital, pharmacy, etc.).

(Note: Beginning January 1, 1980, the DHR has contracted all medical transportation service, including that provided by their own vehicles, to the Home Health-Home Care in Jasper.)

III. DATA ANALYSIS

Performance and Productivity Measures

Performance and productivity figures were compiled from actual transportation operating data collected from the TPCAC, CARTS and the DHR transportation programs. These measures of performance and productivity, which are used as a basis for analyzing and comparing transportation operations, are described below.

1. Passengers per Mile - Passengers per mile is a measure of productivity which can be expressed as either passengers per vehicle-mile or passengers per loaded vehicle-mile.

   a. Passengers per Vehicle-Mile - This figure is calculated by dividing the total number of one-way passenger-trips by the total number of vehicle-miles traveled. The result is a figure which represents a ratio of passengers to the total distance traveled taking into consideration both passenger-oriented and non-passenger-oriented trips.

   b. Passengers per Loaded Vehicle-Mile - This figure is found by dividing the total number of one-way passenger-trips by the number of loaded vehicle-miles traveled. The ratio of passengers per loaded vehicle-mile is a measure of the extent to which more than one passenger is being served at any given time. Generally, this ratio is higher than the passengers per vehicle-mile figure.

2. Passengers per Hour - Passengers per hour is a measure of productivity which can be expressed as either passengers per vehicle-hour or passengers per loaded vehicle-hour.

   a. Passengers per Vehicle-Hour - The most widely used measure of productivity, this figure represents the total number of one-way passenger-trips divided by the total number of hours the vehicle was in operation.

   b. Passengers per Loaded Vehicle-Hour - This measure is found by dividing the total number of one-way passenger-trips by the number of loaded vehicle-hours (i.e. those hours when the vehicle had at least one passenger on board). This figure allows a comparison of the efficiency between the total vehicle-hours of operation and the hours in which the vehicles are actually carrying passengers.

3. Average Trip Length - Average trip length represents an estimate of the average distance traveled during a one-way passenger-trip. The average trip length is calculated by dividing the total passenger-miles by the total number of one-way passenger-trips.

Unit Cost Measures

In addition to compiling performance and productivity measures, unit costs were also calculated. Unit costs, which relate the costs of operating the transportation system to measures of performance, represent a cost-efficiency ratio. The five measures of unit costs used in this study are described below.

1. Cost per Passenger-Trip - This figure is calculated by dividing the total cost of operating the transportation system by the total number of one-way passenger-trips. It serves as an indicator of the cost to the system for each passenger served.

2. Cost per Vehicle-Mile - This unit cost relates the cost of operating the system to the total vehicle-miles traveled (miles traveled for both passenger oriented and non-passenger-oriented purposes). This is a realistic figure of the actual system costs as related to vehicle reliability, productivity, and mileage.

3. Cost per Loaded Vehicle-Mile - The cost per loaded-vehicle mile is a measure of the total system cost as it relates to the total vehicle-miles traveled when there is at least one passenger on board. This figure which is found by dividing the total system cost by number of loaded vehicle-miles, is always higher than the cost per vehicle-mile figure.

4. Cost per Vehicle-Hour - The cost per vehicle-hour can be calculated by dividing the cost of the system by the total vehicle-hours. This figure provides a good measure of what it cost to keep a vehicle on the road during operating hours.

5. Cost per Loaded Vehicle-Hour - This figure relates the cost of the transportation system to the hours of operation when at least one passenger is on board a vehicle. This measure allows a comparison of passenger related costs to the costs accrued from simply maintaining a vehicle on the street. The cost per loaded vehicle-hour can be found by dividing the total system cost by the number of loaded vehicle-hours.

TPCAC - Amarillo

In calculating average productivity measures and unit costs for the TPCAC, the following data was used.

Total cost of system	= $13,616
One-way passenger-trips	= 5,130
Vehicle-miles traveled	= 18,146

Loaded vehicle-miles traveled = 11,911
Passenger-miles traveled = 39,239
Vehicle-hours accrued = 935
Loaded vehicle-hours accrued = not available

From this information, the following productivity measures were determined.

Passengers per vehicle-mile = 5,130 ÷ 18,146 = .28
Passengers per loaded vehicle-mile = 5,130 ÷ 11,911 = .43
Passengers per vehicle-hour = 5,130 ÷ 935 = 5
Average trip length (miles) = 39,239 ÷ 5,130 = 7.6

These measures indicate that the TPCAC operating 8 vehicles within the 81.4 square mile area of Amarillo averaged approximately .28 passengers per vehicle-mile and .43 passengers per loaded vehicle-mile each month. The difference between these two figures can be explained by examining the difference in total vehicle-miles traveled (18,146) and loaded vehicle-miles traveled (11,911). The result is that 6,235 miles (or approximately one-third of the total vehicle-miles) were logged when no passengers were actually on board the vehicles. These miles could have been covered in trips to pick up passengers, trips to the gas station; trips to lunch, etc. The TPCAC vehicle fleet also averaged about 5 passengers per vehicle-hour. In addition, each passenger-trip averaged approximately 7.6 miles in length.

Average unit costs were calculated for the TPCAC and are presented below.

Cost per passenger-trip = $13,616 ÷ 5,130 = $ 2.65
Cost per vehicle-mile = $13,616 ÷ 18,146 = $ .75
Cost per loaded-vehicle mile = $13,616 ÷ 11,911 = $ 1.14
Cost per vehicle-hour = $13,616 ÷ 935 = $14.56

The cost measures indicate that the TPCAC's total cost of providing human services transportation averages about $2.65 for each passenger transported. Expressed in terms of cost per mile, the cost of operating the service averages approximately $.75 per vehicle-mile or about $1.14 per loaded vehicle-mile.

Another good indicator of productivity is that it costs approximately $14.56 per vehicle-hour of operation for the TPCAC to provide human services transportation. The cost per vehicle-hour figure, which indicates what it costs to keep a vehicle on the road during operating hours, represents the most stable indicator of ralative costs between systems. *(Note: A comparison of cost per vehicle-hour between TPCAC, CARTS and the DHR was not possible, however, due to a lack of available data on vehicle-hours accrued for CARTS and the DHR.)*

CARTS - Austin

Average productivity measures and unit cost calculated for the Capital Area Rural Transportation System in Austin were based on the following statistics.

Total cost of system	= $ 9,865
One-way passenger-trips	= 1,845
Vehicle-miles traveled	= 7,529
Loaded vehicle-miles traveled	= 5,593
Passenger-miles traveled	= 27,774
Vehicle-hours accrued	= not available
Loaded vehicle-hours accrued	= not available

From this information, passengers per vehicle-mile, passengers per loaded vehicle-mile and average trip length productivity measures could be calculated. It was determined that CARTS averaged .25 passengers per vehicle-mile and .33 passengers per loaded vehicle-mile. Both of these figures are lower than those for the TPCAC due to the fact that CARTS serves a 7-county region while the TPCAC operates only within the Amarillo urbanized area. CARTS' larger service area also accounts for their average trip length of 15.1 miles being about twice that of the TPCAC's average of 7.6 miles.

Average unit costs were also calculated for CARTS and are presented below.

Cost per passenger trip = $9,865 ÷ 1,845 = $5.35
Cost per vehicle-mile = $9,865 ÷ 7,529 = $1.31
Cost per loaded vehicle-mile = $9,865 ÷ 5,593 = $1.76

The total cost of providing transportation in the 7-county CARTS region equaled $5.35 per passenger-trip, which is about twice that of the TPCAC'S cost per passenger-trip. This can be explained by noting that while the cost of operating CARTS is 28 percent less than the cost of operating the TPCAC system, the number of one-way trips averaged 64 percent less, thus the cost per passenger-trip for CARTS would be higher.

The cost of operating CARTS averaged about $1.31 per vehicle-mile and $1.76 per loaded vehicle-mile. The cost per vehicle-mile figure is approximately 42 percent higher and the cost per loaded vehicle-mile averaged 35 percent higher than that of the TPCAC. These differences are due to the CARTS expenses averaging only 28 percent less than the TPCAC's expenses while the total vehicle-miles traveled averaged 58 percent less and the total loaded vehicle-miles averaged 53 percent less.

DHR Region 10 - Nacogdoches

In calculating productivity measures and unit costs for the DHR Medial Transportation Program, the following data were used.

Total cost of system = $ 7,872*
One-way passenger-trips = 536
Vehicle-miles traveled = 13,465

*Figure represents only those expenses directly related to operation and administration of the DHR vehicles. $10,326 for purchased transportation and $1,901 or 87% of the salaries and fringe benefits for administrative personnel, office rent, utilities, telephone, office support and office supplies (associated with the administration of contracted providers) were subtracted from the original figure of $20,099.

Loaded vehicle-miles traveled = not available
Vehicle-hours accrued = not available
Loaded vehicle-hours accrued = not available

Based on the data available, only the passengers per vehicle-mile productivity measure could be calculated for the DHR vehicles (DHR vehicles alone - excluding purchased transportation). From this information, the DHR was found to average .04 passengers per vehicle-mile -- considerably less than the .25 of CARTS or the .28 of the TPCAC. The lower passengers per vehicle-mile figure is due to the DHR vehicles serving a 40 percent larger geographical area than CARTS and a 99 percent larger area than the TPCAC vehicles.

Average unit costs were also calculated for the DHR vehicles and are presented below.

Cost per passenger-trip = $7,872 ÷ 536 = $14.69
Cost per vehicle-mile = $7,872 ÷ 13,465 = $ .58

It was thereby determined that the cost of providing medical transportation to the 11 counties served by the DHR vehicles averaged approximately $14.69 per passenger-trip. This cost is about 2½ times higher than CARTS and about 5½ times higher than the TPCAC. The difference between the DHR and CARTS cost per passenger-trip figure can be attributed to the DHR transporting 1,309 (or 71 percent) fewer passengers than CARTS with average monthly expenses for both systems being about equal. In comparing the DHR to the TPCAC, the monthly costs total about 28 percent less while number of passengers transported averaged 90 percent lower.

In the cost per mile category, the DHR vehicles averaged $.58 per vehicle-mile - slightly lower than the TPCAC figure of $.75 per vehicle-mile. The DHR figure, however, is 56 percent lower than the CARTS $1.31 per vehicle-mile traveled (due to the CARTS vehicles covering 44 percent fewer miles on the average).

Summary

Table 13 summarizes several of the productivity measures and unit cost calculations for the TPCAC, CARTS and the DHR. In addition, it also presents information as to how these services compare to three other demand-responsive human services transportation providers studied previously: HandySCAT and Project Bravo in El Paso, and CFIT in Lubbock (1).

HandySCAT is a 24-hour in advance call-in type of demand-responsive transportation service provided for the physically disabled citizens of El Paso offered jointly by the Sun City Area Transit System and the area chapter of the American Red Cross. Normal hours of operation are from 7:00 a.m. to 6:00 p.m. weekdays. The system uses seven 10-passenger buses equipped with hydraulic lifts and wheelchair tie-downs to provide service within the city limits of El Paso (239 square miles).

Project Bravo, the City of El Paso's Community Action Agency also offers a 24-hour advance call in demand-responsive transportation service within the City of El Paso. It also contracts with the Department of Human Resources to provide Medicaid transportation which has top priority for transportation. The system uses seven 11-passenger vans, none of which are equipped with wheelchair lifts (disabled clients are referred to HandySCAT). Service hours are from 7:00 a.m. to 5:00 p.m., Monday through Friday.

CFIT (Citizens for Improved Transportation) provides coordinated transportation for elderly and handicapped residents of Lubbock. CFIT operates 2 buses (24 and 28 passengers) and 4 vans, one of which is specially equipped with a wheelchair lift. CFIT also provides scheduling and dispatching of the Citybus (Lubbock's Transit System) lift-equipped bus. Both lift-equipped vehicles operate on a 24-hour advanced reservation basis with the remaining

Table 13: Summary of Selected Human Services Transportation Providers Cost and Operating Statistics

Provider	Approx. Service Area	Total Cost of System	Total Vehicle-Miles Traveled	One-Way Passenger-Trips	Passengers per Vehicle-Mile	Cost per Vehicle Mile	Cost per Passenger-Trip
TPCAC Amarillo	81.4 sq. mi. (urban)	$13,616	18,146	5,130	.28	$ .75	$ 2.65
CARTS Austin	5,663 sq. mi. (rural)	$ 9,865	7,529	1,845	.25	$1.31	$ 5.35
DHR-Region 10 Nacogdoches	9,344 sq. mi. (rural)	$ 7,872	13,465	536	.04	$ .58	$14.69
HandySCAT[1] El Paso	239 sq. mi. (urban)	$15,426	16,942	1,741	.10	$ .91	$ 8.87
Project Bravo[1] El Paso	239 sq. mi. (urban)	$ 8,393	9,668	1,396	.14	$ .87	$ 6.01
CFIT[1] Lubbock	87.1 sq. mi. (urban)	$ 8,502	6,053	2,090	.34	$1.40	$ 4.06

[1]Estimates were based on January-April 1979 cost and operating data

Source: Reference 1

vehicles operating a prescheduled semifixed-route service primarily for the City's Title VII nutrition program.

IV. CONCLUSIONS

The overall objective of this study was to evaluate transportation services provided by human services agencies in order to assist them in developing more cost-effective and efficient total transportation systems. In doing so, transportation cost and operating data were collected from three agencies. This data, however, were extremely limited in some cases, making evaluations and comparisons in certain areas very difficult, if not impossible. For example, all three agencies interviewed indicated that their drivers did not always complete all of the required information on their daily logs (information such as vehicle-hours of travel). It is therefore impossible to evaluate certain aspects such as "cost per vehicle-hour of operation" without the appropriate data base.

Given the nature of the data, it appears that the next step toward developing more cost-effective transportation systems would be to develop a data monitoring system which would include both: 1) a uniform accounting system with common line items and definitions, and 2) a uniform data reporting system for both financial and operating information.

Such a system would prove useful in a number of different ways. First, it would provide a basis for comparing both cost and operating data of different providers. Second, it would provide a measure of how a system's costs and level of service change over time. Third, it would be useful in evaluating the system's efficiency and in determining how costs can be lowered or service can be improved. Finally, a uniform monitoring system would be useful in deciding if purchasing or coordinating transportation services with other providers is warranted.

During the second year's study effort, a system of this description will be developed and will be documented in a subsequent report. In addition, a

plan to implement the data monitoring system will also be developed and documented, for the monitoring system will be of little value if it is not implementable.

REFERENCES

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