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**THE VALLEY TRANSIT DISTRICT:
Specialized Transportation for the Elderly,
Handicapped and Low-Income in the Lower
Naugatuck Valley, Connecticut**

Final Report
February 1979

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Service and Methods Demonstration Program

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U.S. DEPARTMENT OF TRANSPORTATION
Urban Mass Transportation Administration and
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16. Abstract <p>A multifaceted demonstration with special emphasis on service to the elderly and handicapped has been operating in the Lower Naugatuck Valley of Connecticut since January, 1973. The system has included limited fixed route service, demand responsive door-to-door service, subscription service and contract bus service for social service agencies and other groups in the Valley. An automated fare collection system using credit cards and monthly billings to eliminate the need for cash payment was used from 1973 to 1975. Fare subsidization for handicapped and elderly citizens is facilitated by this computerized system which bills sponsoring agencies according to the use of the transportation services by their clients during the previous billing period. The user-side subsidies and monthly billing were continued after 1975 using manual methods.</p> <p>Of the target population of 12,000 individuals, 600 are regular, heavy users of the Valley Transit District (VTD), with few of the others using the system at all. VTD users are primarily low-income, autoless elderly from small households. The system operates 10 vehicles daily to provide its services; the average hourly cost is near \$12. The system has earned revenues equal to almost 50 percent of its costs, although 40 percent of its revenues have been derived from user-side subsidy funds. Finally, VTD has withstood several challenges in regulatory and institutional areas from private bus operators and has slowly expanded its services throughout the demonstration. It is currently operating in post-demonstration status under ongoing funding.</p>							
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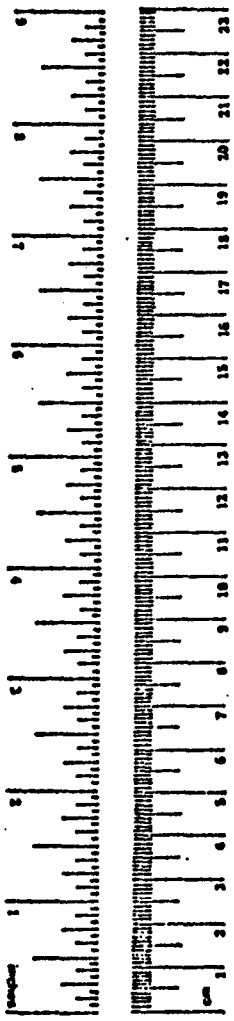
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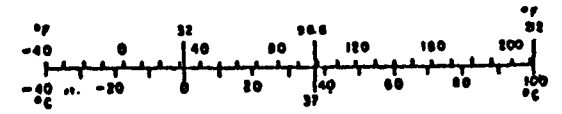
Approximate Conversions to Metric Measures

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				
sp	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)				
	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C



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
km	kilometers	1.1	yards	yd
		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	0.036	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



PREFACE

The Valley Transit District has been funded by the U.S. DOT, UMTA Service and Methods Demonstration (SMD) Program together with local support from the State of Connecticut and the municipalities of Ansonia, Derby, Seymour, and Shelton. As part of the demonstration program, Cambridge Systematics, Inc., under subcontract to Multisystems, Inc., which was under contract to U.S. DOT, Transportation Systems Center, has prepared the following Final Evaluation Report on the demonstration.

The report is based on analysis of data collected with the assistance of the Valley Transit District, Valley Regional Planning Agency, the Lower Naugatuck Valley Community Council, and RRC International, Inc. In particular we wish to thank the following individuals who have been extremely helpful in providing data and assistance to the project:

Joseph Ferrigno -	Executive Director Valley Transit District
Joseph Romano -	Assistant Executive Director Valley Transit District
Shirley Korpalski - Judy Petz Carrie Petz Jeannie Marchand Judy Dunn	Valley Transit District Staff
M. David Vail -	Executive Director Lower Naugatuck Valley Community Council
Edward Burdell -	Executive Director Valley Regional Planning Agency
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Dave Poulin - Ed Dwyer	State of Connecticut D.O.T.
Carla Heaton - Leonard Bronitsky	Transportation Systems Center
Lynn Sahaj -	Project Monitor, UMTA

The author also wishes to thank the Cambridge Systematics staff who worked on the project. Wendy Stern and Carol Walb conducted many of the interviews summarized in Chapter 7 and collected background data. Richard Albright, Dave Welland and Jim Wojno processed all the data and estimated the models reported in Chapters 5 and 6.

READER'S GUIDE

The Valley Transit District began regular operations in early 1973, and operated under demonstration program status until June, 1977. It continues to operate currently as a local transit district under non-demonstration funding programs. This report covers the entire period of the demonstration program, at the end of which the system had attained the configuration in which it continues to operate.

The first chapter of this report is an Executive Summary; the next three chapters describe the objectives of the demonstration, the demonstration setting, and the project operations; Chapters 5, 6, and 7 provide the basic technical analyses; Chapter 8 describes the institutional issues which influenced the project, and Chapter 9 summarizes the conclusions and policy recommendations that can be drawn from this project.

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1. EXECUTIVE SUMMARY

1.1 PROJECT OVERVIEW AND DESCRIPTION OF SITE

The Valley Transit District (VTD) demonstration project has provided specialized transportation services to the elderly, handicapped, and low-income residents of the Lower Naugatuck Valley in Connecticut since January, 1973. Limited public transportation services have also been offered to the general public.

Four types of service are operated by VTD:

- contract service is available to Valley senior centers, health and social service agencies, and elderly housing projects to serve regular group trips to and from the agency, shopping areas, or other activities;

- dial-a-ride service is available to individuals from 6 am to 6 pm Monday through Friday on a two-hour advance request;

- subscription service is used to provide door-to-door service for regular trips such as work trips; it is the only VTD service primarily for general public use;

- fixed route service is provided only in the offpeak for shopping and other nonwork travel primarily by the elderly population.

The system currently has 15 vehicles (11 minibuses and 4 autos), 12 of which are in service daily. Billing (except in fixed route services) is done on a monthly basis with a statement being sent to each individual and each agency sponsoring trips. A VTD credit card is necessary to use VTD door-to-door services. User-side subsidies were provided by a

U.S. Department of Health, Education and Welfare (HEW) grant to cover part of the cost of both agency-sponsored contract trips and certain individual trips taken on other services, but expired in late 1977.

The target population for VTD consists of 12,000 individuals (8,500 elderly, 2,500 low-income, and 1,000 handicapped) of a Valley population of 75,000. More than 3,000 Valley residents possess VTD credit cards, of which 62 percent are members of the target group, and 38 percent members of the general population. In any month, approximately 900 individuals use VTD services of which 600 are target population members.

Total monthly ridership is near 16,000, distributed as follows:

Contract services	10,000
Dial-a-ride services	500
Subscription services ¹	5,000
Fixed route services	500

The composition of VTD's monthly ridership is:

Elderly	6,500
Handicapped	3,000
Student	2,000
General Public	4,500

Members of the elderly population who are VTD users make an average of 3.0 round trips per week by all modes for all trip purposes, compared with 2.7 for nonusers, and an estimated rate of 2.2 by VTD users if VTD service did not exist.

VTD's total operating costs for the demonstration period (1973-77) have been \$1,128,000; it has earned \$549,000 in revenues (of which \$213,000 is user-side subsidy), resulting in a deficit of \$579,000, covered by funding sources described in Section 1.2. Hourly operating costs have

¹Including one subscription service operated in a mode resembling fixed route service.

decreased from \$12.70 in 1973 to \$11.50 in 1977.

The different VTD services have varying operating ratios (ratio of revenue to cost), ranging from 1.20 for contract service to 0.30 for subscription service to 0.10 for dial-a-ride and fixed route service. Productivity also varies from near 13 passengers per hour in contract service to 4 for subscription service, and 1 to 3 for dial-a-ride and fixed route service. Approximately one-third of VTD's operating hours are allocated to contract service, 60 percent are allocated to subscription and dial-a-ride jointly, and the remainder to fixed route service. VTD can thus control its overall operating ratio by adjusting its mix of services.

In the institutional area, VTD has achieved close cooperation with the Valley social service agencies. The Lower Naugatuck Valley Community Council (LNVCC) plays a broker role in coordinating, funding, and planning VTD services for clients and agencies. Some opposition to VTD has been voiced by local school bus and taxi operators who have filed complaints with the Connecticut Public Utilities Control Authority on three occasions. However, VTD has survived these efforts with little restriction of its operating rights, except for certain trips to points outside the Valley.

In summary, VTD has achieved operational status as a transit district in Connecticut after the demonstration grant ended, and is providing services to its target population and the general public. It has had a large impact on the mobility of a small portion of the target population, with lesser impacts on the general public. The system has a

high overall productivity of seven passengers per vehicle-hour and has an operating ratio over .40. These are positive achievements in a large, fairly low density area such as the Valley (56 square miles), and were achieved under fairly severe funding and vehicle fleet size constraints.

The service area for the door-to-door, contract, and subscription services is relatively large (56 square miles) to serve with a limited fleet. The entire area population is approximately 75,000, of which the total target population is 12,000. The area is unique in that the average density is only 1,300 persons per square mile, and the target population density is only 200 persons per square mile. These are very low values for transit service (although VTD does concentrate its services somewhat in parts of the Valley with higher densities). Another unique site characteristic is that the area is extremely hilly and service must be provided on many minor streets, causing operating difficulties. The agencies served by VTD are dispersed throughout the service area: senior centers in each of the four towns, VARCA (Valley Association for Retarded Children and Adults), two hospitals, a day care center, several housing authorities, health agencies and others. VTD has recently been allowed by the Connecticut Public Utilities Control Authority to serve trips by the elderly and handicapped to nearby centers such as New Haven, Bridgeport, and Waterbury, and service has been expanded to these trips.

1.2 DEMONSTRATION OBJECTIVES, BACKGROUND, AND FUNDING SOURCES

The project is primarily related to the Service and Methods Demonstration program objective of improving transit service for the handicapped and elderly. However, this demonstration also seeks to integrate services to the general public with the target population services, meeting the transportation needs of each group more efficiently than if each were served separately. Thus the VTD system addresses the objective of improving transit productivity as well.

An additional local objective is to provide public transit service which can effectively meet the transportation needs of health and social service organizations. An early local objective of the Valley Transit District was to serve the general public to a much larger extent than proved feasible with its initial six-vehicle fleet; thus, there has been a progressive redefining of priorities and objectives throughout the demonstration, with a much heavier emphasis being placed at the end to serving the elderly and handicapped instead of a broader mix of users. This is reflected in the project history quite strongly.

Initiation of the Valley Transit District dates back to the late 1960's when several agencies under the United Fund of the Lower Naugatuck Valley submitted a proposal for the funding of a transportation program for the disabled and disadvantaged. In 1971, the U.S. D.O.T., Urban Mass Transportation Administration (UMTA) agreed to fund the Valley Transit District, which was created by a special act of the Connecticut State Legislature in the same year. VTD was created specifically for the administration of the UMTA demonstration project, but its

powers and scope go beyond the demonstration, as its current post-demonstration status shows.

The VTD demonstration project can be characterized by three phases: Phase 1 (December, 1972 - March, 1973), Phase 2 (April, 1973 - June, 1974), and Phase 3 (July, 1974 - June, 1977).

Phase 1 - December, 1972 - March, 1973: Registration for the dial-a-ride services was actively promoted, and a fixed route service was provided to replace a gap in service due to a strike of the operator of the major fixed route in the Valley.

Phase 2 - April, 1973 - June, 1974: Dial-a-ride services were begun, but quickly became saturated due to the small initial fleet of six buses and due to equipment unreliability. Subscription and contract services were also begun, with contract services carrying the bulk of VTD ridership during this period.

Phase 3 - July, 1974 - June, 1977: VTD began this phase with a severe equipment shortage, but by 1977 had replaced its original vehicles and increased its fleet to the current 15 vehicles. Dial-a-ride and subscription services were expanded once the vehicle fleet allowed, to better serve existing users, and a set of fixed routes was initiated with limited success. At the end of this phase, VTD was a stable operation with an adequate vehicle fleet. Even with the expanded fleet, the vast majority of service was provided for elderly and handicapped users.

VTD funding is summarized in Table 1-1; a wide variety of sources

TABLE 1-1

Overview of VTD Funding

<u>Source</u>	<u>Funding Category</u> ¹				
	<u>Operating Cost</u>	<u>Capital Cost</u>	<u>User Subsidy</u>	<u>Other</u>	<u>Total</u>
a) <u>Grantee: VTD</u>					
UMTA (Demonstration)	\$240,050 ²	\$544,200	0	\$403,000	\$1,187,250
UMTA (Capital)	0	376,640	0	0	376,640
Towns of Ansonia, Derby, Seymour, Shelton	37,750	0	0	0	37,750
State of Connecticut	355,781	0	0	0	355,781
b) <u>Grantee: LNVCC</u>					
HEW (Older Americans Act, Title IV)	0	0	\$188,864	\$526,796	715,660
HEW (Older Americans Act, Title III)	0	0	24,035	7,225	31,260
TOTAL	\$633,581	\$920,840	\$212,899	\$939,021	\$2,704,341

¹ Some of the grant amounts include matching contributions from other governmental bodies.

² UMTA demonstration funding breakdown based on budgeted rather than actual amounts; actual amount of operating assistance is estimated at \$185,000, with the remainder of the funds in this category unexpended or partially shifted to other categories.

has been used. Basic funding has been provided by the UMTA Service and Methods Demonstration (SMD) Program through two demonstration grants totalling \$1,187,250. Additional support from UMTA to purchase new vehicles in 1975 was provided through a capital grant of \$376,640. The four towns served by VTD were required to show financial support for the system as one of the terms of the second UMTA demonstration grant; they had also contributed a matching share to the initial demonstration grant. Finally, the State of Connecticut has provided operating subsidies (including funds from UMTA) to VTD since fiscal year 1975. User-side subsidy funds were provided through grants from the U.S. Department of Health, Education, and Welfare (HEW) to the Lower Naugatuck Valley Community Council (LNVCC), a nonprofit social services agency, which in turn used the funds to subsidize client and agency use of VTD. Two separate grants, totalling \$746,920, were provided. More detailed breakdowns of costs and matching provisions are given in section 4.2. Total system revenues over the demonstration period, exclusive of user-side subsidies, have been \$336,000.

1.3 KEY PROJECT FINDINGS

1.3.1 Service to the Elderly and Handicapped

VTD has had a significant impact on approximately 600 elderly and/or handicapped individuals in the Valley, or 5 percent of the VTD target population of 12,000. These 600 individuals use VTD more than once a month; there are also approximately 1,000 less frequent users. For the heavy users of VTD, their total tripmaking is estimated to be 27 percent greater than

without VTD; this amounts to the difference between 2.2 and 3.0 average round trips per week. VTD users are disproportionately agency clients and senior center attendees who have been made aware of the service, are subsidized to use it, and have services tailored to these trips. The bulk of the added 27 percent tripmaking due to VTD is for senior center and agency trips, often to group activities.

Impact on the non-elderly handicapped is centered on approximately 100 clients of the Valley Association for Retarded Children and Adults (VARCA) workshop transported on VTD contract services.

VTD has penetrated little of the more general elderly travel market because of early problems with vehicle reliability and system capacity dissuading "choice" riders, little marketing outside agencies and senior centers, and the availability of taxi service at fares not far above VTD's and providing a higher level of service. However, VTD has done an effective job of serving the maximum number of trips possible within its financial and fleet size constraints. Each VTD vehicle (except the autos and station wagons) operates approximately nine hours out of each 12-hour service day, and carries more than seven passengers per hour on the average, which is quite high for paratransit service. Thus, the limited impact VTD has had on elderly travel must be related to the capacity VTD has to accommodate tripmaking. Viewed in this manner, VTD has achieved close to maximum effectiveness in serving the target population within its resources.

1.3.2 Service to the General Public

VTD has provided limited service to the general public through its subscription and fixed route services. The subscription services carry less than 1 percent of the total daily intra-Valley work trips, although VTD does not have enough vehicle capacity to increase its market share in this area.

In 1975 and 1976 VTD aimed to maintain a 60 percent operating ratio (ratio of revenues to costs) for the state to subsidize the entire operating deficit without local funding. (The state currently pays the entire operating deficit of VTD, subject to certain limits.) Any service operating over the 60 percent ratio could thus "cross-subsidize" a service operating below 60 percent to enable the system as a whole to maintain its 60 percent operating ratio. One of the VTD objectives was for services to the general public to operate over a 60 percent ratio to balance some needed services to the elderly and handicapped which are likely to generate a lower revenue-cost ratio. However, this was not possible in the Valley; in fact, the elderly and handicapped services were "cross-subsidizing" the subscription service instead. It appears very difficult to generate sufficient ridership in a low-density area such as the Valley to operate a cost-effective subscription service.

The general public service and the elderly services do have some conflicts in peaking patterns, although they are complementary in general. The extent to which operational economies are obtained through the unified provision of service to both groups is difficult to estimate. Vehicle utilization is high, which leads to lower operating (administrative, garage, deadheading) costs and capital (vehicle and garage) costs

than separate systems for the two groups, which would have less effective utilization of equipment. Even with these savings, though, the net impact of the general public services on VTD's finances has still been negative.

1.3.3 Comparison of Fixed Route, Dial-a-Ride, Subscription and Contract Services

Several inferences can be drawn from VTD's experience:

First, contract services to group activities and shopping trips are an extremely productive and efficient means of meeting these travel needs for the target population. VTD has achieved the maximum level of contract operations possible at current agency funding levels. Its method of operating the services is very flexible for users and requires little dispatch involvement, thus cutting costs.¹ Thus, the operating statistics for contract service (productivity of 13 passengers per hour, operating ratio of 120 percent, and a ridership of one trip per capita per month for members of the elderly and handicapped target groups) are near the maximum performance to be expected for the Valley's population and area.

VTD dial-a-ride service is more difficult to assess. Much potential ridership was lost due to reliability problems early in the project, only part of which seems to have been regained. The registration requirement and two-hour call-in time also have some impact on ridership. VTD's dial-a-ride productivity is between one and two passengers per

¹In the past, drivers have had a fixed list of pickups for each contract run; the first few riders picked up knew which of the others required service that day. More typically, though, the dispatcher receives phone calls from the day's users and creates a list of pickups.

hour, and its operating ratio is near 10 percent. With the more regular door-to-door trips being handled by contract and subscription service, though, this is still a relatively good productivity in a low-density area.

VTD pricing of the dial-a-ride service (but not subscription service) is set very close to the revenue-maximizing level, so that either increases or decreases from the present fare structure would lead to decreased revenues. Thus, the only means for VTD to increase its dial-a-ride operating ratio is to increase its productivity, but even a doubling of productivity would only produce a 20 percent operating ratio. VTD recognizes that this service is unremunerative in the Valley, and therefore restricts the total resources it allocates to the service, although service is provided for all essential target group trips that cannot be handled by another service.

VTD fixed route service has been the least effective of its service modes, with very little ridership being carried. The VTD intra-Valley fixed routes had operating ratios under 10 percent and productivities between zero and two passengers per hour. Even the Connecticut Transit fixed route, which is long-established, connects three of the four Valley towns with hourly service, traverses the highest density area of the Valley, and charges only a 35¢ fare as opposed to VTD's 50¢, has a productivity of only seven passengers per hour. This can be regarded as the upper limit for fixed route services in the Valley under present conditions.

The area coverage provided by the fixed routes for elderly users in the Valley is not large, as 80 percent of VTD fixed route users reported walking one block or less to the bus stop. Most Valley trips are short (two to four miles) and densities are low. Thus, fixed routes are not well suited to meeting target group travel needs in the Valley. VTD has not operated significant peak period fixed route service for the general public and sheds no light on this type of service. However, the provision of such service would require a substantial expansion of the vehicle fleet (presuming existing services are not curtailed), and a reorientation of resources and management effort that would be viewed by VTD management as inconsistent with VTD's primary goal of serving the elderly, handicapped, and low-income.

The current subscription service operating ratio is near 25 percent, and the productivity is between four and five passengers per hour. Service to a large employer outside the Valley has maintained an operating ratio over 60 percent and a productivity of 15 passengers per hour, however. Other issues regarding the subscription service were discussed in the previous section.

Thus, VTD provides an interesting perspective on the relative roles and performance of these four service types in a low-to-medium density setting. VTD's experience should be strongly indicative of the experience other similar systems would have. In general, VTD has achieved much of the potential performance of these four service types within the tight constraints of a small vehicle fleet (one vehicle per 6,000 people or

four square miles) and limited resources (maximum operating deficit of approximately \$2.00 per year per person in the Valley).

Systems with less tight constraints may achieve greater impacts, particularly with subscription or fixed route services, which were beyond VTD's resources to operate at a large scale. Finally, systems with fewer vehicle problems and more resources for outreach and marketing programs may impact a larger number of individuals than VTD has been able to.

1.3.4 Fare Collection and Pricing Innovations

While this area is perhaps the one for which the VTD demonstration is best known, it must be recognized that it is only one element in a host of innovations present in the VTD system and that it has generally not been viewed as a critical issue at the local level. A brief review of these innovations reveals that monthly postpayment has been the most successful and enduring of the innovations, and the user-side subsidy concept has also produced some benefits. The actual, physical use of credit cards and onboard service recorders (fareboxes that read credit cards) was not successful, and neither was the original pricing structure in which trip cost could vary for the same ride based on vehicle occupancy, boardings and alightings, and other factors.

Monthly post-payment has been used by VTD for the entire demonstration and the following period. It was computerized based on service recorder data from March, 1973, through June, 1975, purely manual from July, 1975, to July, 1977, and computerized with manual entry of ride data from August, 1977, through the present. The cost of bill prepara-

tion has varied from 11 cents per ride (subscription and dial-a-ride) for the first period, of which five cents was computer cost; to approximately 25 cents per ride in the second period; to near 20 cents per ride in the third period, of which 10 cents is computer costs on VTD's dedicated minicomputer.¹ The error rate (almost entirely missing rides) was 3 to 5 percent in the first period, and less than 1 percent in succeeding periods; this loss of revenue in the first period is also a "cost" which can be attributed to the post-payment arrangement. A final "cost" of post-payment is the nonpayment of bills by users, although this is only 1 percent of the total amount billed. Thus, the costs of monthly billing are significant elements of providing dial-a-ride and subscription services.

The benefits of monthly billing are not large. The monthly billing is required to provide adequate records for the payment of user-side subsidies provided by HEW grants. This data also is of significant value in determining system impacts on tripmaking of its target population. Only 22 percent of the target population users surveyed indicated they preferred monthly billing to cash payment for each ride, and 56 percent clearly preferred cash payment over monthly billing. Monthly billing has also been cited as a source of problems (such as nonpayment of bills and subsequent cancellation of service) with low-income users of VTD. On the positive side, however, a majority of the general public

¹The computer cost for the first period is based on extremely low rates charged VTD by a large industry in the Valley which did the processing; 10 or 15 cents would reflect a more typical cost level. Costs for the third period are expected to be reduced substantially when the dispatcher begins entering ride requests into the minicomputer instead of bookkeeping personnel working from written ride slips.

VTD users did prefer monthly payment. A final, intangible benefit of the post-payment is that it has served, more strongly than any other element of the VTD system, to differentiate it from conventional transit operations in the perceptions of its users, and planners reviewing the system. It has contributed strongly to the image of VTD as specialized transportation, and it is very likely that this has influenced the evolution, planning and regulation of the system.

The use of credit cards and on-board service recorders is redundant in a demand-responsive system, and VTD has eliminated their use in the system, replacing them eventually with direct entry of billing data by the dispatcher from each telephoned ride request. There were several difficulties with VTD's variable fare policy, including adverse user reaction to not knowing the cost of a trip until being billed at the end of the month, high variability in the costs of virtually identical trips, and unpredictable system revenues; the current system uses a fixed, zone-to-zone fare table. VTD's difficulties in achieving satisfactory operation of its variable pricing structure indicate the need to have a well-developed, theoretically sound, and practical pricing policy before developing a computerized billing system. Also, it appears that a fixed zonal fare policy, perhaps with peak period surcharges, can achieve most, if not all, the advantages claimed for the FAIRTRAN^R system. Consumer reaction to the variable fare policy was somewhat negative, with about 20 percent of both VTD users and nonusers finding it objectionable; the second most important annoyance factor (after vehicle unreliability) in an on-board survey of VTD patrons was "not knowing the exact fare when

riding." These surveys (which were not part of this evaluation effort) understate the impact of the variable fare policy, however, since most of the respondents to these surveys used only contract services for which they were not billed. In summary, while VTD's experience does not rule out the use of variable fare policies by other systems, careful design is required to ensure understanding and acceptance by system users. Agencies liked the variable fare structure because it formed a basis for allocating costs equitably and because agencies did not have to deal directly with the fluctuating ride costs in the same way as an individual. However, agencies appear equally satisfied with a fixed fare structure.

1.3.5 Relationship of VTD with Social Service Agencies

VTD has developed a very close level of cooperation with the Valley social service agencies for whose clients it provides transportation; in fact, it is even seen (mistakenly) by some Valley social service agencies as a social service agency itself. The role of coordinating social service agency use and payment for VTD services was taken by the Community Council (LNVCC), which was one of the key initiators of the VTD system. LNVCC helped to determine service needs, plan and allocate VTD services, mediate complaints and difficulties, administer the user-side subsidy grants, and search for ongoing social service funding to support VTD after its demonstration grants expired.

The "broker" role that LNVCC plays is a limited one in that LNVCC deals only with VTD to provide transportation services. Thus, if there is some service that VTD cannot itself provide (e.g. service outside the

Valley prior to April, 1977), VTD contracts with another organization (in this example, the Red Cross and later a New Haven taxi firm) to provide the service. LNVCC does not select from alternative providers of service. This arrangement was chosen in the Valley for two key reasons. First, it offered the maximum potential to coordinate special services, a major LNVCC objective. Second, it was felt to be more beneficial to the target population to utilize and support VTD's special vehicles and range of services even though other providers could have been chosen to provide certain services on a strict lowest-cost basis. To prevent any fragmentation of services or "cream-skimming" by other operators, it was decided to make VTD the sole service provider for LNVCC. Thus, LNVCC's brokerage role is an indirect one, with its major influence being on the types of service VTD operates rather than on the selection of the service provider.

LNVCC's formal influence over VTD is through its control of user-side funds, which are required to support much of VTD's contract service, as well as smaller portions of VTD's other services. However, the basis for LNVCC's interactions with VTD has, in fact, been a similarity in viewpoint and cooperation between the two agencies. LNVCC could control the allocation of user-side subsidy funds to achieve desired changes in VTD service, again a departure from the other "broker" concepts. In this project, VTD and LNVCC agreed on user-side subsidy proportions to favor contract service (generally a 50 percent subsidy to the sponsoring agency) due to its high productivity, and to favor medical trips on a dial-a-ride service (a 50 percent subsidy to the

individual) due to their necessity. A 20 percent subsidy rate was applied to other elderly dial-a-ride and subscription trips. By varying this structure and the amount of funding, the broker agency could influence the operating agency strongly.

In summary, LNVCC defined a unique broker role for itself in the demonstration that appears to have many advantages in a setting such as the Valley in which a specialized public transit agency has been formed to provide services. This broker concept is very supportive of the transit operator, which is necessary to achieve coordinated, stable services, but also retains some control and direction of the services operated.

1.3.6 Experience with Vehicle Fleet

Many sections of this report refer to vehicle problems as partial causes of higher costs, lower ridership, lower reliability, agency dissatisfaction, and other issues. The single largest threat to the use of actual VTD operating experience as a guide to expected performance of similar systems is the potential negative effect of VTD's vehicle fleet which has still not been entirely overcome.

VTD's experience shows that, before sophisticated service planning and implementation can be undertaken, basic vehicle and operation questions have to be well in hand. While the service concepts, pricing policies, interior vehicle amenities, and other items were probably handled in a more sophisticated way in the period from 1973-74 than the present, VTD nearly ceased operation due to its inability to provide a functioning, reliable service. In summer, 1974, VTD had only two func-

tioning vehicles from its original fleet of six; rarely in the period 1973-74 had more than three or four vehicles been available for service. Chapter 4 outlines the key operational and maintenance problems during this period. In the period 1974-77, many of these "extras" were eliminated (although basic concepts were retained) while attention was focused on providing a working, reliable service. In 1977, VTD was showing a strong performance.

One of the key needs for specialized transit operations is small bus vehicles which can perform reliably and at a reasonable operating and maintenance cost. VTD is in many respects a leading example of the problems with current and past small bus vehicles.

1.3.7 Management Techniques for Serving a Large Area

Early VTD planning documents exhibit a large degree of concern about providing service to a large (56 square mile) service area. A sophisticated dispatching technique was developed for this situation, the two-hour lead time for service was adopted to allow for shifting ride times to improve scheduling, and a pricing policy was developed to deal with equity issues among all the trips over the service area.

Much of this concern turned out to be irrelevant, as more than 90 percent of all VTD dial-a-ride and subscription trips have origins and destinations within a 14 square mile core area. Several reasons exist for this concentration of travel. First, VTD's pricing policy sets the fare for most outlying trips between \$3.00 and \$5.00 exclusive of any user-side subsidies; this discourages many trips even though it is cheaper than the taxi fare. Second, service levels for outlying trips

are necessarily lower than those for core trips, and this further lessens demand. Third, most of the population with limited mobility (no automobile or driver's license) lives in the core, and this has formed the bulk of VTD ridership. Thus, the effective size of the VTD service area has been reduced by several factors, both within and beyond VTD's control.

Even the core service area is relatively large, though, and VTD has developed dispatching techniques for operations in this setting that are described in section 4.2. These techniques allow a single dispatcher to control the entire VTD system, and include aids to forming dial-a-ride tours such as relatively flexible pickup time promises and constrained vehicle tours. Another key element is the design of contract services to operate without any dispatcher involvement. The two-hour lead time requirement for ride requests is rarely used to shift a user's time of travel to improve a vehicle tour, as the dial-a-ride demand density is not high enough in general to allow this.

One can, in general, conclude that systems like VTD, when serving a large area with varying densities, will concentrate their services on these core areas. Several forces, including the concentration of target population members, cost, and service level considerations, will influence the system to focus on core areas. If more uniform service is desired over a wider area, strong, explicit steps (such as higher user-side subsidies for outlying trips) must be taken to counteract these other factors, and the resulting equity issues dealt with as well. Even in a system with advance planning aimed at this issue like VTD, limited

service to outlying areas has resulted.

1.3.8 Local Attitudes Toward VTD

VTD has provided an interesting case study in the reactions and positions of many actors in the Valley toward a specialized transit system. In summary, while VTD has had strong support from social service agencies with which it is directly involved, it faces conflicting forces from other quarters. The regional planning agency (VRPA) advocates greater service to the general public, which VTD sees as a potential threat to its specialized services in an environment with limited resources. The school bus and taxi operators in the Valley oppose those elements of VTD service they feel compete with services they are adequately able to offer. VTD has been called before the Connecticut Public Utilities Control Authority (PUCA) on several occasions to answer complaints. The Valley municipalities, while generally supportive of VTD, are reluctant to provide any local funding, although they have done so at two points in the past. Finally, the Connecticut DOT is supportive of VTD and has agreed to a more generous operator subsidy policy than its basic agreement. VTD has preserved and expanded its role in Valley transportation in this institutional setting, although several conflicts (particularly the one between VRPA's goals and the social service agency goals) are still in the process of being worked out.

1.3.9 VTD Transition from Demonstration to Operational Status

VTD began its preparations for transition to operation status in

1975 when it negotiated with the state to be included under its basic subsidy policy for transit districts. At that time a 60 percent operating ratio was required to receive full state deficit funding. UMTA demonstration funds were phased out of VTD's operating budget fairly quickly, with only some administrative costs due to the demonstration being charged against it. VTD then began planning a service mix and fare structure that would allow it to cover approximately 60 percent of its operating costs. The critical element in this transition was VTD knowing the criterion for its continued operation nearly three years in advance of the date it would make its transition.

LNVCC's second HEW grant (for the years 1974-76) had a parallel emphasis to VTD's effort in that a major objective of the HEW demonstration was to locate ongoing sources of social service transportation funding that could be tapped by VTD and Valley social service agencies and municipalities. This effort, somewhat isolated from day-to-day operating problems that sometimes divert attention from longer term issues, expended a great deal of energy and achieved some success. The Valley Association for Retarded Children and Adults (VARCA) has incorporated a transportation element in its rate structure upon the urging of LNVCC and based upon an audit showing VTD could provide better service at a slightly lower cost than VARCA could provide for itself; as VARCA is VTD's largest contract user, this is an important element in VTD's continued viability. An effort was made by LNVCC to anticipate the end of the subsidy to the senior centers and to encourage them to allocate a portion of their operating budgets to take over the funding of the transportation services.

This also achieved moderate success. Other lesser sources of some continued funding beyond the demonstration were found, although LNVCC was disappointed in the overall result. Nonetheless, this effort was a key one in VTD's transition as well.

VTD also needed to demonstrate that it was fully operational at the end of the demonstration period to avert efforts to discontinue the project at that point. This had nearly occurred at the end of the first UMTA demonstration grant in June, 1974. In June, 1977, however, this was not an issue.

Finally, VTD had to be flexible enough to alter its service levels or mix during transition if prior or expected funding or revenue sources did not materialize. An example of this is the end of user-side subsidies for all individuals and agencies (except senior centers) in late 1977. VTD expects a decrease in contract service use due to the higher prices of its services to users. While LNVCC has eased the problem by arranging to carry over unexpended funds from previous years, VTD negotiated a supplemental state subsidy agreement and is prepared to reduce or restructure some of its services if necessary.

VTD's priority is still to provide services to the target population in the Valley, although there may be both financial and political pressures to change this emphasis. The resolution of this issue under current funding possibilities will be the most difficult test of whether VTD's demonstration concept will fully become established in the post-demonstration stage.

1.4 TRANSFERABILITY OF RESULTS

Many of the characteristics of the Lower Naugatuck Valley have influenced the results of this demonstration, and provision must be made for these issues when considering the transferability of VTD results to other areas. First, the Valley is very low density, with only 1,300 persons per square mile and only 200 target group members per square mile. Second, the Valley has relatively low income for a suburban area, which indicates a larger potential market for transit than may exist in other suburban areas; it actually appears to be more typical of urban and rural areas. Third, unemployment was very high in the Valley during much of the demonstration, reaching 17 percent during 1975. This allowed VTD, which is not unionized, to hire well-qualified drivers at very low wages (near \$3.00 per hour); VTD costs reflect this strongly. Fourth, VTD operates in an area that has strong economic and other links to larger, nearby towns that VTD has been enjoined by regulation from serving through much of the demonstration; this has restricted VTD's potential market significantly. Finally, VTD's vehicle problems have caused significant ridership losses, which were not regained when the system achieved stable operation; these losses could amount to 50 percent or more of the ridership on certain services, based on comparisons of early 1973 and 1974 data.

However, within these constraints on transferability, the VTD demonstration has provided much insight on the relative characteristics of several service types, has explored billing and management strategies for paratransit systems, and has established relationships with other

2. INTRODUCTION

2.1 DESCRIPTION OF DEMONSTRATION

The Valley Transit District has operated a multi-faceted experimental demonstration project with special emphasis on the handicapped and elderly in the Lower Naugatuck Valley of Connecticut since January, 1973. The system has included limited fixed route service, demand responsive service over a wide area, subscription service, and contract bus service for social service agencies and other groups in the Valley. VTD matches the most cost-effective service type to the travel requirements of its users. A fare collection system which uses credit cards and monthly billing to eliminate the need for cash payment has been operational over much of the period and a version of it is currently in use. Fare subsidization of agency-sponsored handicapped and elderly citizens is facilitated by the fare collection system which bills sponsoring agencies according to use of the service by their clients during the previous billing period. Other concepts tested by the Valley Transit District include the use of a mix of vehicle types to provide its services and coordination among agencies of public transportation service use.

The Valley Transit District provided four types of service:

1. Fixed Routes: Regularly scheduled buses operate hourly Monday through Friday during the off-peak hours of 10:00 am to 2:00 pm on a single route connecting the four towns (Seymour, Derby, Ansonia, Shelton) served by VTD. Four intra-town fixed routes were agencies in the Valley that should prove to have wide applicability for similar systems.

operated from November, 1975, through February, 1977, but were discontinued due to lack of patronage. The base fare is 50 cents (25 cents for ages 6-18 and over 60).

2. Dial-a-Ride: A two-hour advance notice telephone call to the VTD dispatcher is required for dial-a-ride service anywhere within the four-town area. (VTD calls this service "random door-to-door.") The VTD dispatcher handles calls from the riders, schedules the pickups and communicates with the drivers on a two-way radio. This service is available Monday through Friday 6:00 am to 6:00 pm; patronage is primarily elderly and handicapped users, and pre-registration is required. There is a zone fare system, with the fare ranging from 75 cents to \$5. The average fare is 88 cents.

3. Contract Services: Regularly scheduled door-to-door pickup and delivery services are available for group activities at Valley senior centers, health and social service agencies, and elderly housing. The service is arranged by social service agencies with VTD, and resembles charter bus service in its operation. This service is billed to the sponsoring agency at a rate of \$14 per hour, with certain agencies being subsidized by a U.S. Department of Health, Education and Welfare (HEW) grant. Contract service is available Monday through Friday, 6:00 am to 6:00 pm, as well as on a limited basis on evenings and weekends.

4. Subscription Services: Standing orders for service at the same time to and from the same address daily are also handled by the VTD system, either on separate trips or jointly with the door-to-door (dial-a-ride) service. VTD calls the subscription service "regular door-to-door". One "subscription" service (to and from Sikorsky Aircraft in Bridgeport) closely resembles fixed route operation. Subscription service is tailored for work and school trips for the general public as well as fixed health or social service trips for the target population. The fares are the same as for the demand-responsive door-to-door service. A monthly pass program is available as well. This and the fixed route are the only VTD services for which patronage is solicited from the general public.

The equipment for the project has varied considerably, and now includes 15 vehicles, 10 being in service at peak periods. These are drawn from a fleet of 11 Grumman minibuses, 2 station wagons, and 2 automobiles. Each bus is equipped with a special lowered front step to assist the elderly or slightly handicapped persons in boarding and leaving the bus. Two buses have a hydraulic lift to accommodate wheelchair riders, although automobiles or station wagons are often used for handicapped clients. Each of the buses has been equipped with special FAIRTRAN^{R*} service recorders that are used in conjunction with the billing system. The fare system consists of two elements, one of which is the service recorder which

* FAIRTRAN is the registered trademark of RRC International, Inc.

is carried on the bus in place of a farebox, and which records the data from a rider's credit card (the "V-card," required to use most VTD services), and other pertinent information (time of day, origin point, etc.) on a magnetic tape cassette. The second component is the computer software required to transform the records into monthly billings for post-payment. One feature of FAIRTRAN^R is that the billing system allows third parties (health and social service agencies, governmental agencies) to subsidize the cost of an individual's transportation, with the amount of subsidy varying by time of day, trip origin, etc.

The FAIRTRAN^R system has not been operational since June, 1975, although the third-party billing was continued on a manual accounting basis. A mini-computer was placed on-line in August, 1977, to automate the preparation of the monthly bills, but the service recorders were not placed back in operation.

A more detailed chronology of the system is given in Section 4.1.

2.2 ORGANIZATIONAL ROLES

The Valley Transit District (VTD) is the operator of all the demonstration services described in this report, and is operating ongoing, post-demonstration services as well. It was created in 1971 to operate public transportation services in the Lower Naugatuck Valley.

The Lower Naugatuck Valley Community Council (LNVCC) is a nonprofit agency involved in the planning and coordination of health, social service, and recreational programs in the Valley.

The Valley Regional Planning Agency (VRPA) is the body responsible for transportation, land use, and other planning functions of the Valley.

The Urban Mass Transportation Administration Service and Methods Demonstration Program (SMD) provided the initial project funding, monitored the progress of the demonstration project, and funded the evaluation of the project.

The Transportation Systems Center (TSC) of the U.S. Department of Transportation has monitored the demonstration evaluation.

Cambridge Systematics, Inc. (CS) has performed the evaluation, including the production of the evaluation plan, analysis of data, and preparation of a final report. All data was provided by the three local agencies mentioned above.

2.3 EVALUATION ISSUES

The Valley Transit District is the first example of many innovations which have since been applied, although never as a package, in many other smaller urban areas to serve the transit dependent. These innovations include the provision of several types of transit services to both the target population and the general public under unified management, the introduction of user-side subsidies varying by target group, the use of a community organization as a broker of transportation services, coordination of social service agencies in funding and utilizing transportation services, and an innovative fare system based on the use of credit cards and monthly billing.

The VTD project has provided useful insights on five major issues which are addressed in this evaluation report:

1. Travel impacts of specialized transit services on handicapped, elderly and low-income groups. The key variables of interest are the changes in total tripmaking (by trip purpose), the mode chosen for these trips, and the degree to which the service levels and fares of the VTD services affect target group mobility.
2. Impact of integration of services to the general public with those to the target population. Because the travel patterns of the elderly and those of the general population exhibit different characteristics, and because services to the general public may be able to charge higher fares (reflecting a greater ability to pay) and carry larger passenger loads (due to greater trip density), there are possible operational economies and cross-subsidy effects that can be obtained through unified management of these services. VTD has attempted to exploit these possibilities, and this evaluation assesses the effects on cost, productivity, and service levels to the different groups.
3. Comparison of fixed-route, dial-a-ride, subscription, and contract services. VTD operates a variety of services, attempting to serve each group's travel needs in the most cost-effective manner; VTD also attempts to operate each service type as efficiently as possible. Thus, the Valley provides a good background for comparing the cost, productivity, demand, and service levels of these operating options.

4. Fare collection and pricing innovations. VTD's experience with on-board service recorders, credit cards, manual and computerized monthly billing, several fare structures, and the user-side subsidy mechanisms provide much data on operational, cost, and public acceptance issues with these concepts. The fare collection and pricing system also has large implications for the data base and information available to evaluate, operate, and modify the system in response to changes in travel needs or increased understanding of the system's impacts.

5. Relationship of VTD with social service agencies. VTD's experience with a brokerage concept to coordinate agency use and funding of client transportation, and its use of a user-side subsidy mechanism, also provide much information on the effectiveness of these concepts.

There are four additional issues considered in the evaluation, although they are secondary to the key issues listed above:

6. Experience with vehicle fleet. VTD is an excellent case study of the effects of vehicle reliability and operating costs on overall system performance, as VTD has acquired a more reliable, efficient vehicle fleet as contrasted to an original fleet which was expensive to operate and could not meet VTD's service needs. VTD also has provided information on the effects of using a mix of vehicles to provide its variety of service, matching the most appropriate vehicle type to each service.

7. Examination of management and dispatching techniques of a system with few vehicles serving a large area. VTD has evolved a set of operating practices for the assignment of vehicles to services and areas that are a hybrid between taxi and other dial-a-ride systems. The evaluation report describes these techniques and identifies several key elements used to simplify the dispatching process.
8. Local community attitudes toward VTD. VTD's long history has elicited responses to a specialized public transportation service from the Valley towns, taxi operator, school bus operators, social service agencies, and others. These positions provide a very interesting case study of local attitudes toward these services.
9. VTD transition from demonstration to operational status. Several lessons on this transition are apparent from VTD's experience, which was a relatively smooth change. Funding sources, service levels, and inter-agency relations are key factors in this area.

In summary, the VTD demonstration provides information on these nine issues of general interest, in addition to a wealth of technical data on all aspects of the specialized services operated. The data base available from VTD is quite extensive, and it has proved capable of supporting a wide range of analyses.

2.4 EVALUATION OVERVIEW

This evaluation has collected data on a variety of topics. Much of the data in Chapter 3, which describes the project setting, is drawn from the U.S. Census and has been provided by the Valley Regional Planning Agency. Chapter 4, which describes the system operations, is based primarily on interviews with VTD staff.

Chapter 5 contains a description of VTD service levels, drawn from analysis of several data sources. The primary source of data on dial-a-ride and subscription services in 1973 and 1974 is FAIRTRAN^R records from the automated billing system. This data was provided by VTD on computer tape. From 1975 through 1977, the basic source of dial-a-ride and subscription data was the manual file of ride requests kept by VTD, and weekly summaries of ridership by several categories. A sample of the manual data was keypunched, and the entire 1973-1977 data base was analyzed by simple cross-classification and tabulation techniques. Little level-of-service data was available for either the fixed routes or contract services.

Chapter 6 discusses VTD's impacts on travel demand and mobility. While summary information can be drawn from FAIRTRAN^R records in 1973 and 1974 and successive manual data, this had to be supplemented by a series of three short surveys. All three surveys were conducted between February and April, 1977. The first survey was a home interview survey of target population users of VTD; a total of 83 individuals were interviewed. The second survey was an onboard survey of VTD subscription users; 80 users of a total estimated ridership of 110 responded. The third survey was a mailback survey of

VTD nonusers. Surveys were mailed to approximately 400 target group members, and 76 usable responses were received. About 900 surveys were mailed to the general population, and 133 responses were received. Approximately 100 completed surveys had been the desired number for each of the four survey categories, as one of the aims of the evaluation was to test the effectiveness of small sample techniques of analyzing travel demand. A final element of the data base for evaluating demand impacts was the "V-card" or registration file, which consisted of the registration forms containing socioeconomic data on persons wishing to use the dial-a-ride and subscription services. In addition to the analysis of overall system ridership data and the tabulation of survey responses, a set of models of travel demand were built to attempt to isolate the effects of key demographic elements and VTD service characteristics on ridership. These models are referred to as disaggregate demand models, and are described briefly in Appendix C.

Chapter 7 reviews the operating cost, operating ratio, and productivity of each VTD service throughout the demonstration. This analysis is based on VTD monthly operating statements, VTD monthly income statements, annual audit reports of VTD and LNVCC, and VTD monthly operating statistics. As many of these statistics are not kept separately for each VTD service, some analysis and allocation of costs was required to produce the final estimates reported.

Chapter 8 reports on the institutional issues that have emerged during the demonstration. This chapter is based on interviews with key officials in all the transportation agencies involved in the project, interviews with selected social service agency representatives, and a review of background documents describing the agencies and their functions.

Chapter 9 summarizes the conclusions reached through this evaluation; these were prepared by the evaluation contractor. They were reviewed at a meeting of VTD, LNVCC, VRPA and the State of Connecticut, as well as by the UMTA SMD Program and TSC, and were generally supported.

Appendix A is a set of annotated references prepared because of the number of other reports that have been written on the project. Many of the reports contain conflicting data and results, which this appendix attempts to put in perspective. Less of this report is based on these other sources than had been originally anticipated, and it has been necessary to go back to the original or source data in almost every case to prepare this report. Appendices B and C outline the survey results and briefly describe the models developed in Chapter 6.

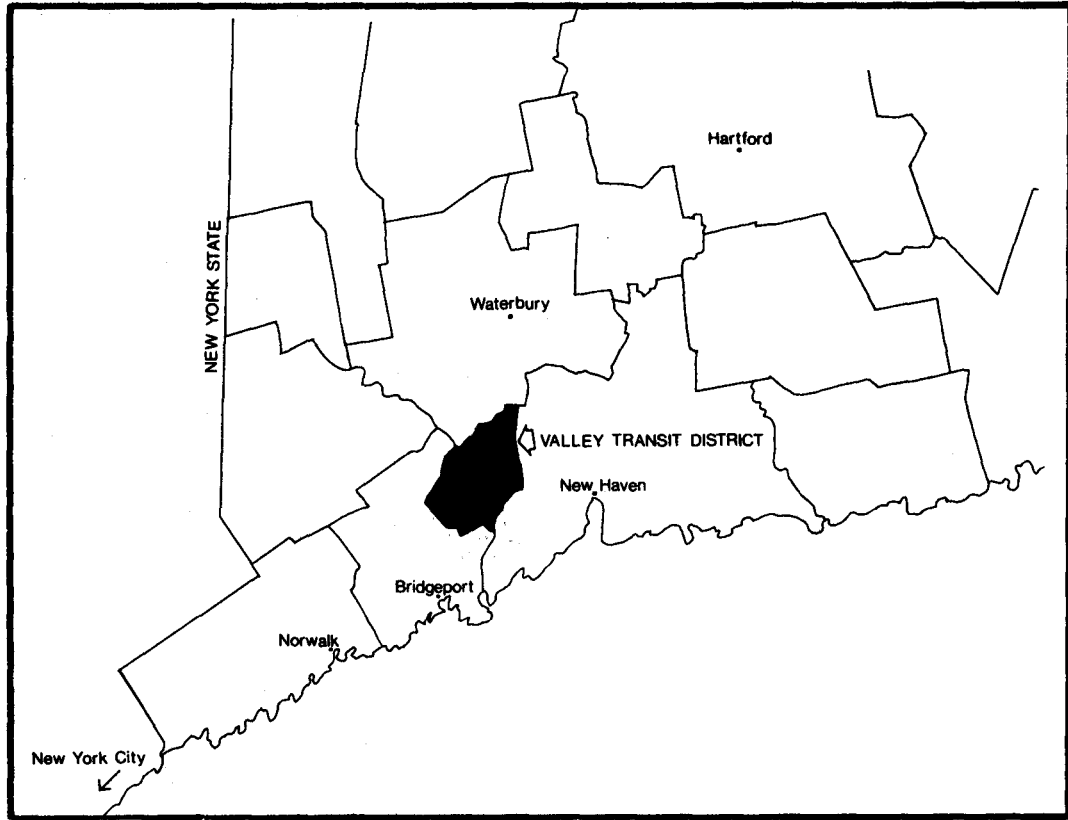
3. DEMONSTRATION SETTING

3.1 GEOGRAPHIC AND DEMOGRAPHIC CHARACTERISTICS OF THE VALLEY

3.1.1 General Population

The Lower Naugatuck Valley Region, or simply the Valley Region, is one of the economically and geographically semi-autonomous planning regions which were created by the State of Connecticut to replace county governmental planning units. Located in the southwestern part of the state, inland of and between Bridgeport and New Haven, the Valley consists of the four towns of Ansonia, Derby, Seymour, and Shelton. (See Figures 3-1 and 3-2.)

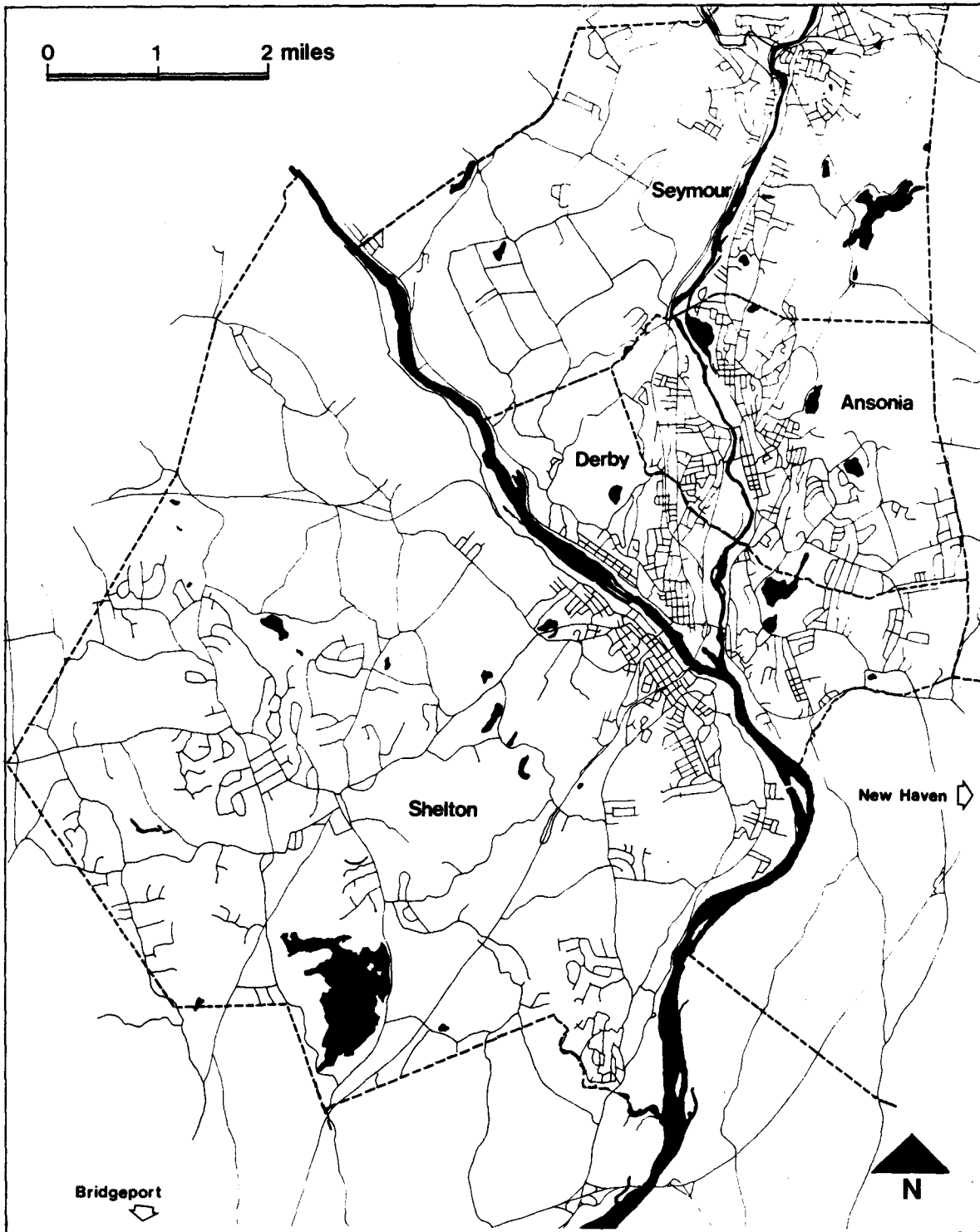
The topography of the region is extremely hilly, with large sections of each town located on very steep valley sides and hills. The region is located on the Naugatuck and Housatonic Rivers, both of which have served as sources of water power and spawned industries typical of many of the Connecticut River valleys. Lately, however, cutbacks in federal spending on defense, obsolete equipment, and other factors have caused decline among these industries. Today, the two major industries of the Valley are a non-ferrous metal works and a heavy machinery plant. The region is old in history and generally in appearance. Each of the four towns has a central business district, and each contains several structures typical of late nineteenth-century architecture.



Source: Reference 1

FIGURE 3-1

Location of Valley Transit District
in Southwestern Connecticut



Source: Reference 1

FIGURE 3 -2
Map of the Naugatuck Valley

Each town has its own characteristics. Ansonia is to a large extent the real core of the area in population and for many services. It has the highest percentage of poor and elderly, and its development is the most dense, with suburban development only in the eastern extreme. Its housing program is the most developed with three senior projects, one low-income project and a middle-income project. The northern end of Ansonia is the one identifiable poverty pocket in the area. With the Ansonia Mall, state offices, and a large branch of the non-ferrous metal plant, Ansonia is the focus for many Valley trips.

Derby, currently undergoing downtown renewal, is similar to Ansonia around its core, but is less developed at its eastern and western ends. The Griffin Hospital, the one hospital for the Valley and surrounding towns, is at the boundary of Derby and Ansonia.

Seymour is primarily suburban and rural, with a small core area. On its western edge is former farmland now being converted to suburbs.

Shelton is the largest town, but in its interior is not strongly attached to the rest of the Valley. Part of Fairfield County, its development and travel pattern are more typical of that suburban commuter area. Near the center of Shelton is the village of Huntington with its own small center and community life. Shelton's core on the Housatonic is, however, typical of the rest of the Valley.

The demographic characteristics of the Valley are shown in Table 3-1.

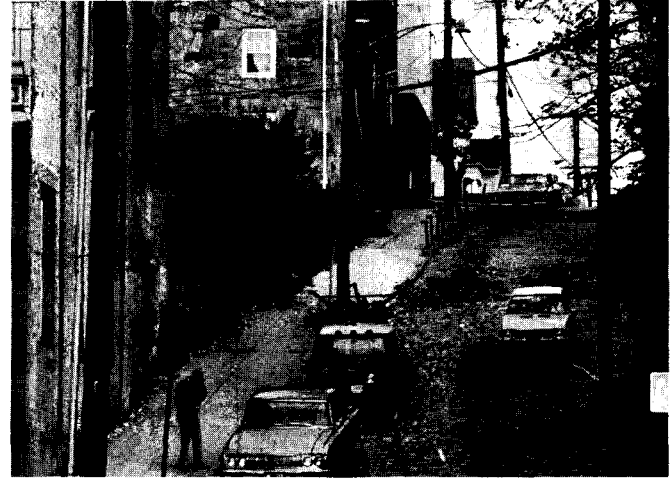
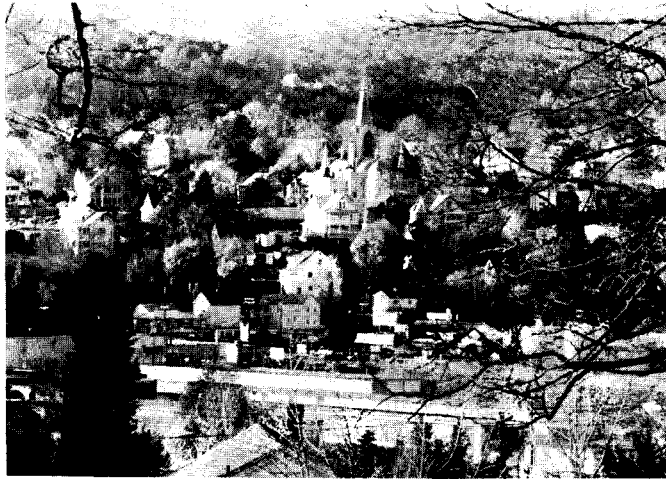


FIGURE 3-3

Typical Valley Land Use and Topography

TABLE 3-1

Socioeconomic Profile of Valley Transit District

	Ansonia	Derby	Seymour	Shelton	Valley	U.S.
Population ¹	20,500	11,800	13,400	29,300	75,000	-
% Change, 1970-74	-3.1	-6.3	+4.9	+7.9	+1.8	-
Area (mi ²)	6.2	5.3	14.7	30.9	56.4	-
Population Density (/mi ²)	3,300	2,200	900	1,000	1,300	-
Median Household Income (\$)	10,100	10,600	11,500	12,200	11,200	10,200 ²
% of Households with Autos	81	85	93	93	88	79
% of Population over 62	13.3	12.9	10.0	9.7	11.3	11.5
% of Households with Income:						
Under \$3,000	8.4	8.0	5.1	5.7	6.7	16.0 ²
Under \$5,000	16.7	11.1	10.4	10.9	13.1	26.0 ²
Minority Population:						
% Black	7.2	1.0	0.3	0.4	2.3	13.8 ²
% Spanish-speaking	-	-	-	1.6	0.6	-

All figures, except as noted, are drawn from data provided by the Valley Regional Planning Agency (VRPA), which are based on 1970 U.S. Census data.

¹ Connecticut State Health Department estimate, 1974.

² Urban

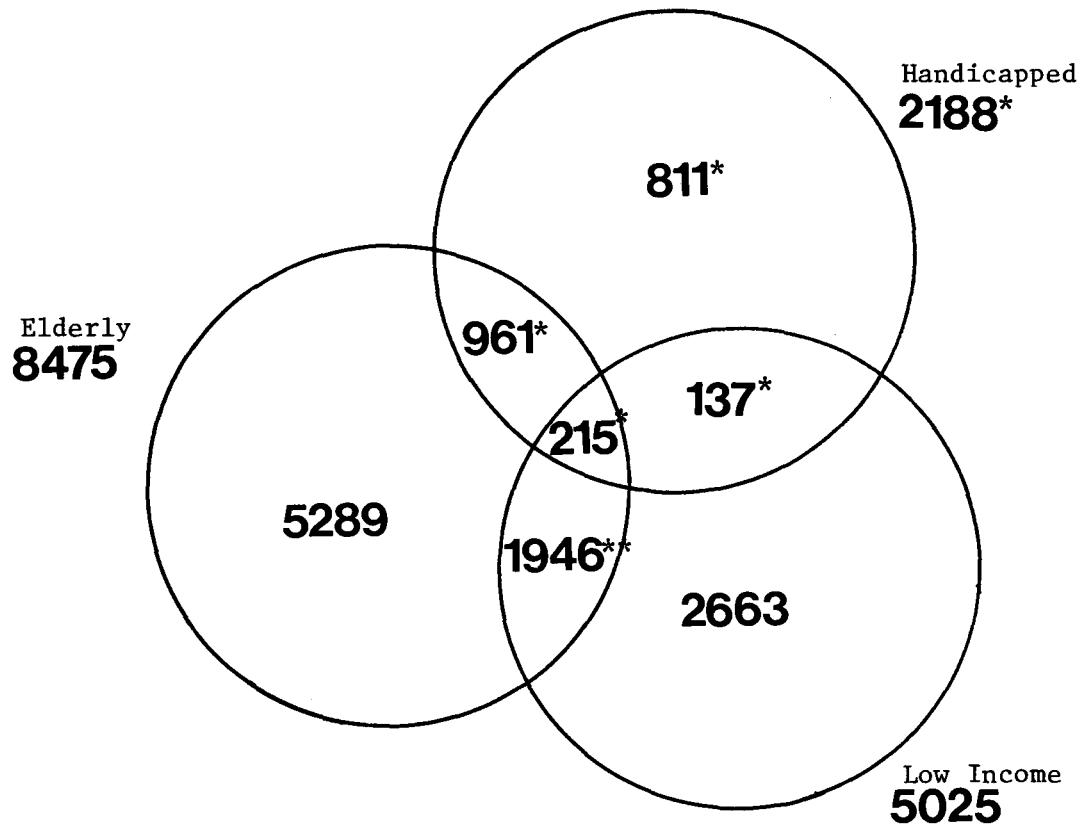
3.1.2 VTD Target Population

Figure 3-4 shows the composition of the VTD target population of approximately 12,000. Figures were obtained, where possible, from the 1970 U.S. Census for the Valley towns¹; most of the statistics relating to the incidence of mobility handicaps had to be derived from the National Health Survey (Reference 21) and must be regarded as approximate estimates for the Valley; finally, the surveys conducted for the evaluation were used to fill in remaining gaps in the data and to corroborate several of the national statistics. The Valley is seen to be near or above median urban U.S. statistics in income and auto ownership, but has a higher proportion of elderly in two towns and has a lower proportion of minorities.

The 12,000 disadvantaged individuals are one-sixth of the Valley population. Of this number, about 25 percent fall into two disadvantaged categories, and only 1 percent fall into all three. The definitions of these categories used to construct Figure 3.3 are:

- Elderly: Persons over 62 years old
- Low Income: Persons living in a family whose annual income is less than \$3,000
- Handicapped: Persons defined in the National Health Survey (Ref. 21) as responding to one of four chronic mobility limitation categories:
- Stays in bed - must stay in bed all or most of the time
- Stays in the house - must stay in the house, but not in bed, all or most of the time.

¹ Some statistics have been updated to 1975.



Total Target Population 12,000

Figures with no asterisk derived from 1970 Census.

*Derived from Reference 21.

**Derived from VTD user and nonuser surveys.

FIGURE 3-4

Valley Transit District Target Population

Needs help getting around - Able to go outside but needs the help of another person or of a special aid such as a cane or wheelchair in getting around

Has trouble getting around freely - Does not need the help of another person or a special aid but has trouble getting around freely.

VTD does not have formal or rigid definitions for its target groups; exact definitions have been chosen only to estimate the size of the target group. The definition of "elderly" varies from 55 to 60 among Valley senior centers, 60 for VTD user-side subsidies in general, and 65 for the Connecticut DOT; a value of 62 was chosen as representative of most of the criteria and to be as consistent as possible with previous VTD planning documents (References 1, 4, 5, 9, and others), which used age 65 as their definition. The functional definitions of "low-income" and "handicapped" have been that the individual or household is a client of a social service agency; no explicit income or mobility standard beyond that used by the social service agency is maintained by VTD. Note that there is no data available on the functionally handicapped in the Valley, as there is in some other SMD projects.¹ The primary VTD target groups to date have been the elderly and the handicapped, with the low-income group receiving less emphasis.

¹ See, for example, Crain and Associates, Incidence Rates and Travel Characteristics of the Transportation Handicapped in Portland, Oregon, April, 1977, report UMTA-OR-06-00004-77-1

3.2 TRANSPORTATION CHARACTERISTICS (Excluding VTD services)

The Valley is one of the many examples of an area which has witnessed a decline in the level of public transport. At the beginning of this century, the Valley, like the rest of coastal Connecticut, had a fairly extensive network of intra- and inter-urban electric railways. The last vestige of these railways, long since converted to buses, was a Connecticut Railway and Lighting Company bus route which ceased operation in the early 1970's.

The remaining local fixed route is operated by Connecticut Transit, which is now state-owned. This route connects Seymour, Ansonia, and Derby with New Haven. Headways are 30 minutes in the peak and 60 minutes in the offpeak, with service being provided from 6:00 am to 8:30 pm Monday through Saturday. The fare within the Valley is 35 cents, and the fare to New Haven is 80 cents.

Another fixed route, this one an intercity service between Waterbury and Bridgeport through the Valley, is operated by a private company, Valley Transportation, Inc. There are seven trips each way through the Valley on weekdays. From Seymour to Ansonia the route operates express over the Route 8 limited access road, and through Ansonia the route is on the west and away from the core. The route is, however, a link between the Derby and Shelton cores. Fares within the Valley are 25 and 35 cents. There are no transfer points between the two fixed routes.

There is also passenger train service between Waterbury and Bridgeport stopping at Ansonia, Derby, and Seymour. Operated by Conrail, a self-propelled rail diesel car makes four round-trips daily. The stops are adjacent to the Seymour, Ansonia, and Derby cores.

The Royal Cab taxi service based in Ansonia serves the entire Valley area. Its fare structure is:

50 cents for one or two persons in zone 1 (covering most of Ansonia)
75 cents for three or four persons in zone 1
25 cents per 1/2 mile or fraction thereof within 10 miles
Thereafter, livery rates of 40 cents per mile

There are currently three to five cabs in operation. The average taxi fare in 1976 was \$1.30. A final component of the public transportation system in the Valley is school bus operators, of which there are three: Blake's Bus Service in Ansonia, the Travelayne Bus Company in Seymour, and the County School Bus Service in Shelton. These carriers, as well as Valley Transportation, Inc., operate charter services that were utilized extensively by social service agencies prior to VTD.

The region is served by several primary highways. Route 8, the major north-south route, is an expressway for most of its length. Route 34, the major east-west route, is a four-lane divided highway with intersections from New Haven to Derby, and a two-lane road from Derby west. There is moderate traffic congestion, although travel speeds are generally quite low for intra-Valley trips on roads other than routes 8 and 34, due to difficult, hilly terrain and low-volume road design. Parking is available in all downtown cores in sufficient quantity at low rates or free; parking elsewhere is also plentiful and free.

Prior social service agency transportation before VTD was quite varied. The Valley senior centers provided service to and from the centers through school bus charters one or two days per week. VARCA had a fleet of station wagons and vans driven by staff members to transport its sheltered workshop clients. Other agencies would transport clients either in agency or staff members' autos, reimbursing staff for mileage expenses. There was no coordination among agencies, and considerable staff time was expended on client transportation. Reference 9 has an excellent summary, agency by agency, of previous transportation used. This issue is also addressed further in Chapter 8.

3.3 OVERVIEW OF INSTITUTIONAL SETTING: TRANSPORTATION AGENCIES

3.3.1 Valley Transit District

The Valley Transit District (VTD) was created by an act of the Connecticut Legislature in 1971. Its service area encompasses the four towns of Ansonia, Derby, Shelton, and Seymour. The District's original mandate was to administer an UMTA demonstration grant for a predominantly specialized transportation system in the Lower Naugatuck Valley for the elderly and handicapped; however, it was intended that the District would be able to continue on its own after the UMTA grant terminated. In addition, the District's powers are broader than the operation of the UMTA demonstration project. It has the power to operate and regulate motor bus service within its service area subject to the approval of the State Public Utilities Control Authority (PUCA) as long as private bus operators exist in the

Valley. However, the PUCA has not made any funds available to local transit districts for this purpose, so VTD has not assumed these regulatory powers. Also, VTD has the authority to acquire and regulate the property and franchises of any company operating a public passenger transportation service if this is deemed necessary to preserve mass transportation.

VTD is governed by a Board of Directors who are appointed for four-year terms by the legislative body of each municipality within the District. The Board members from each municipality are apportioned on the basis of population: each is entitled to one director, plus one additional director for each additional 10,000 residents. Of the ten directors on the VTD Board, there are three each from Ansonia and Shelton, and two each from Derby and Seymour. The directors must meet a minimum of four times per year, although they have been meeting monthly. The Board appoints the Executive Director who is responsible for the management and operation of the system.

VTD's financing authority includes the ability to issue bonds which must be approved by a referendum. VTD also had the prerogative to levy a 1 cent per gallon gas tax made possible by state regulations, but this authority was repealed for all Connecticut transit districts in July, 1975.

3.3.2 Valley Regional Planning Agency

The Valley Regional Planning Agency (VRPA) was created in 1966 by the municipal legislative bodies of Ansonia, Derby, Seymour and Shelton. VRPA's creation was made possible by state legislation which enabled municipalities to voluntarily form regional planning agencies in accordance with officially established geographic boundaries as designated by the State Office of Finance and Control. VRPA is the local Metropolitan Planning Organization (MPO) representative for the Tri-State Regional Planning Commission, the officially designated MPO and A-95 review agency. (The Tri-State Regional Planning Commission is headquartered in New York and serves as the MPO for portions of the states of New York, New Jersey, and Connecticut.)

VRPA has a nine-member governing Board which consists of two representatives from each of the four member municipalities except Shelton, which has three representatives. One representative is appointed by the town's chief elected official and confirmed by its legislative body, and the other representative is an appointee of the town's Planning Commission. Providing technical assistance to the VRPA Board is an executive director, a regional planner, a transportation planner, and a small support staff.

VRPA's primary responsibility has been the preparation of a development plan for the region. Their involvement in transportation planning and, to a slightly lesser extent, social and health planning activities has increased over the years.

VRPA provided technical assistance in the preparation of the original UMTA grant which led to the creation of VTD. During the spring and summer of 1974, VRPA undertook a review of the activities of VTD in order to make a recommendation on its future. At that time, VTD was without a director and VRPA staff members provided interim assistance in recruitment and liaison with state and federal agencies concerning grant activities. VRPA provides transportation planning and grant preparation assistance to VTD and is currently coordinating an UMTA (Section 9) planning study evaluating the services being provided by VTD. VRPA staff also provides support to the Valley Council of Governments.

VRPA does not have independent financing authority and is therefore dependent on federal and state allocations, which can vary from year to year, and on the voluntary contributions from its member jurisdictions. Although the municipal contribution is only a small part of VRPA's total budget (typically about 15 percent), it is the sole source of local money that VRPA has to match available federal and state grants.

There are several committees set up by VRPA to address various regional issues on which the four Valley towns and other local and state agencies are represented. One policy committee and one technical committee have been formed to address public transit issues.

3.3.3 The Valley Municipalities and the Council of Governments

The four Valley municipalities are Ansonia, Seymour, Shelton and Derby, each of which is served by their respective legislative bodies and a part-time mayor except for Seymour which has a first selectman. The towns work

cooperatively whenever possible and are united through the Valley Council of Governments which formally brings the chief elected officials of the four towns together. The COG Board is composed of the chief elected official from each of the four towns. The COG was formed in 1970 in accordance with state statutes and was intended primarily to provide the Valley region with a more effective voice with federal and state agencies. Although the VRPA had been serving this function previously, because the policy board of VRPA was not composed of elected officials, it was felt that their policy decisions had less impact than would a Board made up of elected officials. Because the Valley COG is small, they are generally able to achieve consensus on issues more easily than larger COG's, and when this occurs, their influence appears to be greater within the region and with federal and state agencies than was experienced by VRPA.

VRPA is essentially the backbone of the COG. The director of VRPA serves as the coordinator of the COG, and other VRPA staff provide support to the COG since it does not have any staff or operating funds of its own. The COG coordinator is responsible for handling all COG administrative functions and for informing the chief elected officials of new programs, grants and other activities which might be important to the region.

The COG discusses issues that are important to the region and it is primarily through this forum that the elected officials on occasion discuss the Valley Transit District. The COG, assisted by VRPA and local legislators, created and sponsored the state legislation which led to the creation of VTD. The COG made a contribution of \$40,000 to VTD when it was

first created; each town provided \$10,000. Also, the COG was involved in the spring of 1974 when VTD was experiencing a funding crisis; its role in this case is discussed in more detail in Section 4.1. In general, though, the COG has little involvement with ongoing VTD activities.

3.3.4 Connecticut Public Utilities Control Authority

The Public Utilities Control Authority (PUCA), formerly the Public Utilities Commission, is the state regulatory agency for most intrastate transportation carriers. The three notable exceptions are when PUCA authority is turned over to the local public transit district if desired by the district, for school bus companies under contract to municipalities, and state-owned transit companies (e.g., Connecticut Transit).

According to PUCA statutes, public transit districts are entitled to assume PUCA regulatory authority for all operations within their district. If they choose to do this, however, they must regulate all carriers of all of the industries which they choose to regulate. (If VTD assumes regulatory authority for bus operations, then it must regulate all bus carriers within the district that were formerly under PUCA jurisdiction. However, VTD would not also have to assume regulation of the taxicab industry, but if it did, it would have to regulate all taxi companies within the district.) The PUCA will not make any administration funds available to transit districts for this purpose and, as previously mentioned, VTD has not elected to assume this prerogative.

According to the VTD enabling legislation, no a priori PUCA certification is necessary for VTD intra-Valley operations and service to contiguous towns as long as an agreement has been negotiated with the contiguous town, even if the district chooses not to assume the PUCA regulatory functions. However, when private transit operators exist in the district, VTD's operations outside of its authorized service area are subject to PUCA approval.

VTD has appeared before the PUCA on several occasions either requesting special operating rights or responding to complaints by private operators. The first two appearances dealt with complaints that VTD was infringing on the taxi and charter rights of existing operators. However, aided by vigorous testimony from users, no PUCA action was taken. In June, 1973, as a result of a third complaint, VTD was enjoined from operating service outside the Valley, which resulted in the loss of subscription work and school trips to Bridgeport and New Haven. The PUCA's decision was conditioned on the premise that VTD did not have a contract with the contiguous municipalities outside of its service district as required by its charter.

Most recently, in April, 1977, VTD appeared before the PUCA to request extension of its operations outside of its service district. The private operators who were in opposition to a general extension of service had no objection, however, to an extension of service restricted to the transportation of elderly, handicapped, and wheelchair passengers in specially designed vehicles. This authority was granted to VTD by the PUCA.

3.3.5 Connecticut Department of Transportation

The Connecticut Department of Transportation (Conn. DOT) was formed in 1969, restructuring the former Connecticut Highway Department and including it in a new agency whose mandate was to address multimodal concerns.

In 1970, Conn. DOT first began providing limited support of public transit operations, largely in response to the enactment of state legislation which permitted the formation of public transit districts. State participation increased significantly in 1973 when it assumed the operations of one of the private carriers, the Connecticut Company, which served New Haven, Hartford, and Stamford and which carried approximately 85 percent of the state's bus riders. One of Connecticut Transit's (formerly the Connecticut Company) bus routes operates through the Valley. The route currently carries about 230 passengers per weekday in the Valley; VTD has diverted almost no trips from this service. The PUCA does not have any authority over Connecticut Transit since it is a state-owned system, and any modifications of this line through the Valley are decided upon by the state. Conn. DOT also subsidizes the Conrail rail passenger line that runs through the Valley; only 12 or 13 trips to or from the Valley are served by this line daily. Again, VTD has had no impact on this ridership.

Currently, the Bureau of Public Transportation in Conn. DOT operates with a FY78 budget for transit operations of \$25.6 million. Of this, \$10.9 million is allocated for bus operations and \$14.1 million for rail operations. The remaining funds are designated for studies.

As Conn DOT's involvement in providing subsidies to bus operators and transit districts increased, it was necessary for the agency to formulate a policy for distributing these subsidies. Accordingly, the services that are state-owned or were operational as of December, 1974, are considered to be the "basic level of service", and are fully subsidized by the state. VTD services do not fall into this category since they have expanded so much since December, 1974, that they are considered new services. They are subject to Conn. DOT's policy for all districts and operators not covered by the full subsidization policy, which states that 60 percent of operating expenses must be generated through fare box collections and the remaining 40 percent of operations will be covered by the state. In the event that 60 percent of operating expenses cannot be met through the fare box, the state covers 50 percent of the remaining deficit.¹

However, this subsidization policy appears to be subject to modification and in July, 1977, VTD negotiated a supplemental operating agreement with the state to cover 100 percent of VTD's operating deficit from July, 1976, through June, 1978, subject to a maximum state commitment of \$440,750. This supplemental agreement was conditioned upon the fact that VTD provided a valuable service for the elderly and handicapped and, as a result of the large proportion of specialized services provided by VTD, its deficit would be correspondingly larger.

¹ The state's funds include both UMTA Section 5 monies and the matching state contribution.

Conn. DOT maintains involvement in and awareness of the VTD's operations by its representation on the two transportation committees of the VRPA: the Transportation Coordinating Committee, which is a technical committee, and the Transportation Policy Committee. Conn. DOT is satisfied and supportive of VTD's operations on a general basis. It is not involved in VTD's detailed operations or specific local issues.

3.4 OVERVIEW OF INSTITUTIONAL SETTING: HEALTH AND SOCIAL SERVICE AGENCIES

3.4.1 Lower Naugatuck Valley Community Council

The Lower Naugatuck Valley Community Council (LNVCC) is a private, non-profit corporation, the purpose of which is to plan, coordinate and establish programs in the areas of health, social services and recreation in the five towns served by the Valley United Way (Ansonia, Derby, Seymour, Shelton, and Oxford, which is not included in the Valley Transit District). In addition, the Council was, through 1975, the designated component in the Valley for South Central Connecticut Comprehensive Health Planning, Inc. (SCCCHP), a federally funded area-wide health planning agency which is mandated to have a majority of consumer representation. In 1976, this role was transferred to the newly created Health Systems Agency of South Central Connecticut, Inc., under a broad reorganization of federal health planning programs. LNVCC advised in the creation of the new agency.

The Council was formed in March, 1970, as the result of meetings and discussions between SCCCHP, the Valley United Way, Griffin Hospital's

Department of Community Health, and committees of volunteers and representatives of the health and social service agencies.

The Community Council is composed of the four officers and fifteen members of the Board of Directors, many of whom represent the health and social service organizations in the Valley; this group is responsible for policy decisions. The staff consists of an Executive Director, several health planners, and administrative staff. Seventeen committees exist within the structure of LNVCC, and actively participate in various programs, and finally, 180 volunteers work through the Council.

The first three full years of operation saw the Council primarily involved in the field of health although it is currently expanding more and more into the area of social services. Early in the process of establishing priorities, it defined the three areas of emphasis, including public health, personal health, and environmental health. The Council was then involved in planning in each of these areas and in implementing the plans. This included helping to establish the Lower Naugatuck Valley District Public Health Department in the area of public health, the merger of the Valley's three home health care agencies for personal health, and the establishment of the Valley Transit District for the transportation of the ill, elderly and handicapped in environmental health. The Council has also been involved in numerous other projects, including the formation of a family planning organization, immunization programs for the elderly, Project MANNA (which delivers hot meals to seniors at senior centers), a

community service facility, drug planning, elderly planning, a youth services project, employment programs for the elderly and unemployed, and the formation of a mental health consortium.

3.4.2 Valley Senior Centers

The senior centers of the four Valley towns provide social and recreational activities, transportation to shopping, and meals which are served at the centers through Project MANNA. Weekly attendance is approximately 750 at Ansonia, 900 at Derby, 270 at Seymour and 500 at Shelton. Senior centers receive most of their funding from their respective towns, with additional transportation funding provided through HEW Older Americans Act Title III and Title IV grants which ended June 30, 1978.

Senior centers have traditionally provided transportation service to their clients on a regular basis (e.g., one shopping trip per week, two trips to the center per week), and on an irregular basis (e.g., special events at the center and at other locations). Before VTD existed, senior centers provided transportation to their clients by contracting with local school bus operators; VTD now provides most of this service to the centers. Weekly ridership on VTD by senior center clients is approximately 125 at Ansonia, 135 at Derby, 90 at Seymour and 250 at Shelton.

3.4.3 Valley Association for Retarded Children and Adults

VARCA (Valley Association for Retarded Children and Adults) seeks to teach their clients to lead more independent lives. Almost 100 people per day attend the sheltered workshops at VARCA; 95 percent of them are transported by VTD. VTD is felt to be an absolute necessity for VARCA's clients in that it provides them with the mobility necessary to lead more independent lives. All VARCA's clients are aware of VTD operations and some use VTD on individually scheduled trips as well as on those sponsored by the agency.

Prior to VTD, VARCA transported its clients in its own vehicles with staff as drivers. Since VTD began operations, VARCA has reduced its own transportation to a single vehicle to pick up people in outlying areas, and is pleased to be out of the transportation area.

An addition to VARCA is scheduled to open in April, 1978, which will increase the number of clients to about 150. The existence of VTD played an important part in the decision to expand, as expansion of VARCA's activities hinges to a large degree on the availability of transportation. Without VTD, people would be dependent on family, friends, or VARCA personnel for transportation. Because the ability to travel independently is an important part of the total learning experience at VARCA, VARCA feels it essential that a public transportation system such as VTD exist.

3.4.4 Valley Health Agencies

Several Valley health programs rely heavily on VTD for their clients, and in the case of the Homemakers, for their staff. Hewitt Hospital (a nonprofit convalescent facility) operates a day-care center (funded by Project Life) for twelve elderly persons, half of whom rely on VTD for daily transportation. Griffin Hospital (the Valley's only major medical facility and general hospital) runs a geriatric clinic for about 60 clients, 15 percent of whom use VTD. TEAM (the local anti-poverty agency) provides 100 meals per day to elderly shut-ins (Meals on Wheels) and 200 meals per day for the elderly at eight centralized sites (Project MANNA). Specially equipped meal delivery trucks are owned by TEAM, but are housed, maintained, driven and dispatched by VTD staff. The Homemakers and Public Health Nurses provide home aid, nursing and referral services to approximately 100 Valley elderly per month. Half the Homemakers use VTD on a daily basis and would not be able to work without it; their clients are also encouraged to use VTD. Project Life at the South Central Connecticut Area Agency on Aging (SCCAAA) offers support services to elderly in danger of institutionalization; about 5 percent of its clients regularly schedule rides on an individual basis with VTD.

Finally, the Valley Health Department provides an outreach program to the elderly through a nurse practitioner who does a preliminary assessment and referral. About 400 people are served by this program, about 40 percent of whom travel on VTD. All of these agencies, and others, have had specific

interactions with VTD in arranging or modifying services, user-side subsidies, and coordination with other agencies and funding sources. Chapter 8 describes the role all Valley social and health service agencies have played in defining the VTD system.

4. DEMONSTRATION DEVELOPMENT AND OPERATIONS

4.1 PROJECT HISTORY AND STATUS

Limited public transportation was available to the residents of the Lower Naugatuck Valley before the Valley Transit District. A single fixed route through the Valley is operated by Connecticut Transit (now state-owned) and another by the Valley Transportation Company. The Valley also has a taxi service operating primarily between the business districts of Ansonia, Derby and Shelton. Neither the taxi service nor the bus companies provide specific service to health and social agencies.

Initiation of the Valley Transit District dates back to the late 1960's when several agencies under the United Fund of the Lower Naugatuck Valley submitted a proposal for the funding of a transportation program for the disabled and disadvantaged. In 1971 UMTA agreed to fund the Valley Transit District, which was created by a special act of the Connecticut State Legislature in the same year. VTD was created specifically for the administration of the UMTA demonstration project, but its powers and scope went beyond the demonstration, as its current post-demonstration status shows.

The VTD demonstration project can be characterized by three phases: Phase 1 (December, 1972 - March, 1973), Phase 2 (April, 1973 - June, 1974), and Phase 3 (July, 1974 - June, 1977).

Phase 1 - December, 1972 - March, 1973

Initiation of service slipped from June, 1972, to December, 1972, due to late delivery of the vehicles. Service was inaugurated in

December, 1972, upon the arrival of the first four 21-passenger buses (equipped with a low, retractable hydraulic front step). The inaugural service consisted of a free Christmas shopping shuttle under the sponsorship of the Valley Chamber of Commerce. Starting in January, 1973, VTD operated a fixed-route service, using all six of its original vehicles, filling a gap in service created by a strike of the Connecticut Company (now Connecticut Transit) route in the Valley which extended through the duration of Phase 1. This service was made available to all Valley residents, but the fixed route was dropped when the strike ended in March, 1973. Contract services through social service agencies for the elderly and handicapped also began in January, 1973. Although the dial-a-ride was not yet in operation, registration and the issuance of V-cards began during Phase 1. Registration for the demand-responsive service was open to all Valley citizens.

Phase 2 - April, 1973 - June, 1974

Phase 2 marked the beginning of the dial-a-ride service and the use of the FAIRTRAN^R billing system. Due to demands for service that outstripped available capacity, the Valley was divided into five subareas, each being served only once a week by the dial-a-ride service. The residents in each subarea, however, could travel throughout the Valley on the days that they used the service. Contract services and emergency medical trips were not limited by the subarea policy. Subscription services were also initiated in April, 1973, operating daily in all subareas.

In July, 1973, due to the rapid growth in demand for the dial-a-ride services, VTD decided to limit further issuance of V-cards to only

the handicapped and elderly citizens. By mid-February, 1974, the demand services were again saturated, and VTD decided to discontinue further issuance of V-cards.

The reasons for the quick saturation of the dial-a-ride service capacity were the extensive use of the buses for contract services (which consumed over 50 percent of the total vehicle hours and generated two-thirds of the system revenue) and extensive equipment failures.

The Valley Transit District, in the spring of 1974, applied for two further grants from UMTA. The first was a capital grant for the purchase of nine additional buses, and the creation of a storage and maintenance facility for the buses. The second grant application was for continuation of the demonstration grant for another three years. In addition, the Valley Transit District entered into a contract with the State of Connecticut for reimbursement of 50 percent of all operating deficits for a period of one year.

However, as a prerequisite for the UMTA grants, the Transit District was informed that it would have to show evidence of local financial involvement in the project, and furthermore, show that it was operational as of the first of July. Because of high maintenance and repair costs for the vehicles and extremely high out-of-service time for the vehicles which resulted in reduced revenues the initial demonstration project, which was designed to run through June, 1974, had exhausted its funds by the end of March, 1974. In order to operate for the interim period and show local financial involvement, VTD first

requested funds from the four municipalities. This request was turned down by all the municipalities. Then VTD chose to exercise its statutory authority to levy a tax of 1¢ per gallon on the sale of all gasoline in the four Valley municipalities; however, VTD would accept grants of 50¢ per capita from each town in lieu of imposing the tax. All four towns voted the grants for VTD; the gasoline tax was not imposed and the Federal grants were approved.

Phase 3 - July, 1974 - June, 1977

The summer and fall of 1974 saw large changes in the VTD operation. At one point during the summer, only two of the original six vehicles were operable, causing extremely unreliable and limited service. The Executive Director and all but one of the members of the VTD Board of Directors resigned, and were replaced by new members. An intensive program to ensure vehicle availability and service reliability was begun by the new Executive Director. School buses, vans, and autos were leased to bridge the equipment gap. All subareas in the Valley received daily dial-a-ride service again once the vehicle fleet permitted in summer, 1974.

Due to increasing problems with the on-board service recorders and the use of leased vehicles not equipped with service recorders, the use of FAIRTRAN^R billing system was discontinued in June, 1975. Monthly billing of users and sponsoring agencies and user-side subsidies continued. There was no change in the system to users except that they no longer needed to carry their credit card; they gave their credit card

number when calling for service. However, all accounting and bill preparation was done manually.

Eight new vehicles were received in October, 1975. In November, 1975, the fixed route services in and between the four towns were begun. Contract, dial-a-ride and subscription services were continued without interruption and were expanded as equipment was acquired. Equipment reliability increased, and the system operated without leased vehicles and provided a reliable service level for the first time in its history in late 1975.

Three more vehicles were acquired in August, 1976, when the last of the original six vehicles were retired, having seen little use for the preceding two years. Services for school children were provided for the first time on a large scale in September, 1976, and there was further expansion of subscription services. A minicomputer was acquired in early 1977, and billing became computerized again in August, 1977, although without the use of on-board service recorders.

Demonstration status ended in June, 1977, with demonstration funding having been progressively phased out during the preceding two years. The user-side subsidy program ended in August, 1977, when funds available to the program were exhausted, except for some carryover funds for senior centers. Operations are continuing in a very similar manner to operations under demonstration status, aided by a new subsidy agreement with the State of Connecticut that essentially covers VTD's entire deficit. Some cutbacks in contract services are anticipated due to a lack of funds, and fixed route services were already cut back in February, 1977, due to their poor performance. VTD will continue to offer its mix of contract,

dial-a-ride, subscription, and limited fixed route services as in the past.

4.2 SUMMARY OF FUNDING

The Valley Transit District has been supported by a wide variety of funding sources at the local, state, and Federal levels, as outlined in Table 4-1. The expenditure of these grants is also shown, broken into four categories. "VTD operating" grant allocations are used to cover vehicle, driver, administrative, and other operating costs. "VTD capital" funds are used for vehicle, farebox, computer, and other capital equipment purchases. "User subsidies" indicate funds allocated to support agency and individual use of VTD through fare subsidization; VTD does not have control over these funds, which are administered by LNVCC. "Consultant" indicates funds used for outside assistance, and "Other" includes items such as report printing, and staff time of agencies other than VTD.

UMTA demonstration funding has supported VTD for six years, and was the grant that began VTD's existence. The original grant ran for three years and was extended with additional funding for a further three-year period. This grant supported all VTD development costs, all initial capital costs, and a major portion of VTD's operating deficit in its first two years. An UMTA capital grant for 14 new vehicles was also approved in 1974. Eight new vehicles were bought in 1975, three in 1976, and additional vehicles are being purchased in 1978 to complete expenditure of this grant. Finally, a \$750,000 capital grant

TABLE 4-1

Summary of VTD Funding

<u>Source</u>	<u>Year(s)</u>	<u>VTD Operating</u>	<u>VTD Capital</u>	<u>User Subsidies</u>	<u>Consultant</u>	<u>Other</u>	<u>Total</u>
a) <u>Grantee: VTD</u> UMTA (Demonstration)	FY 1972-74	\$ 55,800	337,950	0	296,000	3,000	692,750 ¹⁾
UMTA (Demonstration)	FY 1975-77	184,250	206,250	0	100,000	4,000	494,500
UMTA (Capital)	FY 1974	0	376,640	0	0	0	376,640 ²⁾
Towns of Ansonia, Derby Seymour & Shelton	FY 1974	37,750	0	0	0	0	37,750
State of Connecticut	FY 1975	69,281	0	0	0	0	69,281 ³⁾
State of Connecticut	FY 1976	115,854	0	0	0	0	115,854 ³⁾
State of Connecticut	FY 1977	170,646	0	0	0	0	170,646 ³⁾
b) <u>Grantee: LNVCC</u> HEW, Older Americans Act, Title IV	FY 1973	0	0	29,476	77,939	33,426	140,841 ⁴⁾
HEW, Older Americans Act, Title IV	FY 1974	0	0	34,330	58,983	77,259	170,572 ⁴⁾
HEW, Older Americans Act, Title IV	FY 1975	0	0	48,604	46,157	74,162	168,923 ⁴⁾
HEW, Older Americans Act, Title IV	FY 1976	0	0	76,454	66,942	91,928	235,324 ⁴⁾
HEW, Older Americans Act, Title III	FY 1976	0	0	8,454	0	5,327	13,781
HEW, Older Americans Act, Title III	FY 1977	0	0	15,581	0	1,898	17,479
TOTAL	-	633,581	920,840	212,899	646,021	291,000	2,704,341

TABLE 4-1 (cont.)

1) Includes matching shares as follows:	
Towns of Ansonia, Derby, Seymour, and Shelton	\$ 40,000
State of Connecticut	24,667
Griffin Hospital (Derby)	3,033
Grant expenditure by year:	
FY 1972	\$451,700
FY 1973	117,100
FY 1974	123,950
2) Includes matching share of \$75,328 from State of Connecticut	
3) Includes UMTA Section 5 funds administered by State of Connecticut, as follows:	
FY 1975	\$32,140
FY 1976	57,965
FY 1977	84,100
4) Includes in-kind contributions from LNVCC as follows:	
FY 1973	\$ 12,049
FY 1974	46,030
FY 1975	50,930
FY 1976	151,149

SOURCE: Grant requests, annual statements, audit reports, and other records supplied by VTD, Connecticut DOT, UMTA, and LNVCC.

application is still pending before UMTA to finance construction of new garage, administration, and multimodal passenger facilities for VTD; this is not included in Table 4-1. The breakdowns of the UMTA demonstration grant shown in the table are based on budgeted amounts instead of actual amounts expended; however, the differences are relatively small. All other breakdowns shown are based on actual expenditures.

The contributions from the Valley municipalities were required by UMTA as a condition of extending the demonstration in 1974 and are a one-time grant which covered excess VTD operating costs.

The State of Connecticut began funding VTD deficits in fiscal year 1975 under its basic funding policy for Connecticut transit districts. The state paid 40 percent of the total operating cost, plus 50 percent of any remaining deficit. Thus, a transit district would have to maintain an operating ratio (revenue-to-cost ratio) of 60 percent to receive full state funding of its deficit; only dollar-for-dollar matching funds are available after that amount. This state policy was applied to VTD in 1975 and 1976, but different agreements were in effect in other transit districts, with some receiving 100 percent deficit funding regardless of operating ratio. In 1977, VTD was able to renegotiate its subsidy arrangement with the state. Subject to certain limits, the state now covers 100 percent of VTD's total operating expenses. The policy will be renegotiated again in 1978.

The HEW grants which complete Table 4-1 are administered by LNVCC, not VTD. They provide funding for VTD only through user-side subsidies which help users and agencies pay VTD fares. A relatively small share

of these grants has been used for user-side subsidies, with the remainder being used for consultants and staff salaries. These funds were provided through HEW demonstration programs, which had a broader set of goals than merely providing user-side subsidy funds for VTD services.

Total funding from all sources exceeds \$2,700,000. VTD and LNVCC have had moderate success in coordinating a wide variety of funding sources during the project, one of its objectives. However, little continuing HEW or other social service funding has been obtained, and the user-side subsidy program ended in August, 1977, with only minor funding for senior centers available through June, 1978. Thus, the major source of continuing funding is the State of Connecticut operating assistance program.

4.3 CAPITAL COSTS

All VTD capital costs have been funded by the three UMTA grants listed in Table 4-1. The breakdown of the capital expenses is:

Demonstration Grants:

6	1972 21-passenger Twin Coach vehicles	\$289,000
	Credit card system	53,950
	Central fare/billing equipment	130,000
	Fare collection and dispatching equipment	71,250

Capital Grant:

8	1975 21-passenger Grumman vehicles	170,400
3	1976 13-passenger Grumman vehicles	41,250
2	1975 6-passenger sedans	8,400
2	1975 9-passenger International vehicles	12,400
10	mobile radios and 1 portable radio (including base equipment and installation)	19,500

The six original vehicles have been retired, and large portions of the

original fare/billing/dispatching systems are no longer used. All equipment purchased by the capital grant is still in operation, although VTD is contemplating replacement of its eight 21-passenger vehicles.

The original vehicles had capital costs of approximately \$1.00 per mile associated with them; the new vehicles, with lower purchase cost and a longer expected life, should have capital costs between 10 and 25 cents per vehicle-mile.

4.4 ORGANIZATION AND STAFF

The Valley Transit District is managed by an Executive Director, together with an Assistant Executive Director and support staff.

The Executive Director fills many roles in the organization in addition to his overall management of the system. His roles include:

- service planning for all VTD services, including the preparation of detailed vehicle tours and schedules for contract, subscription, and fixed-route services, and general service guidelines for the dial-a-ride service;
- marketing VTD services to the general public and agencies (e.g. public schools) which are not current users of the system;
- supervision at a relatively detailed level of all vehicle purchase, maintenance, rebuilding, and repair decisions, which have been a critical element for VTD for nearly its entire operational history; and
- liaison with state regulatory and licensing agencies, dealing with vehicle inspection, registration and fees, operating rights, and

reporting requirements.

The Assistant Executive Director also fulfills many roles. He currently holds two other titles as well, which indicate the scope of his position: Operations Manager and Transportation Coordinator. His activities include:

- as Operations Manager, driver and vehicle assignments to services, both in a long-run sense and to deal with immediate problems as they arise; typically half the Operation Manager's time is spent in the dispatch room;

- liaison and service modifications for social service agencies and clients to respond to day-to-day needs;

- general supervision of drivers and dispatchers; also serving as the substitute dispatcher when the two regular dispatchers are not available;

- general supervision of data collection and reports on VTD operations and usage; and

- as Transportation Coordinator, attendance at numerous meetings at social service agencies to develop funding for VTD services, and a general contact for agency cooperation in services.

There are two basically full-time bookkeeping positions at VTD: one primarily involves maintaining VTD accounts and agency billing, and includes secretarial duties as well; the other position is required solely for preparing monthly billing for users. As start-up effort with the minicomputer system decreases, this position may become part-time.

Two dispatchers are required by VTD to cover its 60 hours of weekly

operation. One dispatcher is on duty at all times, except for a brief overlap period when the second dispatcher comes on duty. Three full-time mechanics have been required to keep the fleet of 11 buses operational; this may decrease as more reliable vehicles are obtained and the older vehicles are phased out.

There are approximately 15 drivers required to cover all VTD services; they work varying numbers of hours weekly. All VTD employees are non-union, and thus there are no restrictions on split shifts or other work rules. The staff is rounded out by a janitor and bus-cleaner (hired from the VARCA sheltered workshop, a major VTD user) and the hiring of part-time temporary employees to handle special needs.

4.5 FACILITIES

VTD offices are currently housed in a leased factory building. A mobile home serves as the office for the Executive Director and the two bookkeepers. A small dispatch room exists in the building itself, where the Assistant Executive Director, dispatchers, and the minicomputer are housed. The remainder of the building is used as garage and maintenance space for the buses. These are temporary quarters until a new building is constructed as part of the multimodal transportation terminal; however, they are a significant improvement over VTD's early quarters, which did not even have a covered area for bus maintenance, which led to many operational problems.

4.6 OVERVIEW OF SERVICES AND OPERATIONS

4.6.1. Integration of Services

Figure 4-1 shows an overview of the mix of services operated by VTD on a typical day. This table shows 102.5 service hours, slightly less than the VTD daily average of approximately 115 daily service hours, broken down by the following service types:

Contract	19.5 hours
Fixed Route	9.5
Subscription	31.0
Subscription and dial-a-ride jointly	26.0
Dial-a-ride	16.5

(The blocks marked D/F are classified as dial-a-ride hours, as the intra-town fixed routes scheduled to be operated at these hours ran only on demand. This is discussed further in section 4.10.)

The following sections discuss the operational details of each VTD service in turn, but it is important to note, as Figure 4-1 shows, that all these services are managed and dispatched jointly. Any vehicle and driver may provide any VTD service; see, for example, run 14 on Figure 4-1.

The number of vehicle-hours assigned to door-to-door service is determined through consideration of several elements including demand, costs, vehicle availability, necessity of trips, and overall VTD financial constraints. The simplest characterization of this decision process is that VTD assigns the minimum number of vehicle hours possible to dial-a-ride service, consistent with meeting the needs of the target population, particularly for medical trips. Almost all dial-a-ride service

FIGURE 4-1

Typical VTD Operation Summary, January, 1977

4-15

Run: Hour:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
6 a.m.			S								S	S		S		
7		S	S	S/D		S		S		S	S	S		S	S	
8		S	S	S/D		C	S	S	S	S	S	S/D		S	S	
9		C	D	S/D		S					C	C	C	S	C	
10	D/F		S/D	S/D					C	S/D	C	C	F	D/F		
11	D			S/D					F				F	D		
12 n.	D/F		S/D	S/D	F				C				D		D/F	
1 p.m.	D			S/D	D				D/F	S/D			C	C	C	S
2	D/F		S/D	D	D/F	D		D	F	S/D				F	F	S/D
3	S/D			S/D	C	S		S/D	S/D	S/D	S/D			C		S
4	S		S/D		C	C		C	C	C	S/D			F		S/D
5	C		S/D			S		S		S				F		S/D

C - Contract, D - Dial-a-ride, F - Fixed Route, S - Subscription

SOURCE: VTD dispatch board was recorded on one sample day (see Figure 4-2).

is provided in the offpeak and user trips are shifted from peak to off-peak periods whenever possible. Dial-a-ride service has been expanded, however, to handle even some nonessential trips as VTD vehicle availability and financial constraints allow to benefit the target population.

The maximum number of hours possible is assigned to contract service, as this is the most productive of VTD's services, maintains the highest operating ratio, and most directly serves the target population. Subscription service is provided in order to improve VTD's overall operating ratio, and fixed route service is operated only in very limited amounts, as it has not been an effective service mode to date. These issues are discussed in more detail in the following sections dealing with each service type.

4.6.2 Dispatching

While two fairly elaborate dispatching systems were designed by consultants for VTD at the inception of the project, neither were suitable for VTD operations. These two are described in reference 1 (pages 101-126), along with the reasons for failure. The system actually used by VTD since early 1973 until the present was developed by its dispatchers and is a modification of a conventional taxi dispatching system.

Figure 4-2 shows the dispatch board, the key element of the system. For each hour of the day, each bus has a slot to hold dial-a-ride, fixed route, and subscription assignments are determined at the beginning of the day (they in fact change little from day to day) while dial-a-ride

FIGURE 4-2

VTD Dispatch Board



trips are dispatched throughout the day on two-hour notice. Since there are a large number of subscription rides, many door-to-door bus tours, especially at peak times, are already fairly well defined at the beginning of a day. As dial-a-ride requests come in, the dispatcher scans the already allocated ride slips to see where a new ride might fit. Rides in the future are put in a "hold" slot for later assignment. The system is flexible and requires no writing other than the usual filling out of the dial-a-ride request; however, it depends heavily on the dispatcher's memory and ability to visualize feasible tours.

There are several elements in the VTD system that simplify the dispatcher's job. One has already been mentioned, namely, the relatively large number of subscription rides defines many vehicle tours. A second element that structures (and restricts) possible vehicle tours may be observed in Figure 4-1: almost all vehicles operate several VTD services over the day. Door-to-door service is interspersed with contract, fixed route, and subscription services, which puts temporal and spatial restrictions on the door-to-door trips each vehicle handles. While the primary purpose of this mixing of services is to minimize drivers, vehicles, and deadheading, it additionally eases the job of the dispatcher by reducing the number of combinations he needs to consider.

A third element is that dial-a-ride pickup times are stated only as on the hour, or 15, 30, or 45 minutes after the hour. Thus, there is typically a 15-minute window (7.5 minutes before or 7.5 minutes after the promised time) allowed for pickup. In 15 minutes, a vehicle can travel several miles; thus, successive pickups can be quite far apart,

and a vehicle can still hold its schedule. In general, if one defines the ratio of the pickup time "window" to the time required to traverse the service area as a measure of dispatch precision, VTD is not a "sharp" system.

A fourth and final aid to the dispatcher is that vehicle load factors for vehicle tours handling primarily door-to-door trips are quite low, rarely exceeding three passengers per vehicle.

However, there are tradeoffs in the design of any dispatching system, and two very positive elements of the VTD system emerge. First, almost no trip requests are ever refused, because the dispatcher has sufficient flexibility to insert trips into tours due to the imprecision of the promised pickup times. Second, these operating practices allow a single dispatcher to control the entire VTD system without undue strain under normal conditions, and to respond to problems if they do arise without disrupting the entire system.

Drivers enter the dispatching room before departing the garage with their vehicle, and transcribe all ride requests currently assigned them onto the driver log form shown in Figure 4-3. As further ride requests are assigned to the vehicle, the dispatcher radios them to the driver, who adds them to the log.

4.6.3 Relationship with Broker

During the entire demonstration, the Lower Naugatuck Valley Community Council (LNVCC), a nonprofit corporation responsible for social service planning in the Valley, has acted as a "broker" of VTD services,

FIGURE 4-3

VTD Door-to-Door Service Log

bus no. _____ time end _____ miles end _____
driver _____ time start _____ miles start _____
date _____ time out _____ total miles _____
remarks _____

Seq.	End	Time	Location & Notes	Zone

SOURCE: VTD

assisting agencies in obtaining VTD services for their clients and activities, and in resolving service problems. In addition, LNVCC has played a role of coordinating and pooling the transportation components of many HEW programs to fund the VTD user-side subsidies. One of the large institutional hurdles that was partially overcome by LNVCC was to arrange for various HEW programs to fund a share of VTD for services to its clients rather than to purchase vehicles for the separate use of each program's target group. LNVCC sees its role in VTD diminishing now that the system has achieved operational status.

The broker role that LNVCC plays is a limited one in that it only deals with VTD to provide transportation services; LNVCC does not select from alternative providers of service. This arrangement was chosen in the Valley for two key reasons. First, this approach offers the maximum potential to coordinate services, a major goal of the demonstration, and second, it was felt to be more beneficial to the target population to utilize and support VTD's special vehicles and range of services even though other providers could have been chosen to provide certain services on a strict lowest-cost basis. Thus, LNVCC's brokerage role is an indirect one, with its major influence being on the types of service VTD operates rather than on the selection of the service provider. LNVCC achieves its influence through its control and allocation of user-side subsidy funds.

4.7 VEHICLE FLEET

VTD began operations in early 1973 with a six-vehicle fleet consisting of five 21-passenger buses and one 16-passenger/3-wheelchair bus.

The vehicles were manufactured by Highway Products, Inc., and the model was designated the Twin Coach (or TC) 25. These buses were designed to specifications developed by a consultant to VTD, and included air conditioning, a retractable bottom step seven inches from the ground, bucket seats, and a luxury interior. Vehicle design was felt to be critical in attracting elderly riders accustomed to the barriers present in conventional transit buses.

However, more critical factors in vehicle design overshadowed these considerations. These vehicles proved to be extremely unreliable, with many problems occurring with the engines, transmissions, brakes, air conditioning, tire wear, and general maintainability. It was rare for more than four vehicles to be operable at any one time, and often there were only two vehicles available. To further compound the problem, one of the 21-passenger buses was destroyed by an engine compartment fire in February, 1974.

Original plans called for maintenance of vehicles and garaging services to be supplied by a local school bus operator. However, it soon became apparent, because of a variety of factors, such as different operating hours, priority for the established school bus operations, personality clashes, and conflicts of interest on charter operations, that this was not a satisfactory solution. VTD moved its vehicles to a parking area in the Shelton town garage in 1973, and began maintenance with its own personnel in April, 1973. The high utilization of the vehicles required that routine servicing be done in the evenings. With only the open lot available, and no satisfactory equipment or work area,

this arrangement was also unsatisfactory as a long-term solution. Facilities were finally located in Derby, and the vehicles were then stored and serviced under cover from September, 1973. Thus, for the winter months of 1972, with temperatures at 0 degrees Fahrenheit, the vehicles were parked in the open, and operated with minimum maintenance, at a site remote from the VTD administration and management offices. The effect on expected vehicle life of the arduous initial operations, and lack of initial preventive maintenance is impossible to separate from other vehicle design issues, but is believed to be substantial.

By summer, 1974, the vehicle shortage was so acute that VTD began to lease school buses, vans, and autos to provide service, abandoning the exclusive use of its specially designed vehicles. An UMTA capital grant was approved in 1974 to purchase nine new vehicles to continue the service. Only eight buses were actually purchased which went into service in October, 1975, when the original Twin Coach vehicles were also retired from day-to-day operations. The Twin Coaches were officially retired in August, 1977.

The new purchase consisted of six 21-passenger buses and two 12-passenger/2-wheelchair buses; they were built by Grumman. Design features include air conditioning, extra wide (50 inch) doors, a fixed bottom step 11 inches from the road surface, and a music/public address system. While these vehicles have proved more satisfactory than the earlier buses, they still incur high maintenance costs and are frequently out of service.

VTD also purchased two 9-passenger International Travelall station

wagons with four-wheel drive, and two Rambler Matador automobiles in 1975 for use in severe weather for essential trips, to serve some handicapped user trips, and to serve dial-a-ride trips when tours have low occupancy. The 12 new vehicles acquired in 1975 allowed VTD to provide reliable service for the first time in its history and to expand its existing services and inaugurate fixed route services.

In August, 1977, VTD received delivery of three more buses: 13-passenger vehicles built by Grumman. Two of the vehicles have special, low steps, but lack of funds prevented VTD from getting this option on the third vehicle. These three vehicles are the first set that has performed at a reliability and maintenance cost level acceptable to VTD staff. Table 4-2 gives comparative maintenance statistics for the three bus designs operated by VTD. As can be seen from this table, vehicle maintenance costs have had a large impact on VTD operating costs. The improvement in maintainability from the early to the late vehicles has been even greater than the table indicates, because the out-of-service time and labor hours required for most maintenance operations have also decreased in the newer vehicles.

VTD is currently considering the purchase of several more buses in the 13-passenger range, and two or three 35-passenger buses.¹ The smaller buses would replace the remaining 21-passenger vehicles to lower operating costs and improve reliability. The 35-passenger vehicles

¹VTD requested bids on four 22- to 26-passenger vehicles in early 1978, and was to take delivery in spring, 1978. The details of the purchase were not known at the time. As can be seen, several options were being pursued by VTD.

TABLE 4-2

Maintenance Requirements of VTD Vehicles

	Component life, or time between major maintenance (miles)		
<u>Component:</u>	<u>Twin Coach 21-pass.</u>	<u>Grumman 21-pass.</u>	<u>Grumman 13-pass.</u>
Brakes: front	3,000	3,000	30,000
rear	5,000	40,000	60,000
Transmission	8,000	8,000	45,000
Engine	30,000	40,000	80,000
Carburetor	5,000	5,000	20,000
Ignition	5,000	5,000	25,000
Doors	weekly ¹	weekly	2 weeks
Tires	2,000 ¹	10,000	15,000
Tune-up	5,000	5,000	25,000

¹ Rear tires; front tire life 6,000 miles.

SOURCE: VTD vehicle records and interviews with mechanical staff.

would be purchased for use on several heavily utilized peak period runs on work trip services, and for contract services in the offpeak, several of which current require two trips but could be served at lower cost with a single trip by a 35-passenger vehicle. VTD management will not buy van-type vehicles because it feels their crashworthiness is unsatisfactory.

VTD thus operates a mix of vehicle types ranging from autos to 21-passenger buses, and soon expects to acquire 35-passenger buses. This range of equipment has evolved as most cost-effective to operate all of VTD's services. Dial-a-ride services, which have low load factors and must negotiate minor streets, operate primarily with 13-passenger vehicles, although the autos and station wagons are used where appropriate. Subscription services operate with 13- and 21-passenger buses, depending on load factor, and some will utilize 35-passenger vehicles. Contract services use 21-passenger buses and will also use the 35-passenger vehicles. Fixed routes typically will operate with 13-passenger buses due to low loads. As vehicle capital and operating costs vary widely over all these vehicle types, substantial savings and improvements in operations are gained through a mixed fleet.

The final component of VTD's fleet is two vans which serve the "Meals on Wheels" program, which provides hot lunches to the elderly. This program is funded by HEW (Title VII). VTD provides the drivers and maintains the vehicles for this program, producing some economies in operating cost. Also, since these meals are delivered in the offpeak period, this improves VTD driver utilization.

Figures 4-4 through 4-8 show the VTD vehicles.

4.8 DIAL-A-RIDE (DOOR-TO-DOOR) SERVICES

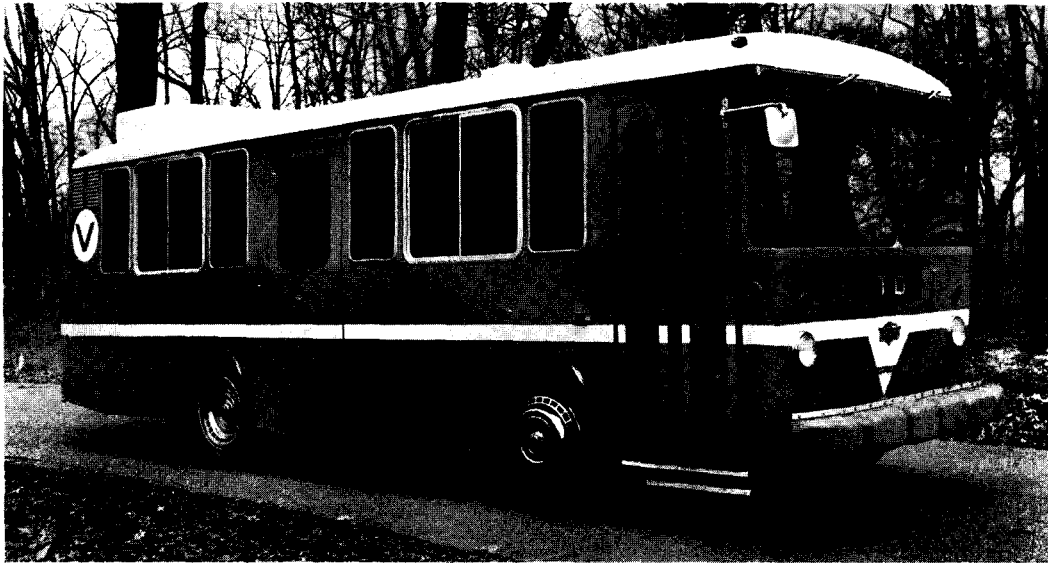
The Valley Transit District offers dial-a-ride service, which it calls door-to-door service, throughout the Valley Monday through Friday, 6 am to 6 pm. While service was restricted to one day per week for each of the four subareas outside the core of the Valley for a period in 1973-74 due to equipment shortage, service has been provided on a daily basis throughout almost all of VTD's history.

The door-to-door service is primarily intended for use by the elderly, handicapped, and low-income groups for medical and other trips not served by contract or fixed route service. One must hold a valid "V-card", or VTD credit card, to use the door-to-door service, as cash is not accepted on the bus. (The V-card is discussed in detail in section 4.13.) The general public is allowed to use the door-to-door service if a V-card is held, but is not encouraged to do so. The door-to-door service is regarded as being relatively expensive to operate per passenger trip, and its role is seen by VTD as serving necessary trips for the target population that cannot be served in any other way.

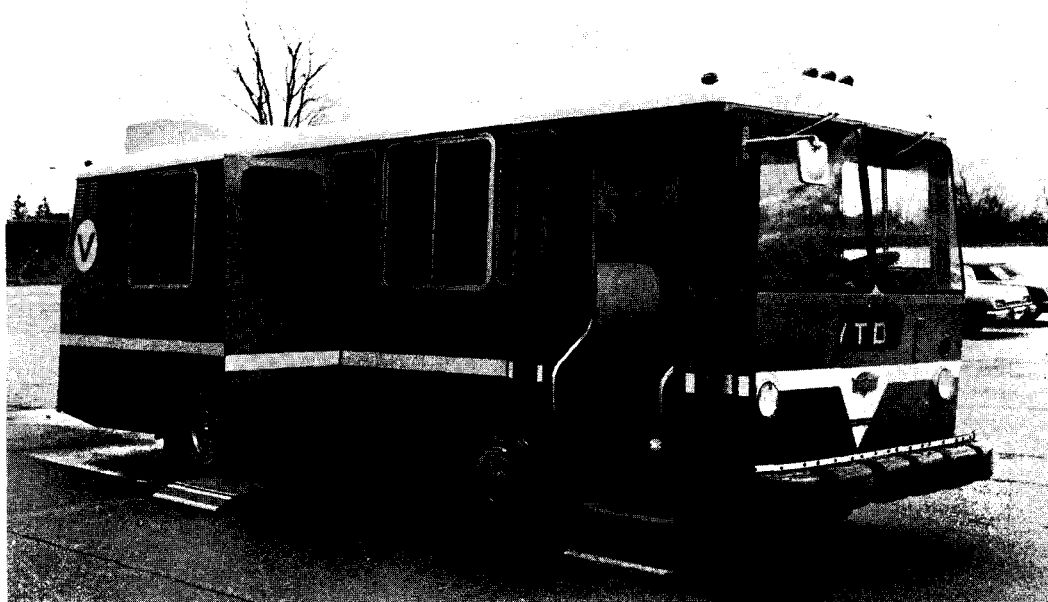
Users are required to call for service at least two hours before they wish to travel. This lead time has been required by the system throughout its history. It was originally instituted to allow for better vehicle utilization and dispatching than were thought to be possible with an immediate request system. While this lead time could probably be cut substantially at this point without decreasing system

FIGURE 4-4

Twin Coach Vehicles (1972)



4-4a: 21-Passenger Vehicle



4-4b: 16-Passenger/3-Wheelchair Vehicle

FIGURE 4-5

Grumman Vehicles (1975 and 1976)



4-5a: 21-Passenger Vehicle (1975)



4-5b: 13-Passenger Vehicle (1976)

FIGURE 4-6

Vehicle Interiors



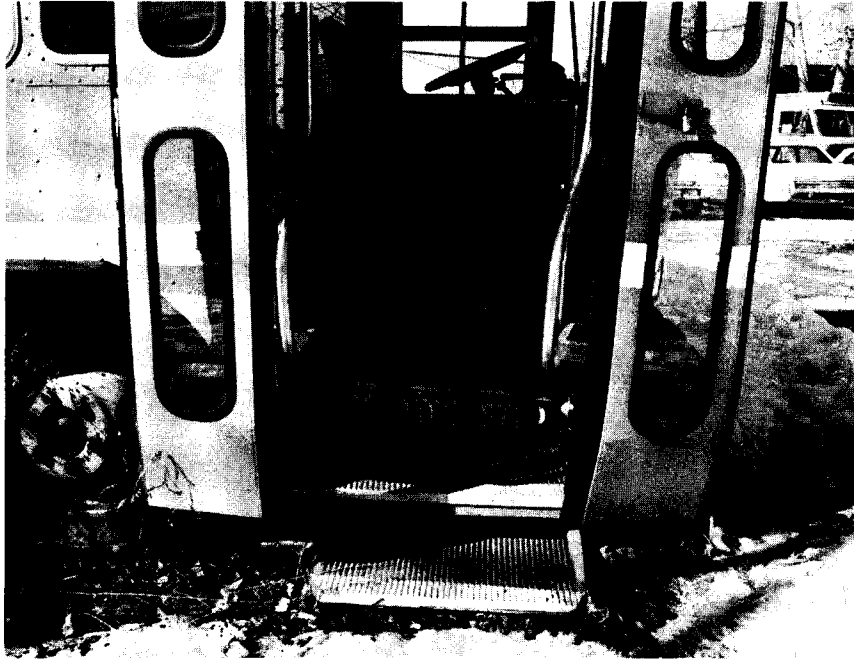
4-6a: Twin Coach Vehicle



4-6b: Grumman 13-Passenger Vehicle

FIGURE 4-7

Vehicle Steps



4-7a: Twin Coach Vehicle

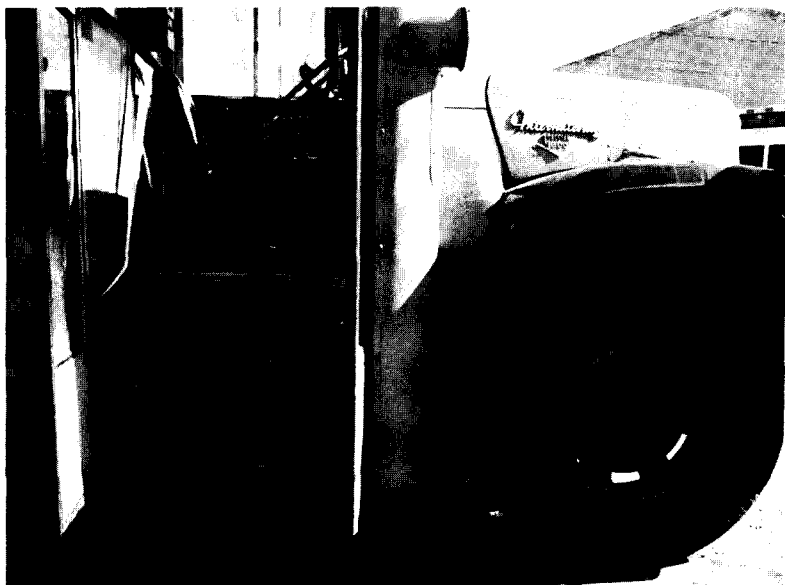


4-7b: Grumman 21-Passenger Vehicle

FIGURE 4-7 (continued)



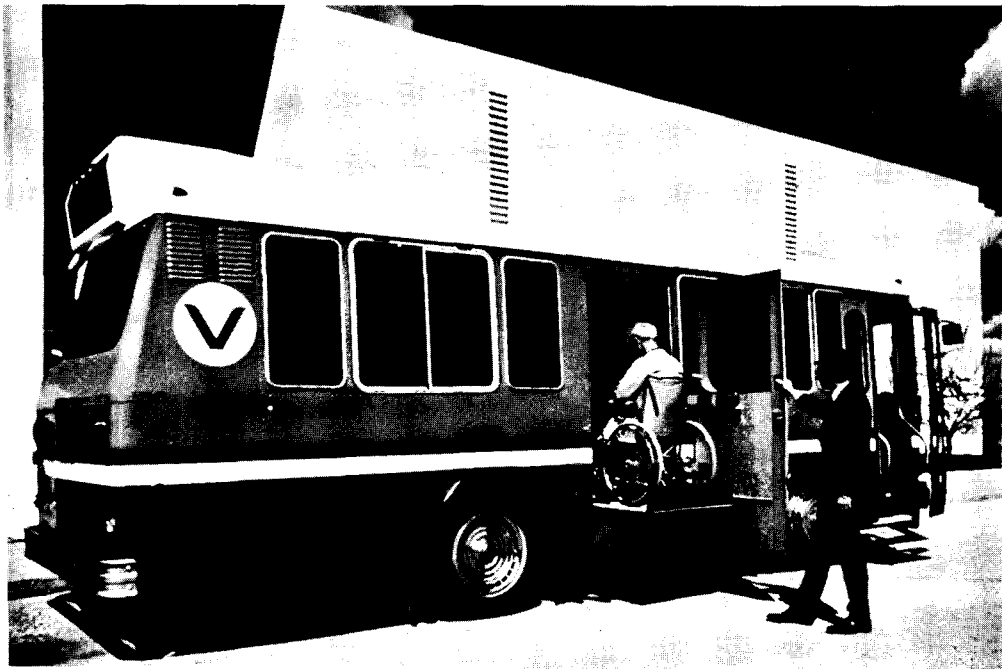
4-7c: Grumman 13-Passenger Vehicle



4-7d: School Bus Vehicle

FIGURE 4-8

Twin Coach Vehicle Wheelchair Lifts



efficiency, the requirement is still kept as being consistent with the use of door-to-door service for only the most necessary trips, which presumably users will know about or can plan in advance.

Figure 4-9 shows the ride slip filled out by the dispatcher to enter the information for a customer's ride request. Only the items marked in Figure 4-9 are recorded. (No drop-off times, in particular, are promised by VTD.) These ride slips have been in use for the entire history of VTD without modification; however, many items are not filled out.

A range of vehicles is assigned to this service, although the smaller buses and the autos are typically used. Finally, several billing and user-side subsidy features are applied in door-to-door service; these are discussed in section 4.12. A fixed zone fare system has been used for the dial-a-ride service since 1974; fares currently range from 75¢ to \$5.00, and the average fare is 88¢. Earlier experiments with a variable fare structure are described in section 4.13.

4.9 CONTRACT SERVICES

Contract services provide door-to-door service for a group of individuals from their homes to a single destination, and return. They are arranged jointly by VTD and a sponsoring social service agency for the use of agency clients. The services operate at specified times and days of the week for each group of clients. Major users of contract services to date have been the senior centers in each of the four Valley towns, both for transporting clients to the centers and to local shopping areas;

FIGURE 4-9

VTD Ride Slip for Door-to-Door Service

The diagram illustrates two VTD Ride Slips. The left slip is a carbon copy of the right slip. A label 'CARBON' with an arrow points from the right slip to the left slip. Both slips contain the following information:

Left Slip (Carbon Copy):

P.U. TIME 2:15
RIDE DATE _____ RIDE # _____

ID # 15071
NAME _____
ADD. _____
PHONE 735-1280

P.U. Griffin Hospital
ZONE 5
D.O. 8 Howe Ave.
ZONE 5
D.O. TIME _____ ()
RIDE TIME _____
P.U. TIME (ABOVE) 2:15

Right Slip (Original):

P.U. TIME 9:45
RIDE DATE _____ RIDE # _____

ID # 15071
NAME _____
ADD. _____
PHONE 735-1280

P.U. 8 Howe Ave.
ZONE 5
D.O. Griffin Hospital
ZONE 5
D.O. TIME _____ ()
RIDE TIME _____
P.U. TIME (ABOVE) 9:45

SOURCE: VTD

the Valley Association for Retarded Children and Adults (VARCA), which operates a large sheltered workshop program; senior housing projects for shopping and social trips; and schools and other social agencies.

The service is arranged jointly by the sponsoring agency and VTD. A bus tour is set up that passes the homes of all potential users of the service, and an approximate pickup time is given each user. Clients are free to use or not use the service on any given day without any prior notification to VTD or to the agency. However, clients in the early part of the run are generally aware of which others will be using the service that day, and they simply tell the driver at that time. Thus, there is little wasted time or mileage on these trips.

Contract operations are very flexible in other ways as well. Drivers serving these runs have become accustomed to the service so much that lists of clients and a map of the tour are not always kept. Also, occasional detours to, for example, drop someone at a shopping area on what is a designated trip to the senior center do occur.

Contract service is available from 6 am to 6 pm Monday through Friday currently; it has been available in limited cases on evenings and weekends at some times in VTD's history, and is currently offered for one church trip on Sundays. Most contract services, except for VARCA, operate in the offpeak period. These services are provided only for agency clients, and thus are exclusively for the target population and not the general public. (VTD does operate a very limited amount of conventional charter bus service, restricted by the Public Utilities Control Authority to only intra-Valley trips, and this is available to the general public.)

Typically, a contract trip serves clients of only one agency, but attempts are being made by VTD to encourage inter-agency cooperation in the use of contract runs. There are several instances where two vehicles performing contract service are in the same area but serving different agencies. However, agency attitudes may be difficult to change because the agencies had fought one another and VTD during much of 1973-74 simply to obtain any service at all, due to equipment shortages. They now regard exclusive use of a vehicle as a service guarantee and are still reluctant to give it up. VTD's early problems with vehicles have had far-reaching effects on the entire system, and this is yet another example. Further factors influencing this issue are that large agencies often have too many clients to share the vehicle with another agency, and the smaller agencies do not use VTD for contract services. Thus, agencies have abandoned the use of their own vehicles, a key VTD goal, but have not shared the use of VTD vehicles among themselves.

Social service agencies are billed the full cost of the contract services, which are currently \$14 per hour. Before July, 1975, the cost had been \$11 per hour. Agencies are charged only for in-service time; they are not charged for any deadheading time required to or from the contract run. There is a subsidy fund to aid the agencies in paying the costs of VTD; it is very similar to the user-side subsidy arrangement for individuals and in fact is funded by the same HEW program. The subsidy amounts have varied greatly over the demonstration, and are discussed in section 4.13. Since individuals using the contract service are not

billed for it, they are not required to have a "V-card."

Contract services have formed the bulk of VTD operations over its history and continue to provide the majority of its revenues. VTD seeks to maintain as much contract operation as possible, due to its high productivity and the high revenue-to-cost ratio the service produces. However, the use of contract services is constrained by the limited funds that the Valley social service agencies have to provide transportation for their clients.

4.10 SUBSCRIPTION SERVICES

VTD subscription service is a variant on its dial-a-ride service, providing prearranged door-to-door service for regularly scheduled trips. In VTD's nomenclature, subscription service includes any regularly scheduled trip, even if only once a week, by any user, and for any trip purpose. In this report, however, a more restrictive definition is used: any regularly scheduled trip made by a member of the general population to or from work. While the two definitions include almost exactly the same trips, the report's definition excludes regularly scheduled trips by members of the target population, which are typically medical or social service agency trips and are made in offpeak hours; for analysis purposes, these trips are more closely related to the dial-a-ride trips than to the remainder of the subscription trips, and so the report uses a slightly different classification than VTD does in its day-to-day operations.

The organization of the subscription services for work trips is

handled by VTD alone in almost all cases. There is no formal marketing program for the service; new users are made aware of the service primarily through word of mouth, although some advertising was done in 1973, a brochure describing the service (and other VTD services) was prepared in early 1976, and some radio and newspaper advertisements were run in summer, 1976. New users are added incrementally to existing subscription runs, which are almost entirely subscription users in the morning peak, but a mixture of dial-a-ride and subscription users in the afternoon peak. When a noticeable change in subscription ridership has occurred since the last time vehicle tours were set up, the entire set of subscription vehicle tours is examined and adjustments are made to improve productivity and, if possible, service levels.

The adjustments are made by a manual, intuitive process, but with several guiding principles. First priority is given to maximizing the efficiency of vehicle tours and the revenue-to-cost ratio. Schedule delay, or the difference between a user's desired arrival time at work and the time VTD actually drops him, is not weighted very heavily. Several subscription users, in fact, are delivered to their work place 30 minutes before the beginning of their shift, although the majority are delivered within 10 minutes of their desired time. Vehicle positioning for services to be operated after the morning peak, and before the evening peak, is also weighted quite heavily, as VTD strongly attempts to minimize deadheading.

Due to higher load factors on the subscription services, arranging vehicle tours is more difficult than for the dial-a-ride service, even

though the tours are preplanned. Timing constraints are also more difficult, as 15-minute windows for pick-up (or drop-off) times are not acceptable for work trips.

VTD's rationale for maximizing the revenue-to-cost ratio for subscription services, even at the expense of reduced service levels for some users, is that VTD feels that it should apply its limited subsidy funds toward providing service to its target groups, whose need for VTD services is felt to be the greatest. Thus, VTD feels that the general public should pay as much of the full cost of service as is practical, and in fact should even provide a cross-subsidy for target group services, if possible. However, subscription services are not providing any cross-subsidy to other services currently. (See section 6.2.)

In day-to-day operational terms, the subscription service is dispatched in the same way as the dial-a-ride service, using the ride board shown in Figure 4-2. Permanent ride slips (using the same form as dial-a-ride trips) are filled out for each subscription trip, and are kept permanently in the appropriate slot on the ride board. They are marked with a colored border to distinguish them from dial-a-ride trips.

Users of the subscription service must hold a valid V-card; they are billed monthly. A few individuals over 60 who are still employed are eligible for user-side subsidies, but the general public is not. Fares for the service are exactly the same as for dial-a-ride service, except that a monthly pass costing \$16 is available for trips in the 75¢ fare zone (a discount of nearly 50 percent), and a \$19 pass is available

for the next zone, which has a single-trip fare of \$1.20. A family pass has been available for an extra \$2 per month which allows members of the subscription user's family to ride on their subscription run only, and on VTD fixed routes. With the decreased fixed route service currently being operated, however, the family pass is no longer used.

In February, 1977, VTD introduced a variation on its previous subscription services. A service to the Sikorsky aircraft plant in Bridgeport from the Valley was begun, but without offering at-your-door service in the Valley, where it followed a fixed route. Cash fares of 50¢ per ride are collected, and no V-cards are required. This service is actually a hybrid between a fixed route and subscription service. This report considers it a subscription service because it primarily serves a single destination (an employer) and it is not advertised to the general public. VTD calls it a fixed route, because it uses the fixed route fare structure, does not provide door-to-door service, and does not require V-cards. The characteristics of this service were chosen by VTD to maximize vehicle productivity and revenue consistent with providing an adequate service. VTD had operated subscription services to the Sikorsky plant in the past, but these services were terminated by a Connecticut PUCA ruling. (This is discussed in Chapter 7.)

4.11 FIXED ROUTE SERVICES

VTD fixed route services do not fit into the usual model of fixed route transit in several ways: they operate almost exclusively in the offpeak, they serve primarily elderly riders and not the general popula-

tion, and they are very short, circuitous routes operating at long headways. Figure 4-10 shows the fixed routes at their greatest extent.

While fixed routes had always been envisioned as a component of VTD's services, they were not implemented in early stages of the demonstration due to equipment shortages and the higher priorities placed on contract and door-to-door services. Even as the vehicle fleet expanded, continued strong demand for contract and door-to-door services absorbed the extra capacity. When fixed route services were finally implemented in November, 1975, the only period having excess vehicles available for services was approximately 9 am to 3 pm. Taking this as a constraint, and still regarding service to the elderly as a priority need, a set of fixed routes were designed that connected areas containing housing occupied by the elderly with shopping areas, medical and social services. Stops were also established at other areas along the routes. Origin-destination trip patterns for the dial-a-ride service produced by the automated billing system were examined in creating the fixed routes. Two-hour headways were chosen, mostly to limit the number of vehicle-hours assigned to this service, whose productivity and revenue potential were unknown. Even so, these services composed about 25 percent of VTD's vehicle-hours and had a large impact on VTD's overall operating (revenue-to-cost) ratio, which is the critical element in VTD's continued existence.

Each of the intra-town routes operated only in the offpeak and on two-hour headways, but the fixed route connecting the four towns operated on one-hour headways, and served the afternoon peak period as well.

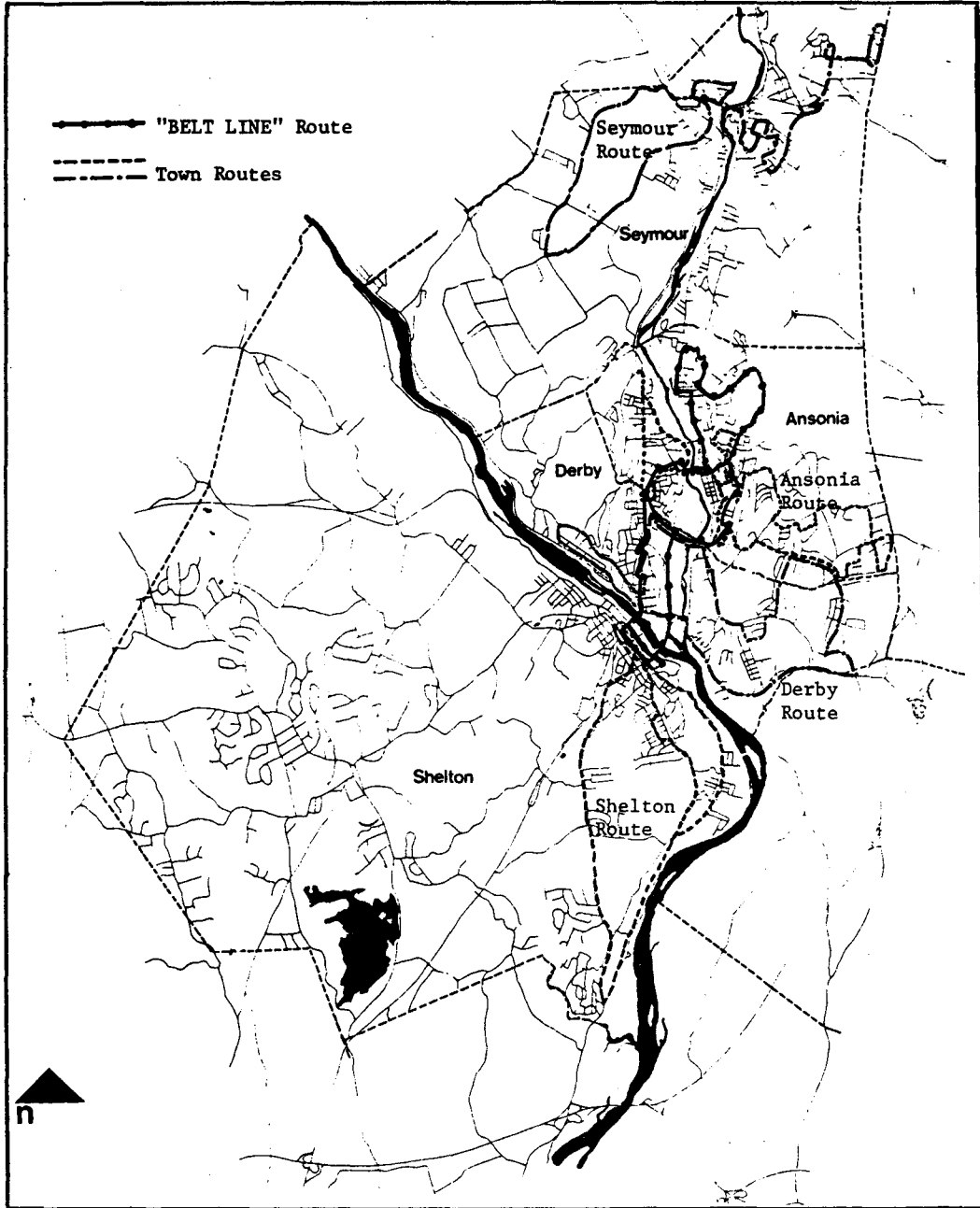


FIGURE 4-10

Fixed Routes

SOURCE: References 1 (base map) and 2 (routes)

Fares on the fixed routes were 50¢ plus 10¢ for each town line crossed for the general public, and 25¢ for the elderly (V-card required as identification) and students. V-card holders could charge their ride on their credit card; others paid cash. No user-side subsidies could be applied to any of these fares, which already contained differentiations by user group. These fares were also lower than the dial-a-ride fares, thus presumably creating an incentive to use the potentially more productive fixed route.

There was little use of the fixed routes once they were operating, with most vehicles carrying 0-2 passengers per trip. Only the route connecting the four towns was attracting any ridership at all. Thus, the operation of the fixed route was modified. Since the primary usage of the fixed routes was by elderly clients who had called for door-to-door service and been directed by the dispatcher to use the fixed route (if their physical condition and other factors allowed), the fixed routes began to deviate to provide door-to-door service to users whose trips generally coincided with the route. This form of operation continued until February, 1977, when all but the inter-town fixed route were discontinued, as the need to pass fixed route stops was an unproductive and unnecessary operating hindrance. The inter-town route still operates as a conventional fixed route from 10 am. to 2 pm, but from 2 pm to 6 pm, operates as a route deviation service for which people must call in advance.

Introduction of substantial fixed route services operating in peak periods and serving the general public, if it is ever done, will probably

await the establishment of a multimodal transfer point in the Valley. At that point it will be possible to integrate and coordinate VTD fixed route services with those already operated by Connecticut Transit and Valley Transportation, Inc. These two carriers already operate the two most central fixed routes in the Valley, and since they both operate at a deficit, it is in VTD's interest for these carriers to continue their operations. The number of vehicle-hours operated in the Valley by these two carriers is equal to more than 30 percent of VTD's total service hours, a very substantial amount. New VTD fixed route services would be likely to complement rather than compete with these routes. Some form of route-deviation operation rather than a conventional fixed route would probably be operated by VTD in view of the long headways, moderate load factors, and relatively short trips that would in all likelihood characterize this service. The Valley Regional Planning Agency (VRPA) has been a strong proponent of these services and would play a strong role in planning for them if a decision is made to proceed in this direction. At this point, however, there are no plans for the expansion of fixed route service.

4.12 MARKETING AND REGISTRATION

Registration for VTD service is accomplished by filling out a V-card (credit card) application form shown in Figure 4-6 and returning it to VTD. No formal approval process is used unless a person requests or appears to be eligible for a user-side subsidy, in which case sponsoring agency approval is required. It should be emphasized that the registra-

tion process is very informal and relatively unimportant, as compared to other demonstration projects for the elderly and handicapped. Registration is not required to use contract service, which accounts for approximately two-thirds of VTD's ridership, nor for fixed routes, nor for the Bridgeport service, which account for an additional 20 percent of VTD's ridership. Thus, most VTD users do not need V-cards. Conversely, many V-card holders have not used VTD. Many clients of senior centers, senior housing projects, and social service agencies, were given V-card applications to fill out even though they had expressed no interest in using the system. Thus, the number of registrants is only a very approximate indicator of the number of potential VTD users, and the actual user pool could be quite different.

Figure 4-12 shows the V-card issuances in the first year of the project. February, 1973, was a month when very active solicitation was pursued. The rise from March corresponds to actual beginning of the door-to-door service. In August of 1973, an attempt was made to solicit card applications through posters at key agency facilities. This solicitation established the V-card application procedure through the application card as it appears in Figure 4-11. By that time, however, a combination of coverage of the agency market and the start of service capacity problems caused issuance rates to decline to a steady level of around 60 per month. The January peak is related to the fuel crisis at the time when the use of subscription services for work trips jumped. By February, 1974, 2,272 cards had been issued.

Currently, the number of V-card holders is 3,296; this corresponds

FIGURE 4-11

V-Card Application Form

This information will be kept confidential
Valley Transit District V-Card Application

Please fill this out:

NAME
Last First Middle

ADDRESS
No. Street Town Zip Code

TELEPHONE SOCIAL SECURITY

SEX M F EMPLOYMENT STATUS AGE

FAMILY INCOME RANGE UNDER \$3000 \$3-5000 \$5-8000 \$8-12,000
 over \$12,000

PLEASE TURN CARD OVER AND COMPLETE →

FOR AGENCY USE ONLY

AGENCY	CODE #	DAYS	TIME 1	TIME 2	ZONE 1	ZONE 2	# in group	\$	LIMIT	AUTH. BY
1.										
2.										
3.										

FOR VTD USE ONLY

CARD NO. TYPE HOME ZONE DATE AUTH.

- PLEASE COMPLETE:
- Are you licensed to drive a car and physically able to do so? YES NO
 - How often is a car available to take you places during the day, either as driver or passenger? USUALLY SOMETIMES RARELY NEVER
 - Do you live with others members of your family? YES NO
 - Do you have responsibility for young children? YES NO
 - Please list below any problem or condition you have which makes it difficult for you to walk or to use certain types of transportation. (like a weak heart, trouble breathing, etc.)

PLEASE RETURN TO: VALLEY TRANSIT DISTRICT
59 Elizabeth Street
Derby, Conn. 06418

PLEASE READ THIS AND SIGN BELOW:

The V-card is the property of the Valley Transit District and must be returned upon request.

The signer is responsible for all charges made on the card issued to him. All charges must be paid within 20 days after the receipt of the V-card invoice.

Signer should report the loss of the V-card immediately to avoid being charged for unauthorized use. Signer liability for unauthorized use will not exceed \$25.

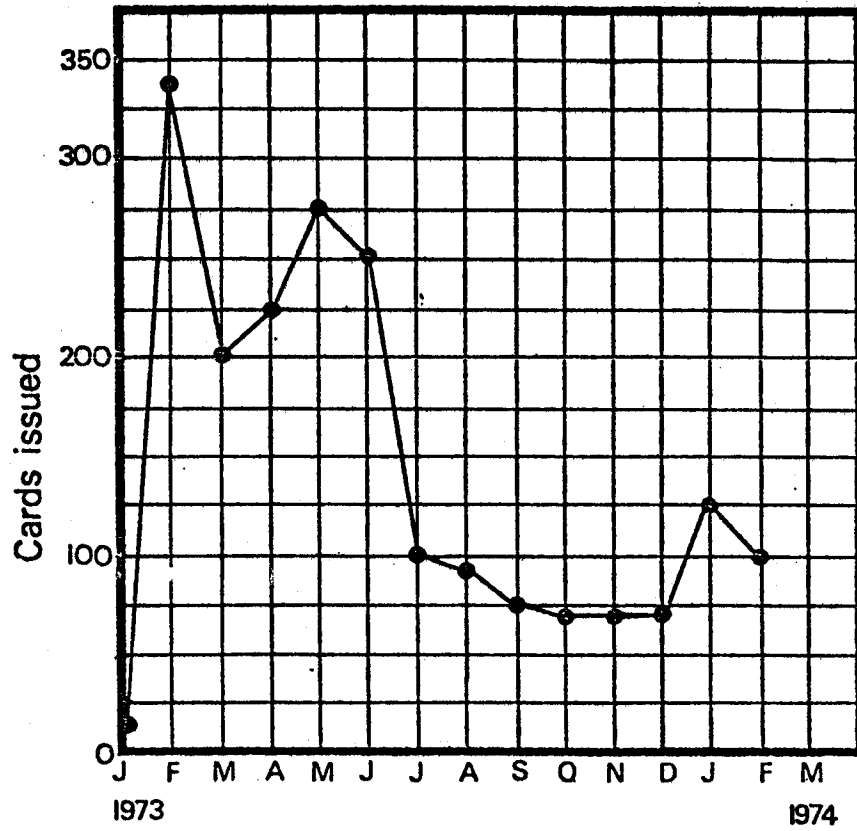
I agree to the above conditions: signed _____ date _____

Note: A slightly modified version of this form was introduced in 1976.

SOURCE: VTD

FIGURE 4-12

Monthly V-Card Issuances
for First Year of VTD Operation



SOURCE: Reference 1.

to an average of 20 V-cards per month being issued since March, 1974. A slight jump occurred during late 1975 due to the arrival of new vehicles and expansion of services. There is no procedure for eliminating inactive V-card numbers, although only approximately 400 active numbers are kept in the minicomputer billing system.

Marketing for VTD dial-a-ride and subscription services has been centered on senior centers, senior housing projects, and social service agencies, with relatively little outreach beyond these organizations. Some advertising of subscription service was also done in 1973; a brochure describing all VTD services was prepared in March, 1976 (with VRPA), and radio and newspaper advertisements were run in summer, 1976. No concerted effort at marketing has been made because service was saturated in the early stages of the demonstration, and because other problems and issues (such as vehicle acquisition and maintenance, and subsidy negotiations) have taken precedence in the latter stages.

4.13 BILLING AND SUBSIDY ARRANGEMENTS

VTD has used an innovative approach to pricing, billing, and subsidy arrangements throughout its existence. The first system utilized is called FAIRTRAN^R, and was developed for VTD by its consultants. FAIRTRAN^R operated from March, 1973, the introduction of dial-a-ride service, through June, 1975.

This system has several basic elements in its operation. The first is the credit card, called the V-card. The credit card is a plastic, laminated card which identifies its holder through a five-digit code.

Individuals must have a V-card, which is obtained through the registration process described in the previous section, to use the dial-a-ride and subscription services, and to be eligible for discounted fares on fixed route services. It is not required for contract services. A V-card will be issued upon request to any Valley resident, although most advertising has been directed at target groups only.

The FAIRTRAN^R system utilizes on-board service recorders, shown in Figure 4-13, which record the following information about each ride:

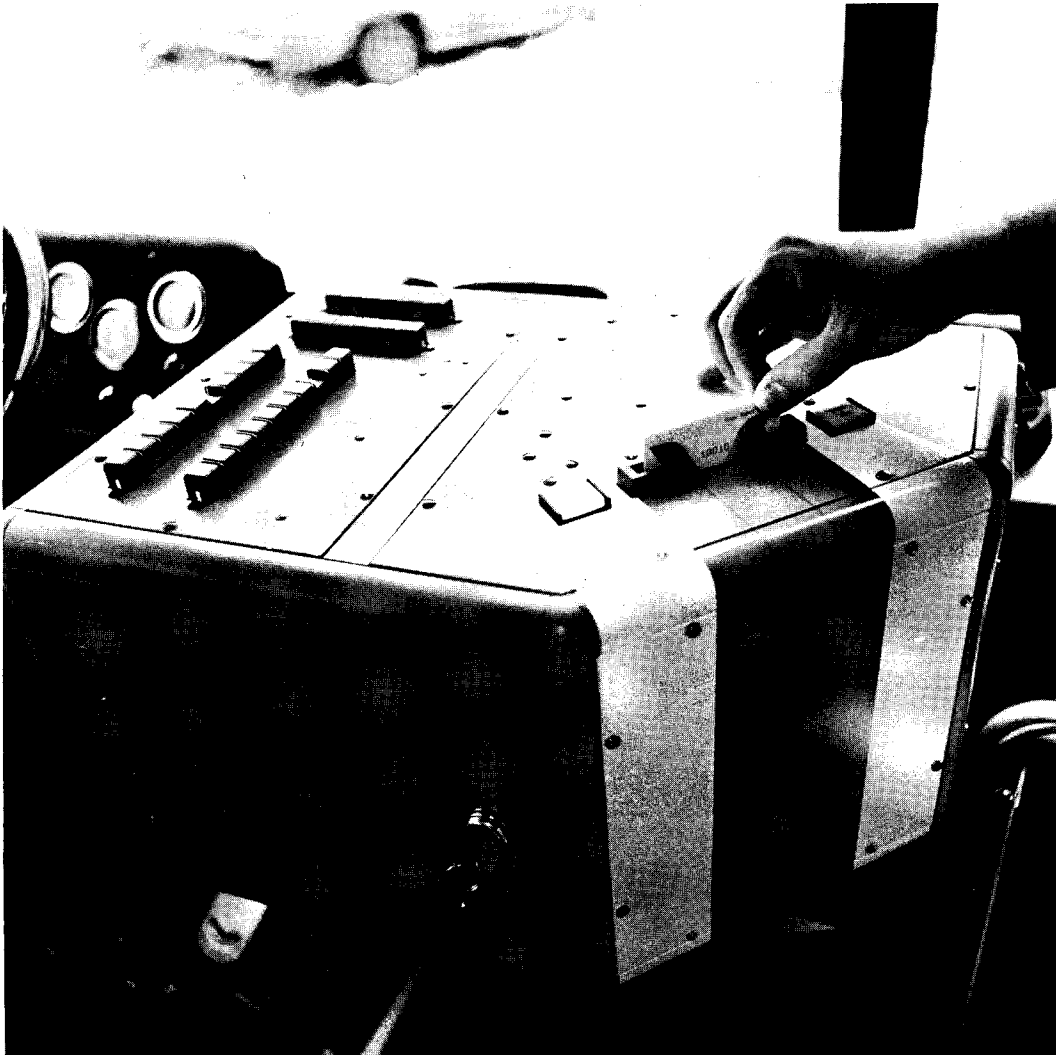
- a. pick-up and drop-off zone and mode of operation, entered by the driver;
- b. user identification number, through insertion of a credit card by the user upon entering and leaving the vehicle; and
- c. time of insertion supplied by an internal clock.

This data is recorded on a magnetic cassette tape, which is in turn entered into a computer system for processing. On a daily basis, the bus tapes are fed into a computer processor which produces the daily edit report. The daily edit represents the translation of the time sequential records of the bus tape into actual rides taken by each user. The pricing structure is then applied to price the rides. The daily rides are added to the cumulative ride file of each user. Then, on a monthly basis, the cumulative ride file is processed to produce a bill containing that month's rides, and any unpaid balance. Bills are mailed to the individual users or agency customers. Remittance is mailed back, or paid in person at the VTD offices. Remittance is manually re-entered into the customer master file to specify the state of the user's balance.

Figure 4-14 shows a typical monthly bill received by a customer;

FIGURE 4-13

FAIRTRAN^R Service Recorder



Valley Transit District

To BURNS, ELSIE
45 CONGRESS AVE.
SHELTON, CONN. 06484

Customer ID

11431

If you have any questions
about your bill, please
call 735 6824.

For Rent-a-Bus and Door-
to-Door service, please
call 735 6408.

\$1.26

Pay this amount

Thank you

Detach here To insure proper credit, please return above portion with your remittance Detach here

Date	Start Time	Origin/Destination	Total Cost	Cost to Customer	Date	Start Time	Origin/Destination	Total Cost	Cost to Customer
DOOR-TO-DOOR TRIPS									
04/19	10-43AM	G2 F2	.48	.39					
04/19	2-33PM	F2 G2	.45	.36					
04/25	1-43PM	G2 F2	.38	.31					
04/25	3-49PM	F2 G2	.25	.20					

AVERAGE PRICE OF DOOR-TO-DOOR RIDES .31

Previous Balance Scheduled Route Rent-a-bus Door-to-Door Deposits Pay this amount
 + + + - =

Valley Transit District

FIGURE 4-14

VTD Monthly Bill to User

SOURCE: Reference 1

the total ride cost, subsidy, and net cost to the user are shown for each trip. In addition to monthly bills for users, the system also generated monthly bills to sponsoring agencies for all the clients for whom they were providing user-side subsidy payments. The user-side subsidies have remained nearly constant throughout the project at 20 percent of total ride cost for all elderly users (over age 60) up to a subsidy limit of \$5 per month, and 50 percent for all handicapped users and for all medical trips. (The medical trip subsidy was 75 percent until March, 1974.) However, all user-side subsidies ended in August, 1977, due to lack of funds.

FAIRTAN^R had several possible restrictions that could be incorporated into the user-side subsidy arrangement. An agency could specify a monthly limit to fare support payments, the zone to zone connection for which it will pay (for example, home to agency), the time of day and day of the week of the trip for which it will pay, and the number of persons in a group on the same card for which it will pay. When payment is billed, the agency has a record of the trips for which it pays, while the user also has such a record (but pays only for the amount not covered by the agency). Except for the payment limit, none of the subsidy restrictions were used by the agencies.

A key feature of FAIRTRAN^R was that it allowed the price of each ride to be computed based on trip length, vehicle occupancy, time of day, group size, and other factors. This flexibility in pricing was regarded as essential in equitably allocating the costs of VTD service to its users. Particularly important was the consideration that the agencies

providing user-side subsidies be able to justify the share of system cost allocated to them through the subsidy mechanism. This "accountability" principle was responsible in large part for the development of the FAIRTRAN^R system for VTD, both to provide the required record-keeping capability and to provide a tool for allocating costs.

The formula used by FAIRTRAN^R to compute individual ride cost was:

$$F = C(R_1 A_1 + R_r T + R_2 A_2)$$

where:

$$R_i = (K + A)/(K + N_i) \quad i = 1, 2, \text{ or } r$$

and

$$N_r = \frac{1}{T_2 - T_1} \sum_j (T_{2j} - T_{1j})$$

where:

F is individual ride cost;

C is the cost per hour (\$8);

A₁ and A₂ are access charges for the origin and destination zone of the trip, which reflect expected deadhead time; these are drawn from a master file;

R₁ and R₂ are reduction factors that split the access charges over all passengers making similar trips;

T is a master interzonal time which is used for billing purposes instead of the actual trip time to remove the effects of circuitry due to other trips;

R_r is a reduction factor for the interzonal charge that splits the component over all users making similar trips;

K and A are constants;

N_1 and N_2 are the number of riders getting on or off within three minutes of the subject rider;

T_1 and T_2 are the on and off times of the subject user; and

T_{1j} and T_{2j} are the on and off times of all other riders j aboard the vehicle during the subject user's trip.

As can be seen, the formula is an extremely complicated method of allocating costs. Several problems emerged with it. First, it was impossible to estimate the cost of a trip for a customer a priori. Second, very minor variations in on or off times could result in drastic variations (e.g. a range of 70 percent) in fare. Third, variation in vehicle occupancy or the trip patterns of other users, over whom another user had no control, could cause large fare fluctuations. Fourth, from the system's point of view, the fares computed from this equation did not necessarily sum to the hourly vehicle cost target, which meant that it could experience deficits (or profits) it could not cover. Finally, the incentives for efficient use of the system were unclear and the pricing equation was unrelated to any economic notion of efficiency.

Four different versions of this fare formula were used in the first 15 months of VTD operation, until in June, 1974, VTD switched to a fixed zone fare system. The reasons for the change were the simplicity and clarity of the system to users, the greater predictability of revenues for VTD, and the ability to use non-FAIRTRAN-equipped vehicles for service.

FAIRTRAN^R continued in use with a fixed zone fare table, based on master interzonal times multiplied by an hourly cost factor (still \$8),

until June, 1975. During this period, most VTD services were provided by leased vehicles not equipped with FAIRTRAN^R service recorders, and thus much data needed to be entered manually into the computer billing system. As the system was not designed for this method of input, this was a tedious task. In June, 1975, VTD ended its use of the FAIRTRAN^R system altogether and began preparing the monthly bills manually. The number of zones was reduced from 35 to 14, and a new, simpler fixed zone fare table was created. Most trip costs were essentially unchanged, and there was no change in user-side subsidy arrangements. The same billing forms were used as in the computerized system; thus, to the user, the change from computerized to manual billing was unnoticeable.

Manual billing continued until August, 1977, when a minicomputer system took over the bill preparation. However, all rides are input manually to the computer from ride slips instead of being read in from on-board service recorders on tape cassettes. FAIRTRAN^R service recorders have been installed on all new VTD vehicles, but VTD has no plans to utilize them, as all information required for billing can be obtained directly from ride slips.

Thus, problems with vehicles and with the cost allocation formula led to the discontinuance of FAIRTRAN^R and the adoption of simpler techniques. However, FAIRTRAN^R did serve a useful purpose in facilitating agency participation in user-side subsidies at the beginning of the project, and in fact, many of its features were designed to satisfy agency concerns. After the system had operated for the first few years, agencies had developed sufficient experience and satisfaction with VTD's

service and pricing to allow the use of a simpler billing system which might not have been acceptable at the inception of the project.

The service recorders themselves operated with moderate reliability. An error rate of about 10 percent was observed on the cassette tapes taken from the buses each day; in addition to hardware problems, errors occurred due to users failing to insert V-cards upon leaving the bus, incorrect zone numbers punched by drivers, and other causes. After manual intervention, the percentage of rides that are not billable drops to 3-5 percent. During the last year of FAIRTRAN^R operation, all fare-box clocks were inoperative due to hardware and maintenance problems, but time was no longer being used in the pricing algorithm.

On another issue, while there was much initial concern that there would be excessive defaults on payment of bills of VTD users, actual experience has been very positive, with less than 4 percent of all bills outstanding after 90 days, and less than 1 percent ultimately unpaid.

Finally, funding and billing arrangements to agencies have varied throughout the project. HEW program grants have provided all funds for user-side subsidies of agency-sponsored users; thus, agencies have not been required to fund these costs from their operating budgets. For contract services, which are billed directly to the agency and are free to the users, the HEW programs subsidized 50 percent of the cost for the entire project with only a few exceptions. From April through December, 1973, the proportion was 75 percent, and for a two-week period at the end of June, 1974, it was 25 percent. VARCA received a subsidy of 90 percent until March, 1974, and then a 75 percent subsidy through June,

1974, when it dropped to 50 percent. All agency subsidies ended in June, 1977, except for some limited carryover funds to be used by the Valley senior centers as a 50 percent subsidy until June, 1978. All agency billing for contract services has been done manually throughout the project.

4.14 VTD DATA BASE

Due in large part to the FAIRTRAN^R system and the billing and user-side subsidy policies of VTD, a large amount of data on system usage and operations is maintained. While much of the information is collected strictly for billing purposes, it also forms a basis for a model data set for system planning and operation.

The first major element of the data base is the FAIRTRAN^R cumulative ride file, which records every dial-a-ride and subscription ride during the period it was operational. Origin, destination, time of day, and fare are recorded. A second data base, the ride slips, also exists for ride information. This contains the same basic information as the cumulative ride file contains actual pickup and dropoff times, while the ride slips contain only the estimated pickup time.

A third key file is the V-card or registration file, which contains age, income, auto ownership, residence, and other demographic information on all users of the dial-a-ride and subscription services.

Data quality decreases for the fixed route service, for which V-card numbers of target population users are sometimes, but not always, recorded. Passenger counts are also available for every vehicle trip. Con-

tract services have the least amount of data maintained of any service; only passenger counts are kept, as no detailed information is needed for billing purposes. As contract services have carried a very large percentage of VTD trips, this is a large gap in the data.

However, the infrastructure for a very complete data base does exist at VTD. If V-card data were kept more systematically on fixed routes, and V-card registration were required to use contract services and data kept on users, a complete record of transit trips by the target population for a five-year period would have been available. Since the marginal effort to collect this extra data is quite low, future systems similar to VTD should be strongly encouraged to keep such a data base to allow assessment of their impacts on mobility, which otherwise are nearly impossible to make.

Several other data base design considerations emerge from this project. First, demand-responsive transit systems do not effectively utilize on-board service recorders such as those in the FAIRTRAN^R system. All ride information is known from the ride slip (with the exception of actual pickup times), and the manual ride slip data also has a lower error rate. The only effective role for service recorders is on fixed route services where the users are not known beforehand, but even in this case, VTD's procedure of manually recording V-card numbers on fixed routes is quite adequate at the relatively low load factors experienced.

Second, the fare zones used by VTD hinder service planning because they are incompatible with either Census tracts or State of Connecticut traffic zones in the Valley, which are the two systems containing all the

land-use, demographic and travel data. Where feasible, fare zones should conform to other zone systems. Third, the use of a minicomputer by VTD to process billing and service data creates input-output interface problems for evaluation and service planning because no allowance has been made for communication with other computer systems on which data bases reside. The VTD minicomputer has three input-output devices only: a keyboard (input), a "floppy disk" (input/output), and a magnetic cassette reader (input). None of these devices are compatible with conventional tape, disk or card input/output which are the only forms in which most other data can be transmitted. Manual input through the keyboard appears to be required to enter any general data into the VTD minicomputer, or to transmit any VTD data to another computer. Future minicomputer systems should incorporate a tape drive or other compatible input/output device to ease this problem.

In summary, the problems in VTD's data base are minor compared to the wealth of detailed and accurate data that is available. While the data base was originally designed to meet the requirements of the billing system, VTD now finds it extremely valuable in monitoring its services and justifying its funding and regulatory requests. The data base is used to prepare monthly summaries of the number of trips by service type and general purpose for "accountability" to HEW and social service agencies. Monthly reports to the State of Connecticut are also required, and while these could be developed with a less extensive data base, VTD's ability to show the impacts of its specialized services on different user groups has aided its case for a special deficit funding agreement.

VTD's data base has been used in a similar manner in PUCA proceedings concerning its operating rights and services. Finally, the data base was used to design the fixed route services operated by VTD. For these reasons, as well as being an aid to evaluation, the VTD data base has been a very useful result of the project.

5. VTD SERVICE LEVELS

5.1 VTD DIAL-A-RIDE SERVICE LEVELS

This section outlines the service levels provided by VTD to users of dial-a-ride service in terms of travel times, wait times, reliability, and costs. Figure 5-1 shows the distribution of dial-a-ride and subscription travel times in the valley, derived from FAIRTRAN^R records. The median trip time is nine minutes, and a VTD trip takes about 70 percent, or four minutes, longer than an auto trip between the same points, on an average.

Table 5-1 shows the mean dial-a-ride and subscription travel time and its standard deviation for selected origin-destination pairs in the VTD system. The standard deviation of travel time is a measure of the variability of travel times on demand-responsive service for similar trips (by definition, 95 percent of all trips have a travel time within two standard deviations of the mean). This data is drawn from 1973-1974 FAIRTRAN^R records. While some of the variability in the travel times is due to different pickup and dropoff locations within zones, a considerable amount is simply variability in travel time caused by varying numbers of intermediate stops and detours. Travel time variability did decrease markedly in most cases from December 1973 to October 1974. Ridership was similar in both months. Weather may explain part of the change, but a larger component is likely to be greater dispatcher and driver familiarity with the area and the system. Time variability probably increased in 1975 due to worsening vehicle reliability problems, but its current level is thought to be lower than in

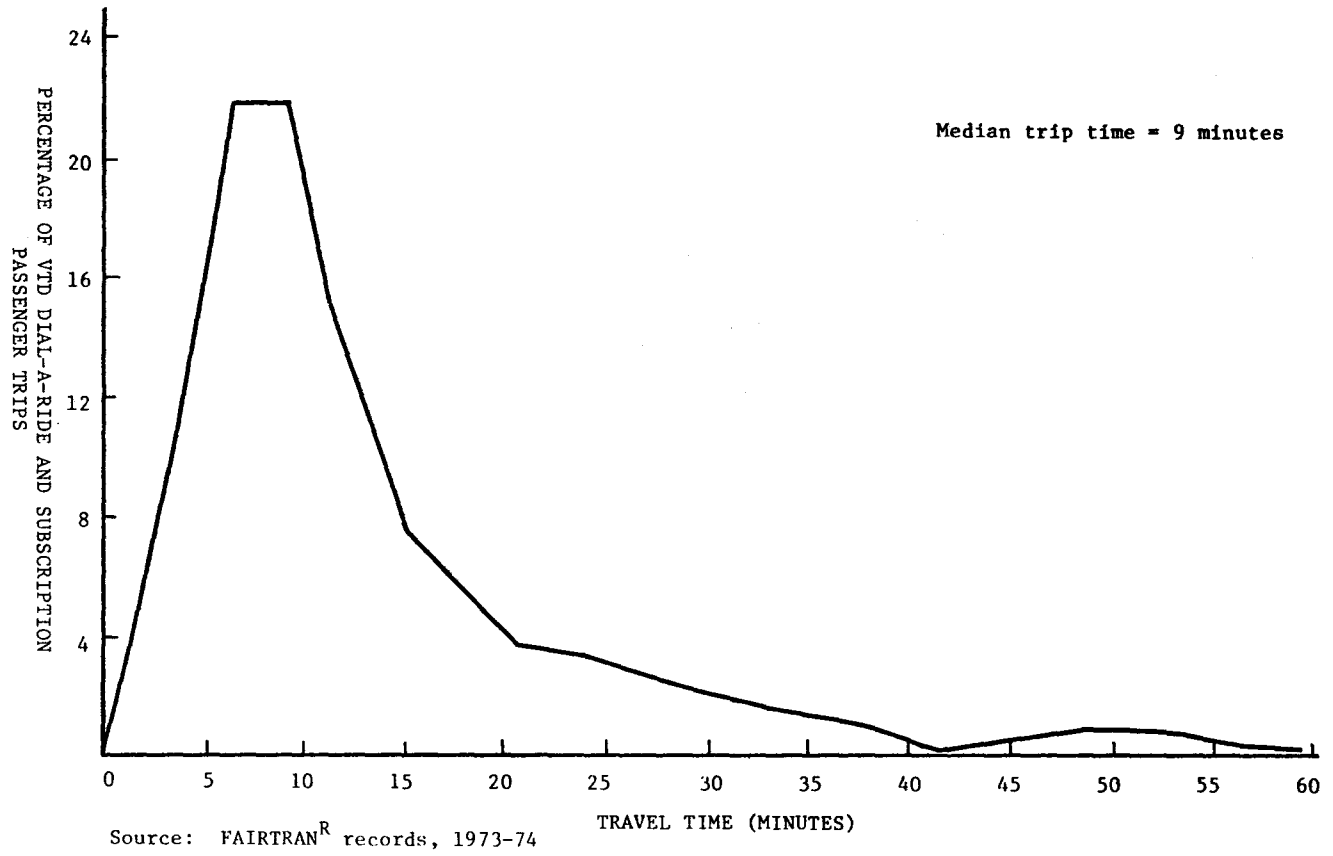


FIGURE 5-1
Distribution of VTD Door-to-Door Travel Times

TABLE 5-1

Mean and Standard Deviation of VTD Travel Time
Between Selected Origin-Destination Pairs

Origin-Destination Pair	Mean Time (minutes)		Standard Deviation (minutes)	
	December, 1973	October, 1974	December, 1973	October, 1974
B3-E1	29	16	6.6	2.1
C3-F2	29	18	17.5	2.8
D2-E3	6	5	5.3	1.9
E1-E2	8	10	2.1	9.1
E2-E2	7	3	14.4	2.3
E3-G2	22	11	14.7	3.7
E5-D3	12	11	6.7	3.4
F2-G2	11	16	7.3	17.0
G2-E1	18	13	5.5	7.7
G2-G4	8	9	2.9	3.3
G3-E2	15	10	13.3	4.1
I4-F2	17	12	8.7	1.4
I4-G2	9	29	3.9	7.4

Source: FAIRTRAN^R records

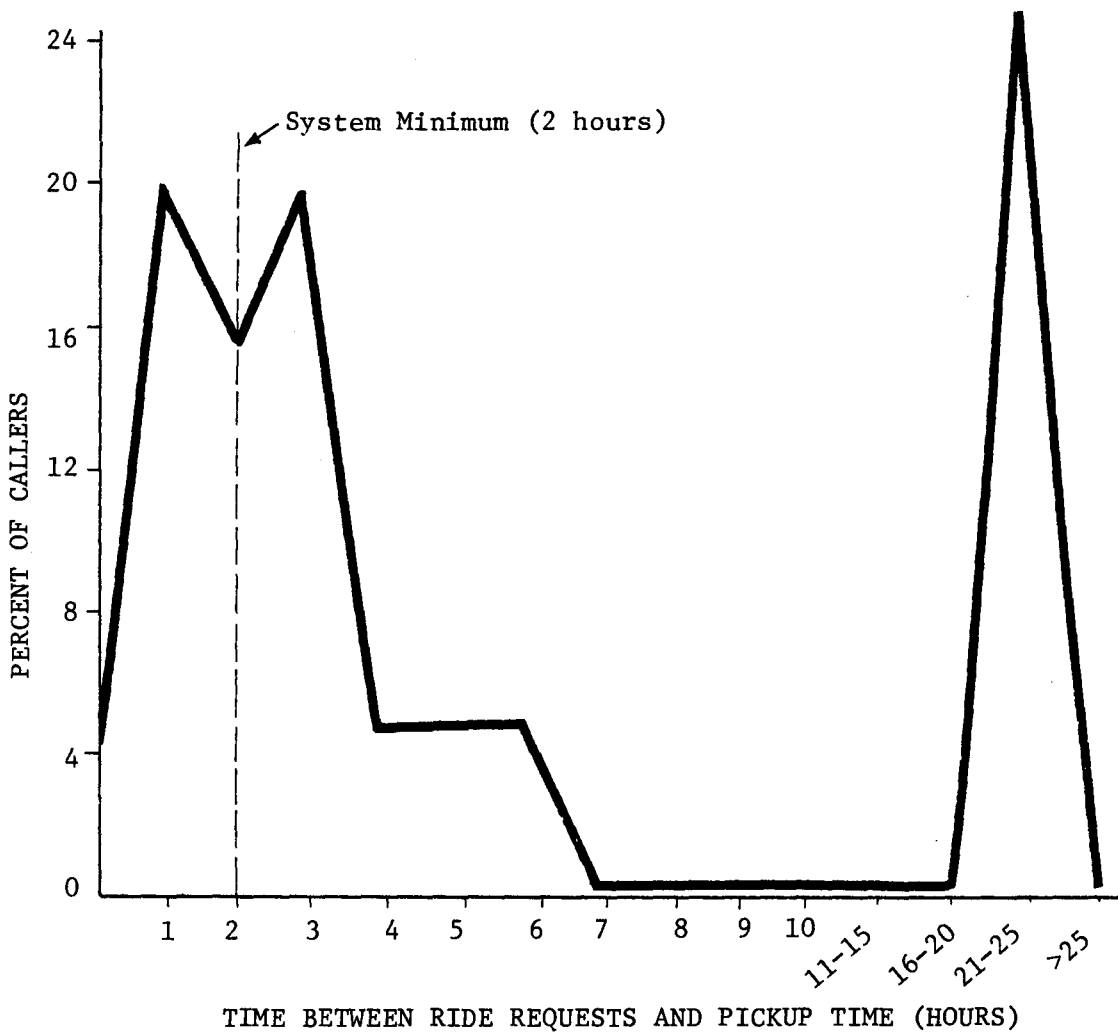
October, 1974. The lack of FAIRTRAN^R data from 1975 on makes it impossible to measure these variables during that period.

Figure 5-2 shows the distribution of actual lead times between user requests for service and pickup time. This is based on 1978 data. While the minimum lead time is two hours, in fact most users call for service much earlier. As the data also shows, VTD accepts users on lead times shorter than two hours, the system minimum, if possible, but it does not encourage the practice.

Table 5-2 shows the difference in pickup time arranged by the dispatcher from the desired pickup time requested by a user for dial-a-ride service. Very few changes from the user's desired pickup time are made, as VTD currently has ample capacity to serve dial-a-ride trips. This table is also based on 1978 data.

Trips are occasionally refused if VTD cannot handle a trip at the time requested, and the user cannot accept the alternate time given by VTD. In all cases where this occurred in the data shown in Table 5-2, the user had called just two hours in advance for a trip in the afternoon peak period, VTD's most busy time.

Figure 5-3 represents the difference between promised and actual pickup times for dial-a-ride service. Data is only available for 1973-1974, which was a period of relatively high unreliability for VTD. At that time, 70 percent of all users were being picked up within 15 minutes of the promised time. At present, approximately 95 percent of all users are estimated to be picked up within 15 minutes of the promised time, as opposed to 70 percent in 1973-1974.



Source: Two-day sample collected by VTD dispatcher, January 11-12, 1978.

FIGURE 5-2

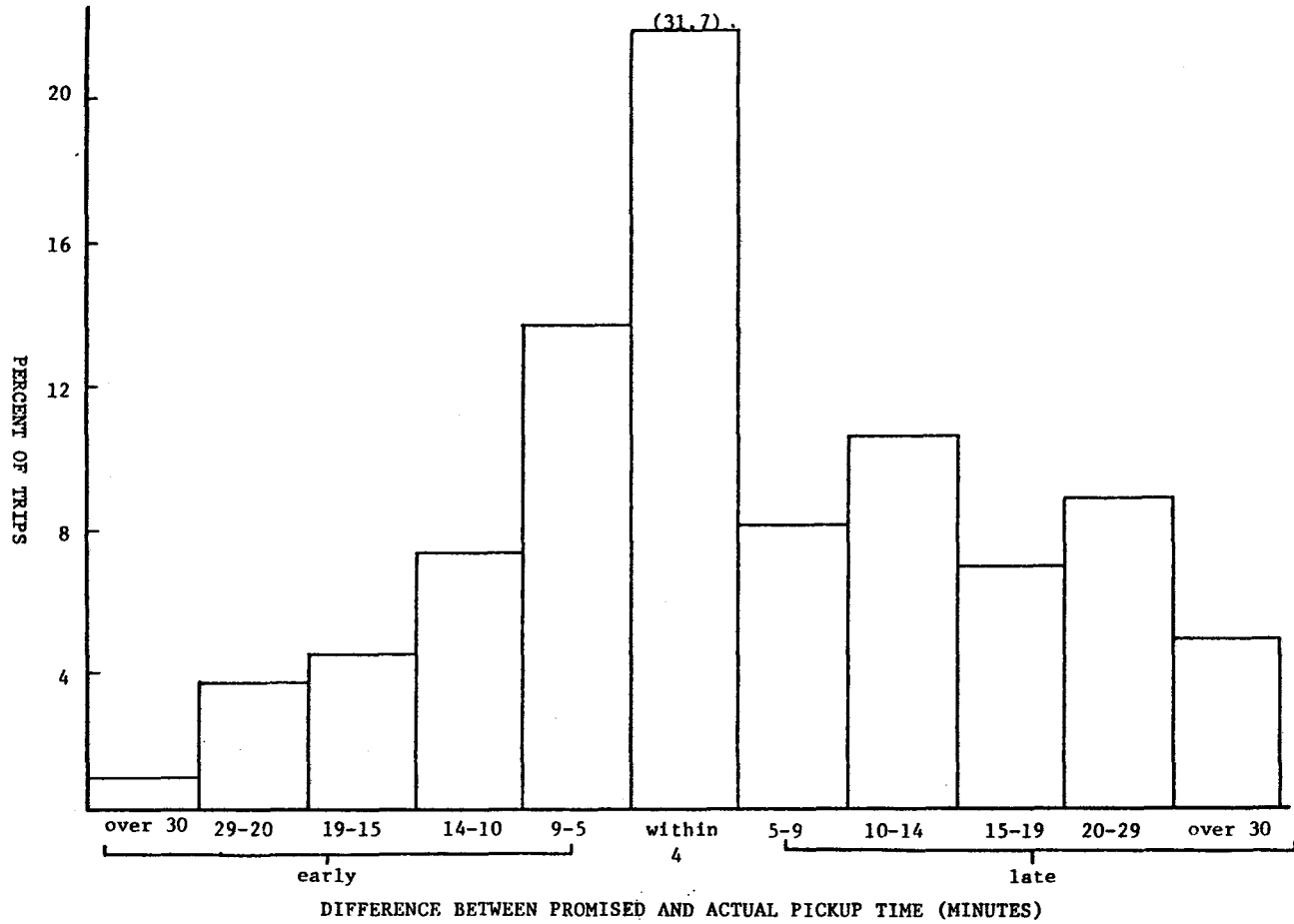
Distribution of Times Between User Ride Request and Pickup Time

TABLE 5-2

Distribution of Time Shifts in Ride Requests

Difference between Pickup Time Desired by User and Provided by System	Percentage of Ride Requests
0 minutes	60
0-15 minutes	20
15-30 minutes	5
30-45 minutes	5
over 45 minutes	5
ride refused	5

Source: Two-day sample collected by VTD dispatcher, January 11-12, 1978.



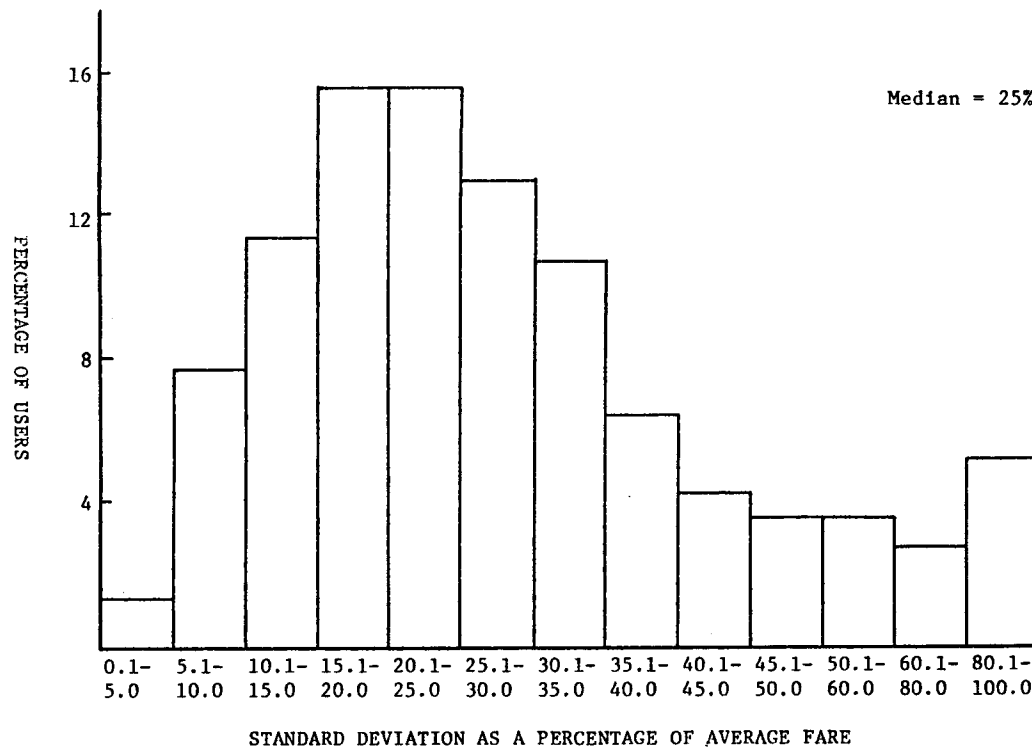
Source: Comparison of FAIRTRANR data on actual pickup times with ride slip data on promised pickup times for the first weeks in May and October, 1973 and 1974, a total sample of four weeks.

FIGURE 5-3

Difference Between Promised and Actual Pickup Time for Dial-a-Ride Service

Figure 5-4 represents the degree of variability in fares for identical trips for the same individual for the period when VTD used a variable fare structure. The ratio of the standard deviation to the mean fare is used to describe this variability, which was quite significant for a large number of users and is cited as a source of dissatisfaction with VTD in some surveys.

A final level of service variable, which is very important but for which no accurate data is available, is service availability. It is known that dial-a-ride service was available only one day per week outside the core area of the four towns from April, 1973, to June, 1974. Furthermore, contract and subscription services were taking essentially all available vehicles in the morning and evening peaks for this period and extending through the remainder of 1974. Thus, dial-a-ride service was, in fact, available only from 9 am to 3 pm, often with only two vehicles for the entire Valley, and rarely with as many as four. In 1975, more vehicles became available and as many as six operated in offpeak dial-a-ride service, with one to three subscription vehicles providing peak dial-a-ride service. In November, 1975, the number of offpeak dial-a-ride vehicles was reduced due to the initiation of fixed routes, but increased as the fixed routes were cut back. With the productivities of two or three passengers an hour that have been maintained through much of the demonstration, and making some approximate judgments on the number of vehicle-hours assigned to dial-a-ride service, it appears that ridership was supply-constrained from mid-1973 through early 1976.



Source: FAIRTRAN^R data, March 1973 - June 1974

FIGURE 5-4

Variability of Dial-a-Ride Fares

In summary, the dial-a-ride service level has been somewhat varied over the demonstration. The years 1973-1975 were marked by a shortage of vehicles, highly variable travel times and fares, indifferent reliability in pickup times and, based on reports from that time, fairly frequent service refusals. The years 1976-1977 have provided a better service level, with generally more reliable travel and wait times, and quite infrequent service refusals. In neither period does dial-a-ride service appear to be seriously competitive with making the same trip by auto, and in fact this is borne out in the demand data reported in the next chapter. However, this service level and the handling of primarily "captive" trips are not inconsistent with VTD's goals for dial-a-ride service or with the resources it has available.

5.2 VTD SUBSCRIPTION SERVICE

While most subscription service statistics are combined with dial-a-ride, independent estimates can be made of a few service components. Table 5-3 shows the VTD pickup time reliability as reported by users on the 1977 onboard subscription survey. It compares actual pickup and dropoff time on one day's operation with the rider's expected pickup and dropoff time. As can be seen, VTD performance is sharper on morning dropoffs than morning pickups; only 2.6 percent of all users were delivered to their workplace more than five minutes later than scheduled. The current reliability of subscription service pickup time is better than dial-a-ride/subscription performance in 1973-74; however, current dial-a-ride reliability is slightly

TABLE 5-3

VTD Subscription Service Time Reliability

	Percent of Trips
<u>Morning Pickup</u>	
more than 15 minutes early	10.0%
5-15 minutes early	11.2
0-5 minutes early	3.7
on time	66.2
0-5 minutes late	3.7
5-15 minutes late	2.5
more than 15 minutes late	2.5
<u>Morning Dropoff</u>	
more than 15 minutes early	6.3
5-15 minutes early	19.0
0-5 minutes early	16.5
on time	49.4
0-5 minutes late	6.3
5-15 minutes late	1.3
more than 15 minutes late	1.3

Source: VTD on-board subscription survey, January, 1977

better than subscription reliability. This appears to be due primarily to the lower load factors and productivity of the dial-a-ride service, which allow vehicles to maintain their tours better.

Table 5-4 shows the schedule delay of VTD subscription service, or the difference between the rider's promised morning dropoff time and his desired dropoff time, and similarly, between desired and promised afternoon pickup time. Approximately 15 percent of the subscription users were displeased with their pickup and dropoff times, while the remaining 85 percent found them acceptable.

In summary, VTD subscription service levels are comparable to dial-a-ride service levels. The median ride time is near 9 minutes; about 70 percent of the pickups are within 5 minutes of the promised time; and schedule delay is less than 5 minutes for about 65 percent of the users in the morning and for about 50 percent of the users in the afternoon. Again, this service level is not competitive with the user of a private vehicle; the largest difficulty the subscription service faces is that many intra-Valley trips are extremely short (only a few miles), and thus circuitry and time spent picking up or discharging other passengers forms a large proportion of travel time. The subscription service is currently operating near its practical capacity at a productivity of four to five passengers per hour, which is quite high for a low-density area like the Valley and a many-to-many operation. Currently, many potential users are not riding the subscription service because VTD cannot offer pickup or dropoff times that

TABLE 5-4

VTD Subscription Service Schedule Delay

	Percent of Trips
Difference Between Desired and Usual am Dropoff Time	
more than 12.5 minutes too early	11.9%
about 10 minutes too early	6.0
about 5 minutes too early	13.4
exactly at desired time	37.3
about 5 minutes too late	17.9
about 10 minutes too late	1.5
more than 12.5 minutes too late	11.9
Difference Between Desired and Usual pm Pickup Time	
more than 12.5 minutes too early	1.9 %
about 10 minutes too early	0.0
about 5 minutes too early	0.0
exactly at desired time	35.8
about 5 minutes too late	13.2
about 10 minutes too late	13.2
more than 12.5 minutes late	35.7

Source: VTD on-board subscription survey, January, 1977.

are at all near the potential user's desired times. VTD can only accommodate new subscription users if it can concentrate its services on fewer employers.

5.3 VTD CONTRACT SERVICE

Little data is kept to characterize contract operations, as there is no fare, wait time, call-in time, or schedule delay associated with them. The average passenger trip time is approximately 20 minutes. No data on reliability is kept.

5.4 VTD FIXED-ROUTE SERVICE

Little data is required for fixed route services either. Of fixed route users, 80 percent walk one block or less to the fixed route stop. All users of fixed route service are aware of the schedule, as one- and two-hour headways are operated on all VTD routes; thus, wait times are believed to be only a few minutes. No transfers ever occur between any of the fixed routes in the Valley. Schedule speeds on the fixed routes, as on all VTD services, are about 13 miles per hour. The routes are extremely circuitous, as shown in Figure 4-10, and serve very short trips; they are also not competitive with the use of a private auto.

6. IMPACTS ON TRAVEL DEMAND AND MOBILITY

6.1 OVERVIEW

This chapter explores the impacts VTD has had on both target population and general population travel demand and mobility from several perspectives. Section 6.2 presents data on the number of individuals who have registered and used VTD in both the target population and the general population.

Section 6.3 gives the demographic characteristics of VTD registrants and presents an analysis of which residents in the Valley registered for the service. This analysis tested several hypotheses on the effects of income, driver's license, auto ownership, household size, and VTD service level on the probability of an individual registering for service. These results, in turn, can be used to characterize the portions of the target population which VTD marketing and registration have penetrated, and can serve as an indicator of likely VTD impacts on travel patterns as well.

Section 6.4 summarizes VTD ridership by service type and population group, and presents information on origin-destination patterns, time of day of travel, and trip purpose.

Section 6.5 presents an analysis of VTD's impacts on the elderly population trip-making frequency and mode of travel. This analysis is based primarily on survey results, but also includes a travel demand model of trip frequency and mode choice. This model, similar to the registration model, is used to determine which demographic variables and service characteristics determine use of VTD by individuals. The model can also quantify certain of these effects and produce descriptive statistics called

elasticities¹ which represent the relative magnitudes of the effects studied. The model itself is presented in Appendix A; the elasticities are shown in Section 6.5.

Section 6.6 gives an overview of VTD's impacts on the general population through its subscription service. This impact is primarily on mode choice for work travel, but some information on the subscription service's impact on mobility is also available. As in the previous sections, most of the analysis is based on survey results, although a travel demand model was also used to make inferences on the key causal variables affecting users' decisions to travel on VTD.

Section 6.7 describes user attitudes and perceptions of VTD, based on several surveys throughout the demonstration, and Section 6.8 outlines some non-travel impacts of VTD, such as impacts on employment and senior center attendance.

Several definitions must be kept in mind throughout this chapter. A registrant is an individual (in either the target population or the general population) who holds a V-card. Registration is required only for dial-a-ride and subscription service; it is not required for contract or fixed-route service. A user is an individual who uses VTD at least once during the time period under consideration. Not all users are registrants, and obviously, not all registrants are users. A frequent or regular user is an individual who uses VTD once a month or more frequently; this is a

¹ An elasticity is the percentage change in travel demand (the dependent variable) caused by a 1 percent change in an independent (causal) variable such as income, travel time, etc.

natural definition that emerges from the monthly billing period. A nonuser is an individual who has not used VTD at all during a specified time period.

The three primary surveys used as data sources in this chapter were described briefly in Section 2.4. Summary tabulations of responses to these surveys are presented in Appendix B.

6.2 NUMBER OF REGISTRANTS AND USERS OF VTD

Figure 6-1 shows the relationship between registration and use of VTD for the target and general populations. The estimate of the size of the target population is described in Section 3.1, and the estimate of the general population over age 16 is drawn from 1970 Census data, from which the target population members are subtracted. The breakdowns between regular users, irregular users, and nonusers in each group are drawn principally from VTD billing records and FAIRTRAN^R data.

There are several estimates of the number of target group users of VTD, and Figure 6-1 reflects a composite number. FAIRTRAN^R records indicate that there were 1,245 users of dial-a-ride and subscription service from March, 1973, through February, 1974, VTD's first year of operation. In VTD's second year, from March, 1974, through February, 1975, there were 709 users of dial-a-ride and subscription services according to FAIRTRAN^R records. Reference 1 indicates that an additional 300 individuals used only contract services during these periods, resulting in between 1,000

Total Target Population (12,000)					
Regular Users 600 { 500 Elderly 100 Handicapped		Irregular Users 1,000 (Elderly)		Nonusers 10,400	
Registered 500 { 400 Elderly 100 Handicapped	Nonregistered 100 (Elderly)	Registered 800 (Elderly)	Nonregistered 200 (Elderly)	Registered 650	Nonregistered 9,750

General Population Over Age 16 (40,000)					
Regular Users 100		Irregular Users 0		Nonusers 39,900	
Registered 100	Nonregistered 0	Registered 0	Nonregistered 0	Registered 1,200	Nonregistered 38,700

Note: There are an additional 160 school children who are regular VTD users, and 60 individuals using the Sikorsky subscription/fixed route service, not included in the above figures.

Source: See text.

FIGURE 6-1

Relationship of V-card Holders to VTD Users and Non-users

and 1,550 users in each year.¹ Two hundred fifty of these users in the first year and 150 in the second year were members of the general population. Thus, between 850 and 1,300 target group members used VTD in each of the first two years.

The 300 contract-only users were primarily regular users and Table 6-1 shows that an additional 300 to 400 users were served by other VTD modes each month. Subtracting the 100 regular general public users of subscription service results in an estimate of approximately 600 regular target group users of VTD during the period March, 1973, through February, 1975. The total number of target group users over the two-year period is approximately 1,500.

For 1976 and 1977, different data sources on the number of users must be utilized, since FAIRTRAN^R was not operational. From October, 1976 through September, 1977, LNVCC data prepared with VTD for the Area Agency on Aging shows that 1,076 elderly users were transported on 31,059 trips using HEW Older Americans Act, Title III user-side subsidies, and an additional 522 elderly used the system either under HEW Older American Act, Title IV subsidies or without subsidies. Thus, a total of 1,598 elderly individuals were served across all VTD services. Another tabulation for the year 1977 shows 905 elderly users supported by Title III funds, and an estimated 250 other elderly users, or a total of 1,155. To both of these totals must be added 100 handicapped (VARCA) users to find the total target population users. Again, Table 6-1 shows approximately 350 users in the sample 1976 and 1977

¹ There was no fixed-route service during these periods.

TABLE 6-1

Distribution of Frequency of Use of VTD Subscription, Dial-a-Ride,
and Fixed Route Services for V-Card Holders

<u>Sample Months:</u>	Number of individuals taking, per month:									Total Individuals
	1 trip	2 trips	3 trips	4 trips	5 trips	6-10 trips	11-15 trips	16-20 trips	over 20 trips	
May, 1973	110	72	33	23	6	51	16	9	14 ¹	334
December, 1973	62	64	23	24	15	36	23	25	31 ¹	303
July, 1974	78	62	19	25	14	43	24	24	13 ¹	302
October, 1974	69	58	17	23	12	29	29	21	28 ¹	286
March, 1975	80	14	15	8	6	22	36	8	21 ¹	210
August, 1975	43	39	15	14	3	19	11	32	22 ¹	198
November, 1976	99	41	17	11	8	30	26	38	79	349
May, 1977	69	29	14	15	10	18	17	18	119 ²	309 ²

¹ This figure is not consistent with the number of subscription users reported for these time periods. It is believed that many of these individuals were not billed through FAIRTRAN^R due to use of non-FAIRTRAN^R equipped vehicles for subscription service and other problems with the billing system. The number of users making over 20 trips per month is believed to be approximately 100 during these periods.

² Excludes 60 individuals using Sikorsky service but not holding V-cards

Source: May, 1973 - August, 1975: FAIRTRAN^R records.
November, 1976 and May, 1977: Tabulation of monthly bills, prepared manually.
Fixed route services in operation only in 1976 and 1977.

months, 100 users being members of the general population. Approximately 300 additional elderly and handicapped persons use contract service regularly, making the number of regular target group users in 1976 and 1977 near 600, with approximately 1,000 additional infrequent (less than once per month) users.

Returning to Figure 6-1, the split between registrants and nonregistrants in each user and population group is shown. This split was estimated for frequent target population users based on the number of respondents to the home interview survey, all regular target group users who held V-cards. This same fraction, adjusted slightly downward, was also applied to infrequent target group users, based on interviews with VTD and LNVCC indicating this to be a good approximation. Finally, remaining target group registrants of the 1,950 total were nonusers. (The registered target population nonusers are composed principally of agency clients who were given VTD registration materials to complete, even though they had expressed no interest in using the system.)

For the general population, virtually all users are frequent users and are registered. While there were some infrequent users in 1973 and 1974, this category is not relevant for the years 1975 - 1977 and continuing beyond the demonstration, as this type of use by the general population is not encouraged by VTD. All general population registrants beyond the 100 subscription users are thus nonusers. The registered general population nonusers are primarily persons who registered in 1973 and 1974 when VTD dial-a-ride services were open for general public use. Many registered to use VTD as a backup to their usual mode of transportation; others registered to be able to use VTD during the fuel shortage of 1973 - 1974. Few actually used the system.

A final user category not contained in Figure 6-1 is schoolchildren. Since 1975, VTD has been transporting 40 handicapped children to public school and 120 non-handicapped children to private schools in the Valley. These 160 regular users are not discussed in the remainder of this chapter. They are classified as contract users, and the arrangement under which they are transported is discussed in Chapter 8.

6.3 REGISTRANT CHARACTERISTICS

There are currently 3,296 registrants, or V-card holders, in the Valley. Most (2,100) were registered in 1973, with decreasing registration in the following years. Registration is required for use of dial-a-ride and subscription services, and to be eligible for target group fares on fixed route services. However, it is not required for contract services, which make up two-thirds of VTD's ridership. For this reason, registration has not been emphasized greatly by VTD, and comparisons of its registration experience with other systems become difficult to make. As discussed in the previous section, the registrant pool and the user pool are quite distinct from one another.

The breakdown of current V-card holders by demographic characteristics is given in Table 6-2. VTD registrants are predominantly female, elderly, and low-income, living in a very small household and having little access to automobile travel. The "handicapped" category is very strictly defined in this summary, and includes only wheelchair users and others requiring considerable assistance to board or alight from the bus.

This profile strongly suggests that registration may be related to certain demographic variables. A model was constructed to test several

TABLE 6-2

Demographic Profile of Current V-Card Holders

Characteristic	Percentage
Sex: male	20
female	80
User group: elderly	57
handicapped	1
elderly and handicapped	1
student	3
general public	38
Annual income: less than \$2000	40
\$2000 - \$4000	11
\$4000 - \$6000	13
\$6000 - \$8000	10
\$8000 - \$10,000	8
\$10,000 - \$12,000	10
over \$12,000	9
Household size: 1	41
2	49
3	5
4	3
5 or more	2
Percentage with driver's license	38
Auto available: usually	20
sometimes	31
rarely	27
never	22

Source: V-card registration file, October, 1977, covering the period January, 1973 - September, 1977. Cards are not updated in this file, so that data is valid only at the time each individual registered; thus, income and perhaps other data does not reflect current levels. Sample size 3,296.

hypotheses about key variables and their influence. The model is based on data drawn from the V-card file for registrants, and on the nonuser target population mailback survey for nonregistrants. The model is given by the following equation:¹

$$p(R) = \frac{1}{1 + e^{-U_r}}$$

where:

$$U_r = 5.575 - 1.398 \text{ LIC} - 1.331 \text{ AO} - 0.795 \text{ HHS} - 0.419 \text{ LINC}$$

(30.39) (24.05) (20.66) (21.39) (7.14)

$p(R)$ = probability that an individual with given demographic characteristics holds a V-card

LIC = 0 if individual has no driver's license
1 if individual has driver's license

AO = number of automobiles owned or operated by individual's household

HHS = number of individuals in household

LINC = natural logarithm of annual household income, in dollars

(...) = "t" statistic values of the coefficients; a value over 1.96 is significant at the 95 percent level

This model predicts, for example, that an individual with no driver's license or automobile, living alone, and with an annual income of \$4,000, has a 79 percent probability of holding a V-card. On the other hand, an individual with a driver's license and a car, living in a two-person household with an annual income of \$8,000, only has an 8 percent probability of holding a V-card. In general, the probability of an individual's holding a V-card decreases with increasing auto ownership, increasing income, holding

¹ The model is estimated on 756 observations; the $\rho^2 = 0.45$, and the -2 log likelihood ratio is 6852.

a driver's license, and increasing household size. An attempt was made to include a measure of VTD service level and cost in the model to test the hypothesis that registration was affected by an individual's expected quality of service; thus, registration in central areas of the Valley best served by VTD might be higher than in outlying areas. However, this variable was insignificant. Table 6-3 summarizes the findings of the model.

The model indicates that VTD has penetrated the low-mobility market quite strongly in its registration effort, but that the proportion of elderly registered in higher auto ownership, income, or household size brackets is low. This is probably a result of the focusing of the marketing effort on social service agencies rather than a broader group and a greater need by lower-mobility individuals for VTD service. This pattern in registration is consistent with VTD's goals to provide service to the mobility-limited clients in the area; VTD feels it does not have the resources to attempt to attract "choice" riders to its services.

6.4 RIDERSHIP STATISTICS

6.4.1 Ridership by Service and Population Group

Table 6-4 gives a summary of VTD ridership by service type and by target group over the portion of the project for which data is available. Contract ridership has made up the bulk of VTD patronage throughout the project, with subscription service showing the next highest patronage. Fixed route service showed a moderate increase in the one-and-a-half years it operated; however, the jump in April, 1977, ridership is due to the introduction of the work trip service to the Sikorsky plant in

TABLE 6-3

Predicted Market Penetration of VTD Registration

	Percentage of Individuals Holding V-Cards In the Target Population					
	\$2,000		\$6,000		\$10,000	
Income:						
Household Size:	1	2	1	2	1	2
No Autos Owned, No License	83	69	76	58	71	53
One Auto Owned, No License	57	37	45	27	40	23
One Auto Owned, Possess License	24	13	17	8	14	7

6-12

Source: Registration model (see text)

TABLE 6-4

VTD Ridership Summary, 1974-77
(Monthly Ridership)

VTD Service:	1974		1975				1976				1977	
	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr
Contract	7439	7462	5791	7136	7955	9608	8446	8406	9913	10455	10338	9387
Dial-a-ride	834	688	513	484	463	541	448	535	604	633	601	458
Subscription	2760	2520	2244	2501	2320	2301	1563	2335	2678	3708	3862	3390
Fixed route	-	-	-	-	-	-	314	651	818	1068	1601	2902
All	11033	10670	8548	10121	10738	12450	10771	11927	14013	15864	16402	16137
Population Group:												
Elderly	4297	5504	3294	4518	4607	5117	5085	6464	5401	6636	6134	6763
Handicapped	3976	2600	2800	2920	3811	3034	2731	2472	5098	3064	2876	2724
Student	0	46	210	182	0	1808	1392	656	836	2456	3530	1244
General Public	2760	2520	2244	2501	2320	2491	1563	2335	2678	3708	3862	5406
All	11033	10670	8548	10121	10738	12450	10771	11927	14013	15864	16402	16137

6-13

Source: VTD weekly passenger count summaries by service type and sponsoring agency (for contract service). Data by service type given directly. Population group data derived as follows: General public ridership is all subscription, plus Sikorsky fixed route (data available separately). Handicapped ridership is all VARCA contract runs. Student ridership is all school contract runs. All remaining ridership (remainder of contract, all dial-a-ride, and all fixed route except Sikorsky) is elderly ridership. For weeks falling across two months (e.g., 3 days in April; 2 days in May), ridership is allocated proportional to the days in each month. Note that Sikorsky fixed route ridership is classified as "fixed Route" instead of "subscription" in April, 1977, the only month in this table in which the service was operating; it carried 2,016 trips.

Bridgeport;¹ ridership on the other remaining fixed route in April, 1977, had stabilized. Dial-a-ride services have carried a steady, minor fraction of VTD trips which are necessary and cannot be made on any other service.

Ridership in April through June, 1973, was approximately 8,000 per month: approximately 400 were subscription trips, 800 were dial-a-ride, and the remaining 6,800 used contract service. From July, 1973, through June, 1974, average monthly ridership was approximately 11,500, with 2,500 subscription trips, 800 dial-a-ride trips, and 8,200 contract trips.² In the remainder of 1974 and 1975, monthly ridership stayed just above 10,000, with about 2,500 subscription trips, 500 dial-a-ride trips, and 7,000 or more contract service. Near the end of 1976, ridership grew to 16,000 per month, with 3,500 subscription trips, 500 dial-a-ride trips, 2,500 fixed route trips, and over 10,000 contract trips. Thus, over the entire project, subscription usage has grown from 400 to over 2,500 trips per month; dial-a-ride has remained stable at 500 to 800 trips; contract use has slowly grown from 8,200 trips to over 10,000; and fixed route service has grown to over 2,500 trips.

The breakdown by user group shows that ridership by the elderly (including the elderly handicapped) constitutes nearly half of VTD's patronage; these trips are handled on all VTD services except subscription. The handicapped users are almost entirely VARCA clients attending a sheltered workshop; they are transported on VTD contract services and use the dial-a-ride

¹ This service is classified as a subscription service in the Chapter 4 discussion.

² 1973-1974 data drawn from Reference 1; it should be considered as an approximate estimate only, as noted in Reference 1 itself. No breakdown by population group is possible.

service for other trips as well. The student ridership was only carried on a significant scale starting in the fall of 1975; one-quarter of these schoolchildren are handicapped and all are transported on contract services. Finally, the general public uses the subscription services (including the Sikorsky service): this segment of the market has shown significant growth in 1976 and 1977 and now constitutes approximately one-third of the total ridership. This increase has resulted due to improved service reliability, expansion of services with the new vehicles received in 1975 and 1976, and increased public awareness of the service, both through a modest amount of advertising and word of mouth. The ridership data by population group is derived as discussed on Table 6-4; the error in these derivations is probably less than 5 percent.

As mentioned at the beginning of this chapter, VTD has had a highly variable impact on members of the target population. Of the three groups considered as part of VTD's target population (elderly, handicapped, and low-income), attention has been focused very strongly on the elderly. Service to the handicapped is mainly provided through contract services to the VARCA sheltered workshop; very little general use is made of VTD by the handicapped. Very few low-income individuals use VTD services as well, for at least three major reasons. First, there has been almost no marketing aimed at this group. Second, agencies such as the State Welfare Department and programs such as Medicaid have either been restricted from or are reluctant to subsidize client transportation on VTD.¹ Lastly, it is difficult for many low-income people to budget for VTD's monthly billing cycle, and a number of these users have been excluded from receiving further VTD service

¹VTD did obtain a Medicaid provider number in late 1975; \$600 of service was funded in 1976 through Medicare.

due to nonpayment of bills. Thus, the discussion of target group impacts is confined almost exclusively to the elderly, including those who may suffer from mobility handicaps or have low incomes. This elderly group makes up 71 percent of the total VTD target population shown in Figure 3-3. Of the remaining 1,000 handicapped individuals, about 100 are served through VARCA, and virtually none of the remaining 2,700 low-income individuals are served by VTD.

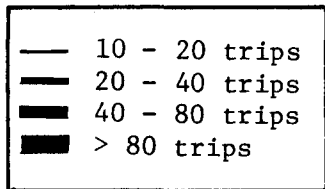
Seasonal variations in ridership include a jump in handicapped ridership during the summer due to an expanded outings program, and the usual summertime declines in subscription and school trips. Many exogeneous factors mask these trends in the past ridership statistics, but these trends should be more stable in future VTD operations.

6.4.2 Origin-Destination, Time of Day, and Trip Purpose Characteristics

Figure 6-2 shows the origin-destination trip pattern for the dial-a-ride and subscription services in the Valley. (FAIRTRAN^R does not distinguish between the two.) A strong orientation focused on the core can be seen. Figure 6-3 shows the approximate origin-destination pattern of contract trips, which are also strongly core-oriented. (Only an approximate pattern can be shown because the destination of some services, like senior shopping trips, varies weekly.) However, both patterns are dispersed enough and serve low enough travel densities as to make adequate fixed-route service difficult to provide. Also, trips are too short to use a dial-a-ride feeder with a fixed route system.

Note: Trip volumes shown are 2-way

H4 = Zone



Source:

FAIRTRAN^R data

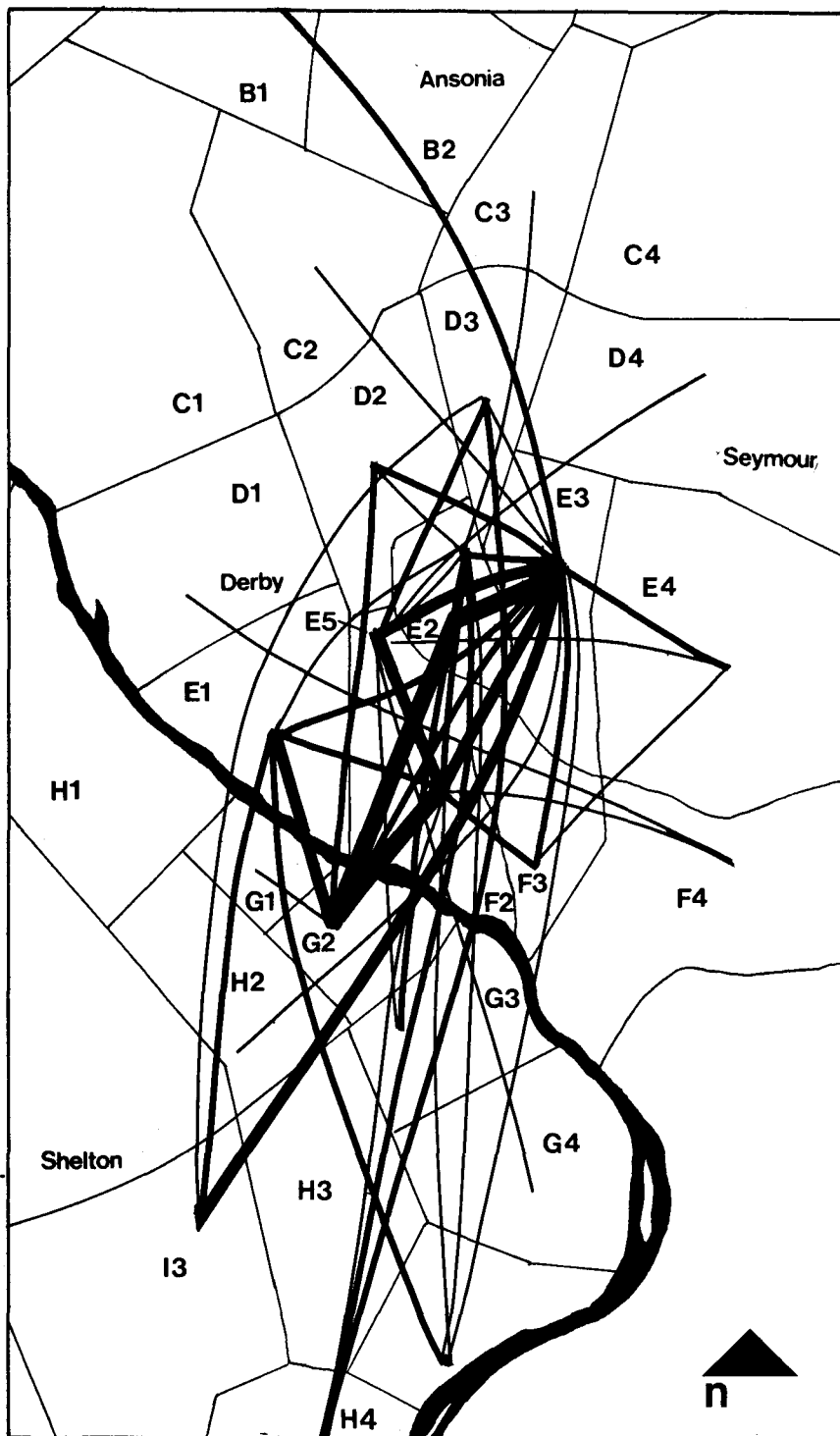
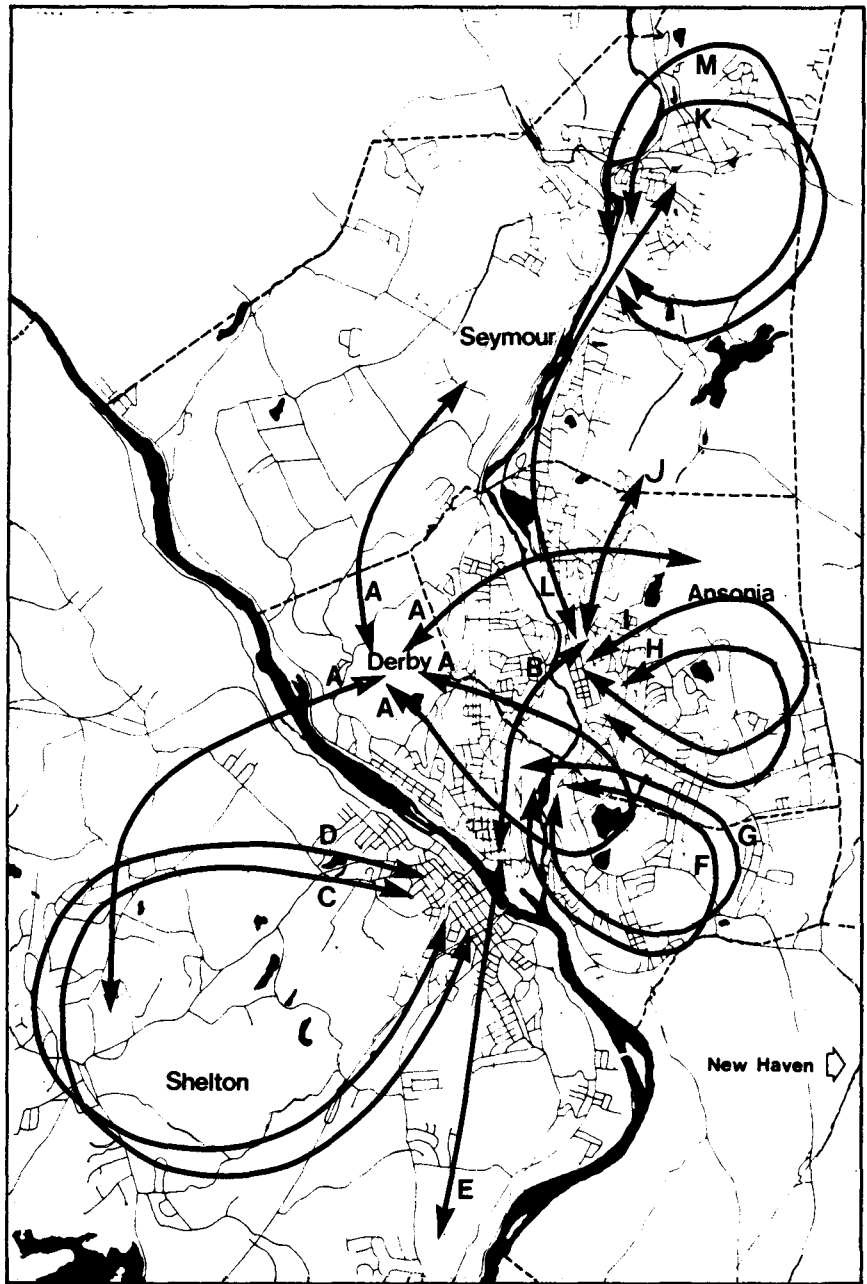


FIGURE 6-2

VTD Origin-Destination Flows,
Subscription and Dial-A-Ride Services
 (July, 1974)

SPONSORING AGENCY (monthly trips)	
A.	VARCA (2,600)
B.	Styger Terrace (100)
C.	Shelton Senior Center (810)
D.	Shelton Schools (430)
E.	Wesley Heights Housing (230)
F.	Derby Schools (680)
G.	Derby Senior Center (400)
H.	Ansonia Schools (270)
I.	Ansonia Senior Center (240)
J.	Woodlawn Apartments (130)
K.	Seymour Schools (2,100)
L.	Father Callaghan Housing (120)
M.	Seymour Senior Center (290)



Source: VTD weekly ridership counts; interviews with VTD staff to determine service pattern.

FIGURE 6-3

VTD Origin/Destination Flows, Contract Services
(May, 1977)

Figure 6-4 shows the variation in individual trip patterns that the origin-destination patterns include; it gives the number of different origin-destination pairs each customer travelled between in a year on dial-a-ride and subscription services. Many of the users travelling only between a single origin and destination are subscription users who use VTD for work trips only. A large proportion of VTD users travel to several destinations during a year, some to as many as 45. This is an indication that dial-a-ride service flexibility and area coverage is an important service feature to many users of the service.

Figure 6-5 shows the distribution of VTD ridership by time of day. Contract ridership is peaked sharply at 8 am and again at 3 and 4 pm with VARCA and school trips. Other contract ridership is spread more evenly over the day. Subscription ridership does not show sharp peaking, although most does occur during peak periods. Dial-a-ride patronage is highest during the midday period but is a small portion of the total.

Table 6-5 presents a summary of VTD trips on each service type by trip purpose. This delineates the focus of each service rather clearly. Subscription services are work-oriented, contract services are geared to group activities on a regular basis, and dial-a-ride handles medical and other non-regular trip needs. The proportion of medical trips as a fraction of total dial-a-ride use has steadily grown over the demonstration, and is currently well over 50 percent. The data in Table 6-5 represents an average over 1974 - 1977.

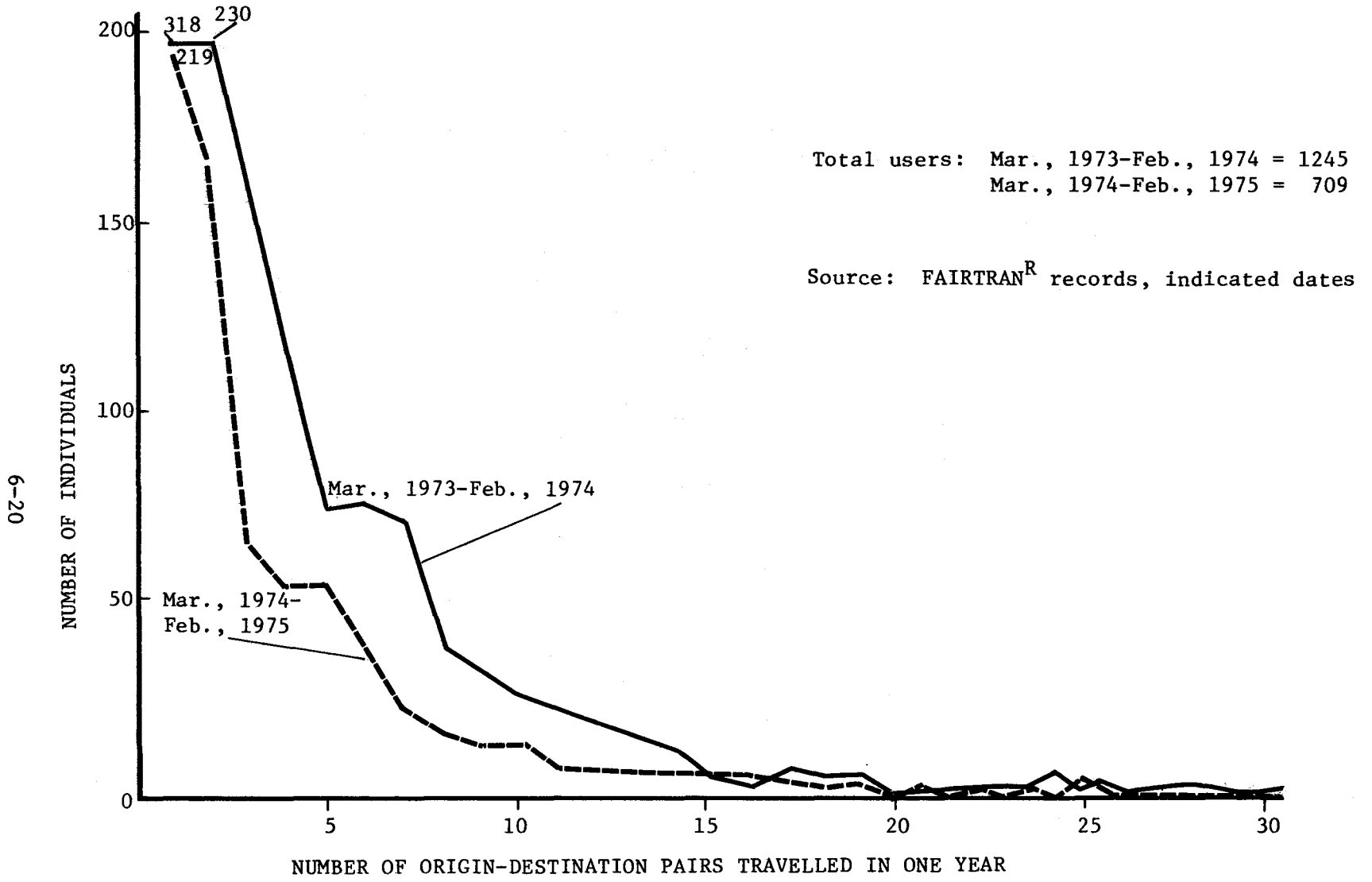
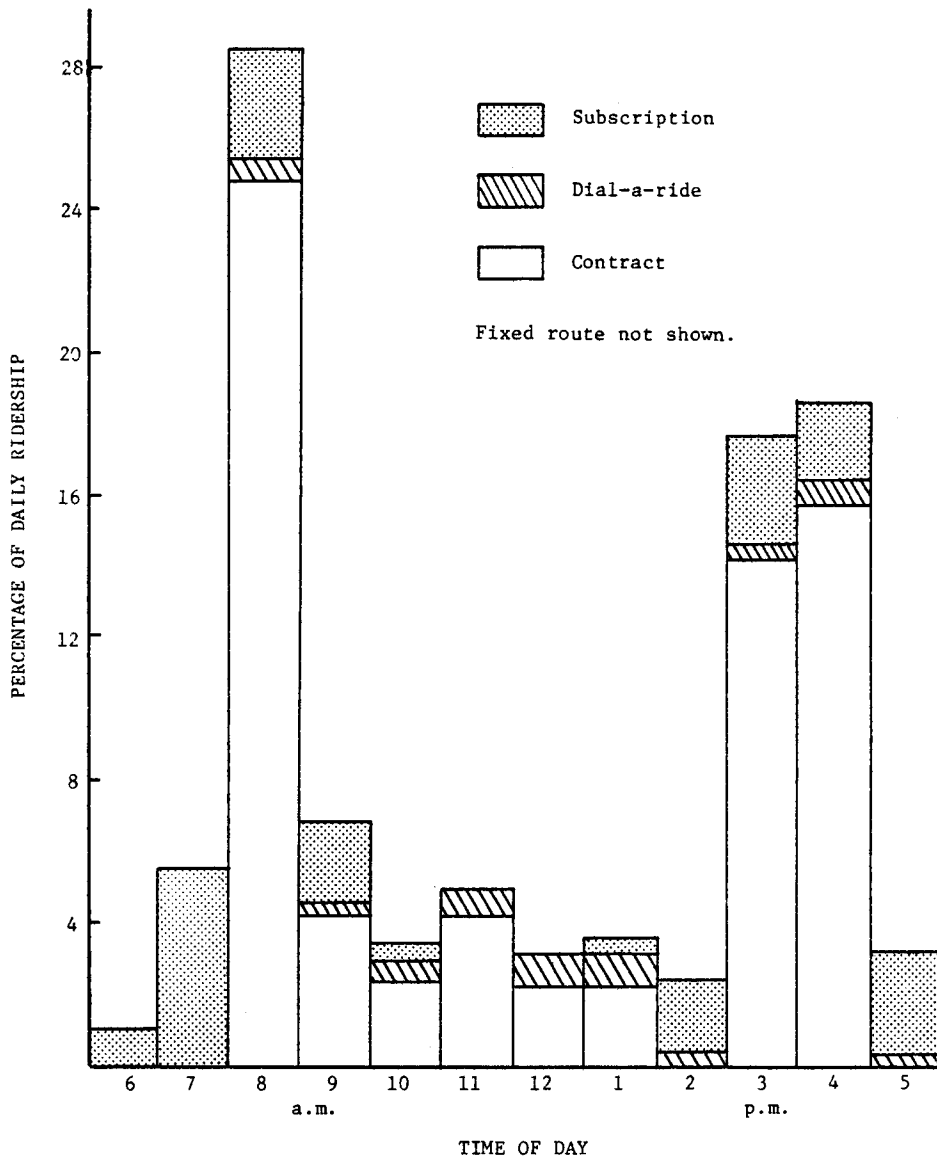


Figure 6-4

Number of Different Origin-Destination Pairs,
By User, By Year, for VTD Dial-a-Ride Service



Source: Contract service: VTD weekly ridership records and interviews with VTD staff to determine time of day service offered. Subscription and dial-a-ride service: analysis of one-week samples of ride slips from May and October, 1974-1977.

FIGURE 6-5

Distribution of VTD Ridership by Time of Day

TABLE 6-5

Summary of VTD Trips by Trip Purpose
(1977)

Trip Purpose:	Subscription	Contract	Dial-a-ride
Medical	0	0	35
Senior center	0	22	4
Social/recreational	0	0	16
Church	0	2	0
Shopping	0	9	45
Work	81	0	*
Sheltered workshop	0	34	0
School	14	33	*
Other or unknown	5	-	-
TOTAL	100%	100%	100%

* Less than 1%.

Source: Subscription: Onboard survey. Contract service: Analysis of VTD weekly ridership counts by sponsoring agency; purpose determined by interviews with VTD staff. Dial-a-ride service: Analysis of ride slip one-week samples from May and October, 1974-1977 with purpose deduced from trip destination and user by VTD staff; for the 25 percent which were still unknown, proportions were assumed to be the same as recorded in the onboard survey reported in Reference 1.

6.5 ELDERLY TRIP FREQUENCY AND MODE CHOICE

6.5.1 Demographic Profile of Elderly Users and Nonusers

Table 6-6 shows a comparison of the demographic characteristics of frequent elderly users and nonusers of VTD. Frequent users are those who travel on VTD at least once per month. The respondents in the survey make an average of eight trips per month on VTD, which is the average trip-making of frequent VTD users; thus, they are considered representative of this group. The table shows that females are even more disproportionately represented in the VTD users than in the VTD registrants. Incomes of users are low, as is household size, auto availability, and driver's licenses. Interestingly, the proportion with a mobility handicap (responding to a set of probe questions on the surveys) is similar in both groups, and is similar to the national level statistics (approximately 22 percent) for the elderly reported in Reference 24 and used to construct the estimated target group size.

6.5.2 Elderly Mode Choice

Transportation modes used by the elderly are shown in Table 6-7. For comparison, the modes used by the general public are also shown. Not surprisingly, the surveys indicated that auto (drive self and ride with others) is the most important mode of transportation in the Valley for all three groups for nearly all trip purposes. However, VTD users cited auto less frequently than nonusers did. This is reflected in the demographic information collected from survey respondents which shows that users have a lower level of auto availability relative to nonusers. As can be seen in Table 6-7, VTD users were given the option of naming more than one mode if they typically used more than one mode for a specific trip purpose. In fact,

TABLE 6-6

Demographic Profile of Elderly Population

<u>Characteristic</u>	<u>Percentage</u>	
	<u>Frequent VTD Users</u>	<u>VTD Nonusers</u>
Sex: Male	7	42
Female	93	58
Annual Income: less than \$2,000	50	13
\$2,000 - \$4,000	18	26
\$4,000 - \$6,000	15	24
\$6,000 - \$8,000	6	13
\$8,000 - \$10,000	12	11
\$10,000 - \$12,000	0	7
over \$12,000	0	7
Household Size: 1	48	25
2	48	51
3	1	15
4	1	7
5 or more	1	3
Percentage with Drivers License	8	62
Auto Availability: usually	4	{83}
sometimes	4	
rarely	0	{17}
never	92	
Percentage with Mobility Handicap ¹	20	20

All differences (except handicap percentage) statistically significant at the 99) confidence level.

Source: Users: Home interview survey. Sample size 83
Nonusers: Mailback survey. Sample size 76.

¹ As defined in Section 3.1

TABLE 6-7

Mode of Travel by Trip Purpose for Users and Nonusers of VTD

	Mode of Travel (percent of individuals using)						Total ¹
	VTD	Ride with Friend	Drive Self	Walk	Other Bus	Taxi	
<u>Elderly VTD Users:</u>							
Work	75	50	25	25	0	0	(175)
Medical	81	54	15	15	15	0	(180)
Social	45	83	17	0	5	0	(150)
Senior Center	85	33	19	33	5	10	(185)
Shopping	77	72	16	8	4	0	(177)
<u>Elderly VTD Non-users:</u>							
Work	0	17	67	17	0	0	100
Medical	0	24	70	3	0	3	100
Social	0	26	61	13	0	0	100
Senior Center	0	8	42	50	0	0	100
Shopping	0	17	70	11	0	2	100
<u>General Population VTD Non-users:</u>							
Work	0	7	91	3	0	0	100
Medical	0	5	96	0	0	0	100
Social	0	10	89	1	0	0	100
Senior Center	-	-	-	-	-	-	-
Shopping	0	4	94	2	0	0	100

Source: Users: Home Interview Survey; Non-users: Mailback surveys

¹ Since most VTD users cited more than one mode, percentages will total more than 100. In the case of non-users, respondents indicated only one mode and percentages will therefore total 100.

nearly all VTD users cited another mode as well, which they used on a typical basis. If VTD were not available, and individuals fell back to using their alternate mode only, Table 6-7 gives a fairly good idea of what the resulting mode splits would be, since the total minus the VTD share is near 100 percent for VTD users for all trip purposes. The use of non-VTD modes can then be compared across all three groups shown in the table to get a sense of the relative mobility of each. Between 33 and 83 percent of elderly users rely on rides with friends or family, depending on trip purpose, as opposed to 8 - 26 percent of elderly VTD nonusers, as opposed to 4 - 10 percent of the general population. Only 16 - 25 percent of elderly VTD users would drive themselves, as opposed to 42 - 70 percent of other seniors, and 89 - 96 percent of the general population. From 8 - 33 percent of VTD users would walk, as opposed to 3 - 17 percent of nonusers, and only 0 - 3 percent of the general population. From 4 - 15 percent of VTD users would use other bus services, where none of the other groups use this mode. Up to 10 percent of VTD users would use taxi, as opposed to up to 3 percent of elderly nonusers, and no use by the general public. This comparison shows that VTD users as a group are considerably less mobile than the other groups if VTD service were not available since they rely much more heavily on rides, walking, other bus services, and taxis than the others.

VTD's overall mode share of the elderly travel market is shown in Table 6-8. It carries a very large portion of senior center trips, and smaller but still significant shares of other trip purposes. It is interesting to note, from Table 6-7, that VTD users have less attractive

TABLE 6-8

VTD Mode Share of Elderly Travel

Trip Purpose	Estimated VTD Mode Share		Estimated Number of Weekly Round Trips	
	Survey	Actual	Total	VTD
Senior Center	27%	25%	2400	600
Medical	2	1	3000	30
Shopping	4	3	11300	320
Social	1	1	4200	25

Source: Mode share (survey): User (home interview) and nonuser (mailback) surveys, weighted to correct for different sampling rates.

Mode Share (Actual): For senior centers, actual data is available. For other purposes, total trips were estimated by applying weekly trip rates found in surveys to the user and nonuser groups. VTD trips by purpose were derived from VTD weekly ridership counts, to which the trip purpose splits in Table 6-5 were applied in cases where the purpose was not known.

Trips (Total and VTD): See above description; work trip data not shown due to overlap with general population.

alternate modes (walk, taxi, other bus) for senior center trips than any other trip purpose; this is consistent with VTD's high mode share in this market. It is possible that senior center trips are not considered essential enough or occur too frequently to ask for a ride from another person, or that rides from other seniors are simply not available; other trip purposes do involve members of other age groups. These issues will surface again in the discussion of elderly trip frequency impacts of VTD, particularly for senior center trips, on which VTD seems to have had a very large effect.

The key issue which all these statistics raise is, why does VTD compete very well in the senior center travel market but less well in other areas, particularly medical trips. It is possible that the socioeconomic characteristics of senior center attendees are different than those of the other travel markets, or that the VTD service levels for senior center trips (served by contract mode) are different than for other trips (served by dial-a-ride and contract modes). Also, no fare is charged for senior center trips. To address these issues, a model of mode choice was calibrated which is reported in Appendix C.

The results of the model are summarized in Table 6-9, which shows the elasticities of mode choice by the elderly derived from the model. Choice of mode in the Valley could not be statistically related to travel time and cost. This was not unexpected, as travel time and cost differences for the short trips in the Valley are not large, and other factors which either do not vary over the population (e.g., VTD call-in time) or are unmeasurable (e.g., effects of past VTD unreliability) and cannot be included in the model have large impacts on mode choice. VTD use for senior center trips

TABLE 6-9

Elasticities of Mode Choice by the Elderly

With respect to:	Trip Purpose			
	Senior Center	Medical	Shopping	Social/ Recreational
Household income	-3.0	-0.2	-0.4	-0.1
Auto Ownership	-0.7	-0.05	-0.1	-0.03
VTD Service Level	*	*	*	*
Auto Service Level	*	*	*	*

* Insignificant

Source: Mode Choice Model (Appendix C)

is sharply affected by income and auto ownership, with low income, low auto ownership individuals using VTD heavily. VTD use for shopping is less affected by auto ownership and income, though there is still significant use by low-income individuals. Finally, medical trips and social trips are affected little by income and auto ownership, with even low-income and low auto ownership individuals using modes other than VTD. Thus, VTD is serving the portions of its market with the least mobility, indicating that trip generation may be as important an issue as mode choice. This is addressed in the next section.

6.5.3 Elderly Trip Frequency

As shown in Table 6-10, the surveys indicated that nonuser individuals of the general population make 2.8 times as many trips as senior nonusers and 2.5 times as many trips as senior VTD users.¹ Senior VTD users make 1.1 times as many trips as nonuser seniors; however, as can be seen in the table, this is due to the large number of senior center trips made by frequent VTD users. If senior center trips are excluded from the tripmaking of both groups, nonuser seniors make 1.35 times as many trips as senior users. The sample sizes on which these estimates are based are too small to draw firm comparisons of senior users and nonusers, especially with the

¹ User tripmaking to senior centers was adjusted because application of the 1.62 trip rate to the 500 regular VTD users yielded a weekly senior center rideship of 800, as opposed to the 600 actually recorded. Thus, the trip rate value was reduced to 3/4 of the survey value, or 1.21. This overestimate occurred because early information used to select the user sample was incorrect and led to choosing too many senior center users, and because the response rate of senior center users was higher than other VTD users.

TABLE 6-10

Elderly Tripmaking Frequency

(Average number of round trips/week)

Trip Purpose	Regular Senior VTD Users (83 Respondents)	Senior Non-User (76 Respondents)	General Population Non-User (133 Respondents)
Work	.39	.22	3.87
Medical	.12	.36	.16
School/training	.01	-	.42
Social/recreation ¹	.30	.52	1.09
Senior Center	1.21	.28	-
Shopping	.98	1.33	1.96
Average Number of Round Trips/Week	3.00	2.71	7.50

Source: Users: Home interview survey, adjusted for oversampling of senior center trips

Nonusers: Mailback surveys

¹

Surveyors noted a reluctance by regular VTD users to disclose social trips, perhaps because they feared that they would not be considered mobility-limited or in need of VTD if they reported substantial social travel; thus, this figure may be an underestimate for regular elderly VTD users.

very high variability across individuals of trip rates (see Appendix B, Figures B.1 - B.6). There is a significant difference between elderly and non-elderly trip rates, but even this is greatly diminished if work travel is excluded.

Certainly the estimates in Table 6-10 appear to show that elderly user travel is similar to elderly nonuser travel. How much this is due to VTD is difficult to assess. A before/after study with data collected in January, 1973, and January, 1974, is reported in Reference 9. (January, 1973, was before VTD service to the elderly had begun, and January, 1974, was the ninth month of system operation.) The fuel shortage of the winter of 1973-1974 obscured any change due to VTD, however, as total tripmaking by all groups declined. Even the baseline January, 1973, travel information is unusable as one-way and round trips are mixed together. Approximately four trips (presumably the majority were round trips) per week were recorded for the elderly in January, 1973.

By the time the present evaluation effort began in late 1976, the opportunity for further before/after measurements had passed, as the system had been in operation almost four years.¹ A set of questions was, therefore, designed in the home-interview survey to ask users how their current travel would be affected if VTD were no longer available. Table 6-11 shows the responses to these questions. Medical tripmaking is the least affected by VTD, with 90 percent of users continuing to make all trips even without VTD. Social, senior center, and shopping trips would all be

¹ Furthermore, the original 1973-1974 survey data had been lost, eliminating the opportunity to follow up on the 1973 data, even if certain corrections could have been made in it.

TABLE 6-11

Self-Reported Impacts of VTD Service Availability on Regular Senior User Tripmaking

Trip Purpose	Estimated Number of Regular Users Making Trips for This Purpose		Percent of Respondents Using VTD That Would Make None of These Trips Without VTD	Percent of Respondents Using VTD That Would Make Fewer of These Trips Without VTD	Percent of Respondents Using VTD That Would Make the Same Number of These Trips Without VTD	TOTAL
	By Any Mode	By VTD				
Work ¹	48	36	50	0	50	100
Medical	156	126	5	5	90	100
Social/ Recreational	120	54	60	10	30	100
Senior Center	366	312	35	27	39	100
Shopping	414	318	29	29	42	100

Source: Home interview survey. Note that percentages in columns 3, 4, and 5 are applied to the number of VTD users in column 2, not the total number making trips (column 1). Also note that use of VTD (column 2) may be infrequent for any one purpose.

¹

Based on a very small sample; only 8 respondents in the home interview survey made work trips.

affected to a larger degree, with 29 to 60 percent of users not making any of these trips, and an additional 10 to 20 percent making fewer trips.

Table 6-12 shows the same responses, weighted by the tripmaking of each individual. For the 500 regular elderly VTD users, the self-reported decline in tripmaking over all purposes (except work) is 27 percent. This figure is strongly weighted by senior center and shopping trips. For senior center trips, the estimate may be plausible because of the lack of good alternative modes mentioned earlier, and also because senior center transportation has been provided for ten years or more by Valley centers, the service having predated VTD. Many users, it is certain, do not consider other alternatives for travelling to the senior center. For shopping trips, the reasons for a sharp decline are less clear, but the dominant alternate mode to VTD is to receive a ride from a friend; walking and "other bus" are clearly less useful for shopping trips than for other purposes. This lack of alternatives, plus the relatively large amount of shopping service provided by VTD for a long period, may again lead users to feel that their tripmaking would decrease if VTD service were not available.

For all senior VTD users, both regular and infrequent, total tripmaking is estimated to decrease by 12 percent if VTD were not available, again weighted heavily by senior center travel. Finally, for all elderly, a 2 percent drop in total travel would result. The home-interview surveys also indicate that VTD has a significant impact on the perceived tripmaking ability of VTD target population users. When asked "how much harder would it be for you to get around if VTD weren't available" of regular users, 60 percent said "very", 29 percent said "somewhat", and 11 percent said "not at all".

TABLE 6-12

Self-Reported Impacts of VTD Service Availability
Applied to Total Senior Tripmaking

Trip Purpose: ¹	Regular VTD Users			All (Regular and Infrequent) VTD Users			All Elderly (Users and Nonusers)		
	Total Trips (all Modes)	Number Not Made with- out VTD	Percent Not Made with- Out VTD	Total Trips (All Modes)	Number Not Made with- out VTD	Percent Not Made With- out VTD	Total Trips (all Modes)	Number Not Made with- out VTD	Percent Not Made with- out VTD
Medical	60	2	3	420	2	0	3000	2	0
Social/ Recreational	150	14	9	670	18	3	4200	18	0
Senior Center	600	230	38	880	288	33	2400	288	12
Shopping	500	107	21	1830	134	7	11300	134	1
TOTAL ²	1310	353	27	3800	442	12	24870	442	13
NUMBER OF INDIVIDUALS	500			1,500			8,500		

6-35

¹ Units are weekly round trips

² Excludes work, school, and training trips because sample size is too small to make any projections

Source: Home interview survey. Total trips developed by applying trip rates (Table 6-10) to number of individuals in group. Percentage of trips not made by regular VTD users found directly from survey tabulation, assuming that "fewer" means "half" as many trips on the average and by assigning each user the average number of weekly VTD trips implied by Table 6-8. For infrequent users, their percentage was computed by assuming they would not make the same proportion of trips on VTD as frequent users. Since infrequent users take fewer VTD trips, the percent reduction in their total tripmaking is less. This assumption is probably an overestimate of the tripmaking decrease for infrequent VTD users since they probably have better alternate modes than regular VTD users. Regular and infrequent users are added to obtain the middle column in the table. Nonusers are assumed not to be affected by VTD availability at all; they are added to the last column.

While these survey responses are strongly indicative of VTD's impact on user tripmaking, they are based on user responses to hypothetical questions. To further explore the impacts of VTD on elderly trip frequency, a model was estimated that attempts to explain the current, observed travel behavior of VTD users and nonusers in terms of the relative auto availability, costs and travel times of auto and VTD, income, and other characteristics that influence travel behavior. Then the model could be used in a predictive sense with VTD removed as an alternative to quantify VTD's impact on tripmaking in a manner more directly tied to observed experience. The model is a regression using individual level data, and is reported in Appendix C. The results of the model can be seen in Table 6-13, which shows the elasticities computed from it. A key finding is that senior center trips by all modes decrease sharply with income, presumably as other social activities are substituted. Shopping trips are inelastic with respect to income, apparently reflecting that a basic number of shopping trips needs to be made by all people. Also, higher-income people can possibly afford to have articles delivered; and some low-income elderly may be forced to shop frequently due to lack of a vehicle to carry large purchases or possibly even lack of storage or refrigeration for perishables. Interestingly, medical and social/recreational trips show the same elasticity with respect to incomes. Apparently, income does influence the number of medical trips made by individuals. One expects social/recreational travel to increase with income, even more so since senior center travel is decreasing with income.

TABLE 6-13

Elasticities of Total Tripmaking by the Elderly

With Respect to:	Senior Center Trips	Medical Trips	Shopping Trips	Social/ Recreational Trips
Household income	-2.40	.26	.02	.26
Auto ownership	.48	1.13	.29	.79
Household size	.83	.85	.23	.59

Note: Elasticities computed at mean value of all variables:

Household income	\$7400
Auto ownership	0.90 autos/household
Household size	2.22

Source: Elderly trip frequency mode (Appendix C)

The pattern of tripmaking responses with respect to auto ownership is striking. Medical tripmaking is very elastic with respect to auto ownership, followed by social/recreational travel, which would have been expected a priori to be the most elastic since it is the least necessary. Senior center and shopping trips are relatively less sensitive to auto ownership, although all four trip types are strongly impacted by auto ownership.

Household size most strongly affects senior center tripmaking, with these trips increasing as household size increases. Apparently members of two-person households make more senior center trips than members of one-person households; why this is so is not immediately obvious. Medical tripmaking is similarly affected by household size; possibly the presence of a second person to assist allows the taking of such trips where otherwise the medical services would either not be sought or would be delivered at the home.¹ Other trip purposes are less sensitive to household size.

Level-of-service variables were incorporated in the model in a constrained manner because of the difficulty of relating them statistically to observed travel; the values were chosen based on elasticities estimated from FAIRTRAN^R data and responses to other survey questions. (These estimates are discussed in Section 6.5.4.) Even with large coefficients, however, total tripmaking elasticities for the elderly population as a whole with respect to VTD service levels are small due to the small share of the market served by VTD. Only for senior center trips would changes in VTD service level have significant implications for the elderly group as a whole.

¹ The survey on which these models are based did not ask questions about the frequency that services (e.g., medical, shopping) are delivered at people's homes in substitution for travel by the people. This would be an interesting topic for future surveys.

The frequency model was then used to predict the change in tripmaking that would occur if VTD service were not available at all to elderly Valley residents. This model, based on current actual behavior, is used to corroborate the changes in behavior self-reported by respondents on the survey and tabulated in Table 6-12. With VTD removed as a travel option, the generalized cost of travel¹ changes for each individual, for each trip purpose, and a new trip frequency is predicted. The change in generalized travel cost is greatest for the most frequent users of VTD, since the implied utility of VTD is the greatest for them. The results of this analysis show that the average weekly tripmaking of the 500 regular VTD users would decline 32 percent from 3.0 round trips per week to 2.0 round trips if VTD were not available.² This is quite consistent with the self-reported decline of 27 percent from 3.0 to 2.2 trips per week; no large deviations between the model results and the self-reported results occurred in the aggregate predictions of tripmaking change for any trip purpose. However, a chi-square test done on the correlation at the individual level between self-reported and model-predicted changes in trip frequency by trip purpose was significant only at a 64 percent confidence level. Thus, while model results corresponded

¹ The generalized cost of travel is the time and fare by each mode collapsed into a single "cost" variable; for each individual, his/her generalized cost is the sum of the costs of all modes available to him/her, weighted approximately by their probability of use.

² The model was actually run on the uncorrected VTD user trip rate of 3.4 trips per week (as reported in Appendix B), before the oversampling of senior center trips was corrected, which brought the trip rate down to 3.0. It predicted a decline from 3.4 trips to 2.3 trips if VTD were unavailable, a 32 percent decrease. This same approximate decrease would be expected from a base trip rate of 3.0, resulting in a trip rate without VTD of 2.0.

with survey responses, there is still a large amount of variability at the individual level which is not captured in the model.

To sum up this section, the models and surveys have provided estimates of the impacts of service availability and socioeconomic variables on the tripmaking patterns of the elderly in the Valley, and how tripmaking has been affected by VTD. The models indicate that auto ownership, household size, and income still affect travel very strongly, which means that VTD's service has not achieved broad improvements in mobility. However, it has produced significant improvements for the low-mobility segments of the elderly population, and the models have allowed the evaluation to quantify this impact.

6.5.4 Elasticity of Demand with Respect to Service Levels and Fares

While the survey and model efforts described in the previous sections were able to offer many insights into elderly travel demand, they were unable to provide much information on the impacts of VTD service level on demand. This result was anticipated, and alternate means of obtaining these estimates were developed. Several further questions on the home interview survey were designed to yield estimates of tripmaking elasticities, and time series FAIRTRAN^R data on ridership was also analyzed to determine demand responses to service changes. Table 6-14 shows these additional results.

An elasticity with respect to advance request time was computed from responses to a survey question on how many more trips the respondent would make if the lead time were reduced from two hours to one-half hour. While this estimate is based only on an answer to a hypothetical question, it gives some idea of the sensitivity of this variable which cannot be examined

TABLE 6-14

Elasticity of VTD Demand with Respect to
Selected Level-of-Service Variables

Elasticity of VTD Demand With Respect to:	
Advance request time (30-120 minutes)	-.15 to -.42
Door-to-Door service fare ¹ (75¢ - \$1.00 range)	-.72 to -1.20
Contract service fare (25¢ - 50¢ range)	-.15 to -.34

Source: Analysis of home interview survey responses

¹
Analysis of home interview survey responses yielded an estimate of -.72 to -1.20; analysis of 1973-1975 FAIRTRAN^R data gave an estimate of -.73 to -.87.

in any other way. An elasticity of $-.15$ to $-.42$ is quite low and indicates that a 75 percent cut in call-in time (from two hours to a half-hour) would produce between a 12 percent ($.75 \cdot .15$) and a 31 percent ($.75 \cdot .42$) increase in dial-a-ride usage. This is a relatively small change, but it can also be made at very low cost and thus may be worthwhile to make. Members of the general public or elderly nonusers may be more sensitive to this parameter than the elderly users on whose responses this estimate was made, since they are generally more service sensitive.

A similar question on the user survey asked the response to the introduction of a 50 cent fare for contract service, which is currently free. The elasticity reported in Table 6-14 is based on an average fare of 25 cents (the average of 0 and 50), as elasticity (or percentage change) is undefined with a zero fare. This elasticity is quite low also, indicating that ridership would not decrease greatly with the introduction of a fare. Approximately 23 percent of elderly contract ridership would be lost by instituting a 50 cent fare.

Yet another survey question probed the elasticity with respect to dial-a-ride fare. This was found to be quite high, by contrast. An elasticity greater than 1 in absolute value means that a fare increase would reduce patronage sufficiently that revenues would fall also. The survey indicates that VTD dial-a-ride fares are in this range, and that any increase would likely be counter-productive. However, the current fares appear to be near the revenue-maximizing point, and thus decreases in fare are also likely to reduce revenues.

FAIRTRAN^R data on VTD trips and fare levels for all origin/destination pairs was used for the years 1973-1975 to obtain another estimate of this elasticity. By assuming a very simple hypothesis that VTD trips were a function of the number of elderly V-card holders in each zone and the fare to other zones, with travel times, service availability, and other modes remaining constant, a time-series model of VTD ridership by origin-destination pair as VTD fares varied could be built. (These fares did vary due to changes in the pricing algorithm and its built-in variability.) This model yields an estimated elasticity of $-.73$ to $-.87$, again quite high and corroborating the survey results.

Travel times on the system are short enough that it is unlikely that large changes could be made in them, or even if there were large changes, that demand would change much. Other variables such as reliability and service availability could not be addressed in a quantitative fashion.

As a final note on this section, it is difficult to interpret these elasticities as either mode choice or trip frequency elasticities: they are likely to be a combination. In the FAIRTRAN^R data, it is not known whether trips lost to VTD through fare changes, for example, were made by another mode or not made at all. In the survey data, questions on "how much more or less would you use VTD if..." have a similar ambiguity. However, these estimates are still useful in determining the level of service variables that are most critical to travel demand decisions.

6.6 IMPACTS OF SUBSCRIPTION SERVICE ON GENERAL PUBLIC TRAVEL BEHAVIOR

Table 6-15 summarizes the demographic characteristics of VTD subscription users as compared to nonusers of VTD in the general population. The demographic profile of nonusers reflects only those who could possibly use VTD subscription service, as nonuser surveys were sent only to individuals who both live and work in the Valley. As with the elderly population, the VTD users have low incomes, low auto availability, and come from smaller households in general, although there is a significant group from very large households.

Subscription service currently carries approximately 150 of the 30,000 daily intra-Valley work trips. Of the remainder about 20,000 are auto drivers, 5,000 are auto passengers, and 5,000 walk. About 100 individuals use subscription service regularly, with some not travelling every day and others only using VTD one way. Approximately 60 other individuals use the VTD Sikorsky service for their work trips from the Valley to the plant in Bridgeport.

VTD service has an impact on the tripmaking ability of subscription users. Twenty-one percent of the respondents to the subscription survey said they wouldn't be able to make this trip without VTD; 32 percent would have to rely on a friend or relative for a ride; 18 percent would walk. At present, VTD has little impact on auto ownership (3 percent said they would purchase another car if VTD service were not available to them).

A statistical model similar to the one calibrated for elderly mode choice was calibrated for general population subscription use. This model sought to determine whether use of subscription service was related to

TABLE 6-15

Demographic Characteristics of Users and Nonusers of
VTD Subscription Service (1977)

Characteristic	Percentage	
	VTD Users	VTD Nonusers
Sex: Male	9	49
Female	91	51
Annual Income:		
Less than \$2000	12	1
\$2000-\$4000	7	3
\$4000-\$6000	26	3
\$6000-\$8000	21	5
\$8000-\$10000	12	10
\$10000-\$12000	14	20
Over \$12000	7	58
Household Size:		
1	22	9
2	42	28
3	6	25
4	3	19
5 or more	28	20
Percentage with Drivers' Licenses	33	93
Auto Availability:		
Usually	9	{ 98 }
Sometimes	42	
Rarely	26	{ 2 }
Never	23	

Source: Users: Subscription onboard survey; Sample size 80
Nonusers: Mailback survey; Sample size 133

certain demographic variables, VTD and auto service levels, or location in the Valley.

The model is shown in Appendix C. Three modes are included: VTD, drive alone, and shared ride as either a driver or passenger. The model shows that auto ownership, possession of a driver's license, and income are strong factors in the choice to use an auto mode. Also, travel time has a very high coefficient, which will again favor the auto modes. Travel cost is the least important of the variables in the model.

These results should be used with caution, as the elasticities derived from this model are very large, in general; while they reflect a significant relationship, the estimate of the magnitude of the relationship is probably confounded with several effects not in the statistical model, but known from other sources to have a large impact on subscription use. For this reason, estimates of elasticities are not presented, and even the qualitative relationships discussed above, while indicative, are not certain.

The model cannot be regarded as a good indicator of VTD ridership potential, because of several considerations. The primary consideration is that unmeasured attributes such as service availability and reliability very strongly influence VTD subscription ridership and yet are not captured in the model. Lack of service availability (discussed in Section 5.2) is reflected in VTD's inability to offer reasonable pickup and dropoff times to potential new users during peak periods because current service is operating at its practical capacity. While no records are kept, a substantial number of potential users have not been accommodated, and some users who tried the service with less-than-desirable pickup and dropoff times soon gave it up. Reliability, as described in Section 5.2, is also a significant

problem with the service. Thus, subscription service as presently operated by VTD is capacitated; much demand that would be attracted to the service at the existing measured service level simply cannot be handled, nor can the existing service level be provided to new users. These effects cannot be incorporated in the statistical model; thus the statistical analysis is of limited validity.

To sum up, it appears from an examination of user and nonuser demographic characteristics, supported by limited statistical analysis, that VTD subscription service is serving primarily autoless, low-income individuals without drivers' licenses, and that these are the prime determinants of use. The statistical analysis also suggests that for trips as short as typical Valley work trips (ten minutes mean time), individuals are unwilling to pay a time penalty (as shown by a high coefficient on time) to achieve some cost savings by using transit (as shown by a low weight on cost). VTD's subscription level of service is not sufficient to attract individuals with autos available; only 9 percent of subscription users responded that they had a car usually available for their work trip. However, it is an adequate service for those without autos, providing access to employment and schooling.

6.7 USER ATTITUDES AND PERCEPTION OF VTD

While user/nonuser demographic characteristics and VTD service levels and availability are treated as the basic determinants of VTD's impact on tripmaking and mode choice in this evaluation, there is also a set of more subjective factors that can add insights into these impacts. For example, reactions to vehicle design, FAIRTRAN^R billing, or driver courtesy could affect use of VTD by a significant number of people. This section explores some of these issues.

At the beginning of the project, in discussions with user groups in the Valley, it was clear that FAIRTRAN^R was treated with some misgivings. Not only does one pay with a credit card (something many of the elderly may not have had before), but the cost of the ride is not known until the bill arrives perhaps a month later. When the bill does come, the same ride taken by an individual may cost different amounts on different days. A market survey was done in April, 1973, shortly after inauguration of door-to-door service to examine this issue. The survey was administered to members of senior groups who were familiar with VTD at least through a slide presentation. Of 144 respondents, 33 percent did not use VTD; about 20 percent of this group did not like the fare system. Of those who did use the bus, 23 percent did not like the fare system. All told, 21 percent of the total sample had some objection to the fare system.

In early 1974, an onboard survey was conducted among users of the VTD demand service. Two questions related to attitude toward the FAIRTRAN^R system. One question asked, "What would help you take more rides on door-to-door service?" The ninth most important response to this question was "go back to coin fare", with the equivalent of one out of five people rating this factor very important. The second question asked for an annoyance rating of various features of the bus service. In this case, the second most important response was "not knowing exact fare when riding", with the equivalent of one out of fourteen respondents citing this as very annoying.

User response to monthly billing versus coin fare was again examined in the surveys conducted in early 1977. A key difference in the current billing system from the earlier one is that fares are fixed and known beforehand. Of the 83 respondents in the survey of senior VTD users, only

22 percent preferred monthly billing, while another 22 percent were indifferent; the remainder preferred cash payments for each ride. However, in the subscription user survey, of 72 responses, 64 percent preferred monthly billing, 31 percent were indifferent, and only 6 percent preferred cash payment. It is unclear whether the preference for monthly billing is based on the availability of a discounted monthly pass for subscription service, or a true preference exists. A final surprising result is that the surveys indicated that 76.5 percent of the elderly users are not aware of the percentage of user-side subsidy they receive. To sum up, therefore, even after four years of monthly billing and a simplified fare system, target group users still preferred cash payment for each ride and were generally not aware of the user-side subsidy. The general public appears to be more receptive to monthly billing.

User reactions to vehicles were examined in the 1974 onboard survey, and the response to the interior design of the 1972 vehicles was quite positive. In particular, concerns over personal injury while boarding or riding the bus were voiced by only 1 percent of the users. The new vehicles acquired by VTD have not maintained the same interior design amenity level as the original fleet, although almost all the vehicles do have special doors and steps. While no direct questions were asked about vehicle design in the 1977 survey, the rankings of desired improvements shown in Table 6-16 indicate that vehicle design considerations are secondary to service considerations. Twenty-eight percent of the elderly users and 9 percent of the general public reported, however, that they had difficulty negotiating the steps of the bus, even with VTD's modifications.

Table 6-16 also shows the relative importance of other potential VTD service improvements as ranked by the survey respondents. Evening and weekend service and reduced call-in time were the most desired improvements by dial-a-ride users. Contract users would prefer weekend and evening service and better vehicles. Door-to-door service through route deviation was the most desired fixed-route improvement, although few users suggested any improvements for contract or fixed-route service. Subscription users were the only group citing lower fares as the most desired improvement, with reliability and better vehicles following. Both senior and general population nonusers cited reduced call-in times for dial-a-ride service and better reliability (reflecting past experience, either first- or second-hand), and several other improvements as well.

6.8 NON-TRAVEL IMPACTS

Several additional impacts on employment, medical, social, and other opportunities to individuals can be attributed to the existence and services of VTD. This section summarizes a study performed in 1974 and reported in Reference 9.

VTD has a moderate impact on employment. Approximately 18 handicapped VTD users are able to hold employment which they could not if VTD service did not exist, because they have no other transportation available. This represents nearly 18 percent of VTD's regular handicapped ridership. Another six individuals are employed as homemakers for seniors and require VTD service to hold the job. At least twelve other non-handicapped individuals are believed to be dependent on VTD for holding a job. These results are corroborated by 1977 survey data which indicate that about

TABLE 6-16: Relative Importance of Potential VTD Improvements as Ranked by Survey Respondents

Possible Improvements	Senior Users			(63)* Subscription Users	(76)* Senior Non-users	(133)* General Population Non-users
	(82)* Door-to-Door	(75)* Contract	(73)* Fixed Route			
Reduced VTD fares	9.8%	-	2.7%	28.6%	10.5%	6.0%
Evening and weekend service	31.7%	14.7%	-	-	13.2%	15.8%
Service outside Valley	1.2%	8.0%	-	-	10.5%	10.5%
Call-in time reduced to 1/2 hour	14.6%	-	-	-	27.6%	25.6%
Coordination with other transportation	1.2%	-	2.7%	-	13.2%	12.0%
More dependable pickup and drop off times	3.7%	-	-	20.6%	21.1%	19.5%
Better buses	1.2%	10.7%	-	20.6%	-	-
More help boarding bus	-	1.3%	-	-	-	-
More contract runs	-	1.3%	-	-	2.6%	2.3%
Fixed route buses running twice as often	-	-	4.1%	-	-	-
Route deviation on fixed route buses	-	-	11.0%	-	-	-
Better knowledge of routes and schedules	-	-	5.5%	-	-	-
More direct, faster trips	-	-	-	14.7%	10.5%	14.3%
Straggler service (subscription)	-	-	-	12.7%	-	-
Don't know	36.6%	64.0%	74.0%	-	-	-
Other	-	-	-	3.2%	-	-
TOTAL:	100.0%	100.0%	100.0%	100.0%	109.2 ¹	106.0 ¹

*Number of respondents

Source: Senior users: Home Interview Survey; Subscription users: Onboard Survey; Nonusers: Mailback Survey

¹ Even though respondents were instructed to select only one desired improvement, a few indicated more than one, thus bringing the total above 100 percent.

3.6 percent of all frequent senior VTD users (or about 18) make work trips that they otherwise would not be able to make, and about 21 percent of subscription users (or about 21) similarly would not be able to work. Thus, approximately 40 Valley residents are employed who would probably not be able to hold a job if VTD service did not exist.

Studies of the change in medical facility use and composition of patients were undertaken in 1973 and 1974, and are described in detail in References 10-13; they showed no measurable impact of VTD on these measures. Thus, while VTD has probably lowered the cost and improved the ease of taking medical trips, it has not opened any new opportunities to users, who were making the same medical trips without VTD service being available. This is again borne out in the 1977 survey, which shows almost no sensitivity of medical tripmaking to the availability of VTD service.

To examine the impacts of VTD on other opportunities, attendance at senior centers was examined as an example. Data from the Shelton Senior Center comparing similar dates before and after VTD service initiation showed attendance increases of 8 and 25 clients on the two days of the week served by VTD trips. Pre-VTD attendance was 100 to 120 clients on those days. However, the Derby and Ansonia senior centers reported minor attendance losses over the same period. Some of these problems were attributed to the unreliability of VTD service at the time, which impacted users directly, but also impacted nonusers through the disruption of senior center schedules. A loss of four clients was reported by Derby, and no figure could be established for Ansonia. The current VTD services to these centers are extremely reliable, and thus these negative impacts no longer hold. Due to the many other changes in senior center programs and

clients, it is impossible to isolate the impact of VTD service on attendance changes. However, the initial data on Shelton, indicating perhaps a 10 percent increase in attendance, may be taken as indicative of VTD's impacts. It must be noted that the senior centers have provided transportation for their clients before VTD; thus, it was not a new service for these clients, but only an improvement. Therefore, the possible 10 percent increase in senior center attendance was due only to expanded days of service and specially designed vehicles. The impact of VTD service as a whole on senior center attendance is much greater.

7. VTD OPERATING COSTS AND EFFICIENCY

7.1 VTD OPERATING COSTS

Table 7-1 summarizes VTD annual operating costs, revenues, and subsidies over the life of the demonstration project.¹ Passenger revenues and user-side subsidies have each covered about one-quarter of the total operating costs, the state has funded almost one-third, and Federal and local grants covered the remainder of VTD operating costs. The trend of passenger revenues and state grants covering an increasing portion of operating costs can be seen, and this will be very strong in 1978 and following years. The downward trend in user-side subsidy funds is also expected to continue.

Table 7-2 shows the composition of VTD operating costs. Driver costs are typically less than one-third of total operating costs, which reflects a wage rate between \$3.00 and \$4.00 per hour for VTD drivers. Vehicle repairs and maintenance are quite substantial, and are approximately one-fifth of the operating cost; this is due to the low reliability and maintainability of VTD's first two vehicle purchases in 1972 and 1975. Dispatcher costs are very low, reflecting the simple dispatching system used by VTD. Finally, administration costs reflect the staff time for service planning, billing, accounting, and other tasks, and are

¹Table 7-1 totals do not correspond exactly to Table 4-1 totals. In fact, annual audit statements for each of the agencies involved in the demonstration disagree, sometimes widely, for nearly every year in the project. These differences appear to stem from differences in cash-basis versus accrual accounting, and differences in accounting for funds carried over from one fiscal year to another.

TABLE 7-1

VTD Annual Operating Costs, Revenues,
and Subsidies, 1973-77

	(6 months) <u>FY 1973</u>	<u>FY 1974</u>	<u>FY 1975</u>	<u>FY 1976</u>	<u>FY 1977</u>	<u>FY 73-77 TOTAL</u>
TOTAL ANNUAL OPERATING COSTS	\$57,000	216,000	294,000	274,000	332,000	1,128,000
TOTAL ANNUAL REVENUES:	22,000	122,000	103,000	141,000	161,000	549,000
Passenger	9,000	61,000	59,000	81,000	112,000	322,000
User-side subsidy	13,000	52,000	43,000	56,000	49,000	213,000
Other	0	9,000	1,000	4,000	0	14,000
TOTAL ANNUAL DEFICIT:	35,000	94,000	146,000	133,000	171,000	579,000
Funded by:						
UMTA Demonstration	35,000	56,000	77,000	17,000	0	185,000
State of Connecticut	0	0	69,000	116,000	171,000	356,000
Towns of Ansonia, Derby, Seymour, and Shelton	0	38,000	0	0	0	38,000

7-2

SOURCE: Primary source is annual VTD audit statements. Breakdown of revenues is not given in all years; in these cases, LNVCC audit statements were used to determine the user-side subsidy amount. LNVCC statements were adjusted to match VTD audit figures, as differences in accounting methods appeared to exist. Breakdown of deficit funding is also not given in all years; State of Connecticut provided information on their share. Amount funded by UMTA estimated for all years. Fiscal year 1977 data is preliminary. All data rounded to nearest \$1,000.

TABLE 7-2

VTD Operating Cost Breakdown, 1973-77

	<u>FY 1973</u>	<u>FY 1974</u>	<u>FY 1975</u>	<u>FY 1976</u>	<u>FY 1977</u>
TOTAL ANNUAL OPERATING COSTS	\$57,053	216,117	249,303	273,900	335,617
Vehicle repairs and maintenance	(4,158)	(51,694)	56,713	48,415	64,703
Fuel costs			18,902	24,819	38,450
Driver wages	14,666	73,182	58,260	79,840	109,474
Dispatcher wages			14,545	8,804	9,477
Insurance and safety	(38,229)	(91,241)	16,175	22,817	36,128
Administration			33,119	59,388	56,547
Other operating costs ¹			51,589	29,817	20,838
ANNUAL VEHICLE HOURS	4,500	18,720	14,992	22,770	29,003
ANNUAL VEHICLE MILES	54,000	220,000	177,992	264,456	388,245
ANNUAL PASSENGERS	25,000	136,000	111,797	136,503	196,221

7-3

¹Utilities, taxes and licenses, equipment rentals, advertising, and other.

SOURCE: VTD annual audit statements. Fiscal year 1977 audit has been superseded by a State of Connecticut audit not shown. Annual vehicle hours, miles, and passengers drawn from VTD monthly operating statements to State of Connecticut. FY1973 hours and miles, and FY74 miles and passengers estimated from preliminary figures in Reference 1, all that is available for those years.

about one-sixth of VTD operating costs.

The fiscal year 1977 costs can be regarded as a good estimate of VTD's long run cost structure. The major element that could change significantly in the vehicle repair and maintenance cost, which could decrease by 50 percent or more if VTD could acquire a vehicle fleet whose performance matched that of the three Grumman vehicles bought in 1976. Another long-term issue centered around cost is driver dissatisfaction, which affects personnel turnover and ultimately service quality. Driver wages have been near \$3.00 to \$3.50 per hour throughout the demonstration, with the system shifting to the use of solely part-time drivers in 1975, thus eliminating fringe benefits. During 1975, with Valley unemployment being as high as 17 percent, VTD was able to attract reliable drivers in spite of the low wages. As unemployment dropped in 1977, due to the recall of many workers laid off by Bridgeport defense contractors, driver dissatisfaction with pay became a large issue. Vehicle reliability and maintenance problems have also contributed to driver problems. Finally, there is too little management and administration reflected in VTD's cost structure, which limits its ability to control markets and plan its services, and to deal with other agencies. Increases in driver wages and administrative costs could offset reduced vehicle expenses, but even so, the system would be in a more stable long-run cost framework.

If operating costs are allocated on a vehicle-hour basis, VTD has improved its operating efficiency considerably during the span of the project. In fiscal year 1973, cost per vehicle hour was \$12.70; in 1974,

\$11.50; in 1975, \$16.60 due to vehicle problems¹; in 1976, \$12.00; and in 1977, \$11.50. Accounting for inflation, this is a substantial decrease in real cost. Part of the decrease is due to economies of scale, but the majority comes from improved vehicles and better utilization of resources.

¹The number of vehicle hours operated in 1975 is believed to be understated by 10 to 20 percent, as the first five months' operating statements each have identical, low numbers of hours. Later months have much higher, varying numbers of hours that correspond well with later experience as well. Thus, 1975 operating costs per vehicle hour are probably overestimated by 10 to 20 percent; the true cost is believed to be nearer \$14.00.

7.2 VTD OPERATING AND PERFORMANCE STATISTICS BY SERVICE

While the preceding section has summarized overall VTD operating statistics, many insights can be gained about the system by examining each VTD service separately. In particular, these statistics serve to quantify several aspects of VTD's operating strategy discussed in Chapter 4.

Table 7-3 reports the operating ratios of each VTD service for twelve sample months in the last three years of operation.¹ VTD does not maintain operating ratio statistics by service; the figures shown are derived as part of the evaluation to illustrate the differences in services.

VTD contract services, after the abnormally high operating costs experienced in fiscal year 1975, have produced revenues in excess of their operating costs in 1976 and 1977. Agency trips are thus cross-subsidizing other VTD services to a significant degree. Dial-a-ride services show a very low operating ratio, and are maintained to serve necessary trips not served by other services. Subscription services have an operating ratio of 20 to 30 percent, which is lower than VTD's stated goal of having services to the general public maintain a high operating ratio. While VTD views a cross-subsidy from the general public to the target population as desirable, in this case the general population is being subsidized by target population agencies through their contract service costs. Finally, VTD fixed route services had

¹These statistics have been kept monthly since July, 1974; no data are available before this period.

TABLE 7-3

VTD Operating Ratio Summary, 1974-77
(Revenue/Cost Ratio)

VTD Service:	1974		1975				1976				1977	
	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr
Contract	.66	.66	.66	.66	1.16	1.16	1.16	1.16	1.21	1.21	1.21	1.21
Dial-a-ride	.09	.09	.04	.06	.03	.06	.13	.05	.15	.07	.10	.06
Subscription	.31	.35	.18	.31	.17	.24	.20	.16	.28	.21	.27	.29
Fixed route	-	-	-	-	-	-	.01	.03	.04	.06	.10	.62 ¹
ALL	.48	.48	.36	.46	.47	.51	.57	.45	.52	.38	.51	.56

¹Including work trip service to Sikorsky plant, which is categorized as a subscription service in this report but is called a fixed route by VTD.

SOURCE: Revenue: VTD monthly income register, which lists estimated revenues by contract, door-to-door (subscription and dial-a-ride together), and fixed route services. Dial-a-ride and subscription revenues are proportioned according to ridership. All revenue statistics include user-side subsidies, which provide approximately 50 percent of contract revenues and 25 percent of combined dial-a-ride and subscription revenues.
Cost: VTD monthly operating statements, which give total vehicle hours and revenues (as a check). Contract vehicle hours are derived by dividing contract revenues by the hourly contract service rate; fixed route vehicle hours are derived from schedule requirements; and the remaining vehicle hours are allocated between dial-a-ride and subscription services, by hour of the day, proportional to ridership. Service breakdown by hour of day based on three sample days. Annual (fiscal year) average hourly costs are then applied to the vehicle hours for each service, and revenue/cost ratios can be computed.

very low ridership, which accounted for their low operating ratio. The work trip service introduced by VTD to the Sikorsky plant in Bridgeport (classified as a fixed route by VTD) has been very successful, in contrast.

The fluctuations in operating ratio (and in many of the other statistics presented in this chapter) can be explained by variations in unit costs, overall level of operations, vehicle fleet, weather and service mix, as well as by random variations in passengers and vehicle-miles from month to month. Few of these effects have uniform, systematic impacts on VTD performance, however, and an analysis of their effects yields few generalizable insights. For example, contract runs are added and dropped from time to time; some have high passenger loads and others low; some are short trips and others are long, and so on. Subscription service showed poorer performance in 1975 after a major Valley employer closed. All services show lower performance during winter months because the elderly (and others) travel less during adverse weather. Ridership is also increased by special outings during the other months of the year. Vehicle problems can vary dramatically from month to month, causing significant variations in several system measures. To sum up, many short-term and highly variable phenomena affect these statistics, some of which can be explained; however, the long-term level of performance of each service has remained fairly stable and is a more useful focus for analysis.

Table 7-4 shows VTD productivity, measured by passengers carried per vehicle hour operated, by service. Contract services show the highest productivities, followed by subscription services. Dial-a-ride

TABLE 7-4

VTD Productivity Summary, 1974-77
(Passengers/Vehicle-hour)

VTD Service:	1974		1975				1976				1977	
	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr
Contract	9.8	8.8	9.1	8.6	14.5	14.8	9.8	9.8	15.4	16.6	13.7	13.1
Dial-a-ride ¹	3.4	2.7	1.4	2.0	0.8	1.0	2.1	1.0	2.5	1.4	1.7	0.9
Subscription ¹	11.3	9.8	6.0	10.1	4.0	4.1	3.2	3.0	4.7	3.9	4.7	4.3
Fixed route	-	-	-	-	-	-	0.7	1.5	1.9	2.4	3.6	17.3 ²
ALL ¹	8.8	8.5	6.2	7.7	6.3	7.0	5.4	4.6	7.4	6.0	6.9	7.3

¹As mentioned in section 7.1, fiscal year 1975 vehicle-hours are believed to be understated by 10 to 20 percent. Since contract hours are estimated from an independent source (monthly income statements), the entire error occurs in the dial-a-ride and subscription hours, which are believed to be understated by approximately one-third. Thus, productivity is overestimated by approximately one-third. The true productivity during this period is believed to be near two passengers per vehicle hour for dial-a-ride, and approximately six passengers per hour for subscription.

²Including work trip service.

SOURCE: Passengers: VTD weekly passenger counts, summarized by month.
Vehicle-hours: See discussion under Table 7-3.

TABLE 7-5

VTD Service Mix Summary, 1974-77
 (Percentage of Total Vehicle Hours)

VTD Services:	1974		1975				1976				1977	
	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr
Contract	.61	.59	.46	.63	.32	.36	.43	.33	.34	.23	.32	.33
Dial-a-ride } Subscription	.39	.41	.54	.37	.68	.64	.35	.50	.43	.60	.49	.59
Fixed route	0	0	0	0	0	0	.22	.17	.23	.17	.19	.08
ALL	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TOTAL HOURS	1250	1250	1380	1320	1694	1783	2007	2577	1891	2640	2369	2203

7-10

SOURCE: See discussion under Table 7-3.

productivities are low due to a large service area and low demand density. Fixed route productivities have hovered near dial-a-ride productivities which, when combined with the fixed routes' less attractive service levels, have made them an unattractive service type for VTD.

Table 7-5 shows the mix of services operated by VTD, and how it has changed over time. In 1974 and early 1975, VTD was severely constrained by vehicle availability; this meant that it had to devote a large portion of its available resources to meet contract commitments, and had few vehicles with which to operate other services. As vehicle availability improved in late 1975, VTD expanded other services, even though their operating ratios were lower, and instituted fixed route service to expand its overall service level. Since the fixed routes performed poorly, they were cut back in 1977 and door-to-door services expanded, as a more cost-effective means of serving the target population.

The absolute amount of contract services has remained fairly constant over the period, even though its proportional share has decreased. While VTD would willingly expand contract services, agency demand for them is severely limited by lack of funds.

Table 7-6 shows the contribution of each VTD service to total revenues. Contract revenues have always provided the bulk of VTD income and promise to do so into the future.

Table 7-7 shows another measure of the efficiency of each VTD service, cost per passenger trip. Contract service turns out to be extremely efficient in handling the class of trips (senior centers, shopping,

TABLE 7-6

VTD Revenue Summary

(in dollars per month)

<u>VTD Services:</u>	<u>1974</u>		<u>1975</u>				<u>1975</u>				<u>1977</u>	
	<u>Jul</u>	<u>Oct</u>	<u>Jan</u>	<u>Apr</u>	<u>Jul</u>	<u>Oct</u>	<u>Jan</u>	<u>Apr</u>	<u>Jul</u>	<u>Oct</u>	<u>Jan</u>	<u>Apr</u>
Contract	8371	8075	6974	9089	6028	9074	12060	11959	9028	8619	10526	10077
Dial-a-ride	385	406	260	243	239	378	339	334	412	531	403	357
Subscription	1273	1488	1140	1257	1196	1607	1183	1457	1825	2284	2590	2643
Fixed route	-	-	-	-	-	-	79	146	193	286	531	1201
ALL	10029	9969	8374	10089	7540	10985	13661	13896	11458	11624	14026	14278

SOURCE: VTD monthly income register, which is kept on a different basis than the monthly operating summaries used for other tables; thus, all figures will not coincide exactly. All revenue estimates include user-side subsidy.

TABLE 7-7

VTD Per Passenger-Trip Cost Summary, 1974-77

(in dollars)

VTD Service:	1974		1975				1976				1977	
	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr
Contract	1.70	1.89	1.82	1.92	0.83	0.81	1.23	1.22	0.75	0.70	0.84	0.89
Dial-a-ride	4.90	6.25	12.10	8.49	14.88	12.60	5.69	11.50	4.64	8.50	6.80	13.29
Subscription	1.47	1.71	2.76	1.65	2.97	2.96	3.80	3.96	2.44	2.96	2.47	2.70
Fixed route	-	-	-	-	-	-	16.88	8.14	6.24	4.78	3.19	0.67
ALL	1.89	1.95	2.68	2.17	1.90	1.72	2.24	2.60	1.56	1.93	1.67	1.58

SOURCE: Passengers: VTD weekly passenger counts summarized by month.
 Costs: See discussion under Table 7-3.

TABLE 7-8

VTD Average Per-Trip Revenue Summary, 1974-77
(in dollars)

VTD Service:	1974		1975				1976				1977	
	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr
Contract	-	-	-	-	-	-	-	-	-	-	-	-
Dial-a-ride	0.46	0.59	0.51	0.50	0.52	0.70	0.71	0.62	0.68	0.62	0.67	0.78
Subscription												
Fixed route	-	-	-	-	-	-	0.25	0.25	0.25	0.25	0.33	0.41

7-14

SOURCE: Passengers: VTD weekly passenger counts, summarized by month.
Revenues: VTD income register. See discussion under Table 7-3.

etc.) assigned to it by VTD. Dial-a-ride service is relatively costly but serves a different class of trips.

Finally, Table 7-8 shows average per-trip revenues (or fares) for each service. Contract service is not charged to the user, so it is not included. Ride slip and billing samples for selected months indicate that the average dial-a-ride fare is near 88 cents; thus the average subscription fare will be somewhat lower than the combined average fare shown, but no accurate month-by-month estimate can be made. The average fixed-route fare reflects the high proportion of elderly and student riders (25-cent fare) as opposed to general public riders (50-cent fare), except in April, 1977, which includes the Sikorsky fixed route.

To sum up, this section has presented a range of operating statistics that reflect on VTD's operating strategy and efficiency. Several key issues are pointed out by these statistics. First, one of VTD's goals in providing services to both the general population and a target group was to maintain a high operating ratio on general population services to cross-subsidize the specialized services. This has emphatically not occurred, with target population services as a whole maintaining a higher revenue/cost ratio than general population services. VTD is still addressing this goal, however, and the new Sikorsky work-trip service is meeting its revenue goals. Second, this section has showed how VTD can adjust its mix of services to respond to changes in total funding level, required operating ratio, or other financial constraints. In early periods, VTD operated primarily contract services, although it was later able to expand. If future financial conditions should become

constrained, VTD's options for meeting these conditions are well defined. In general, this flexibility and the entire service-based "profit center" or accountability approach have many benefits for VTD.

Third, VTD and LNVCC have organized as many trip needs as possible into group activities served by contract service. Shopping trips and some social trips are the leading examples of trips that are served by dial-a-ride in many systems but can also be served effectively by a more efficient contract mode. While there are some losses in individuals' flexibility to take these trips when and where they want, there are also very large gains in system efficiency from this arrangement, as shown by all the statistics in this chapter. VTD is an interesting case study of this issue, which is bound to arise in other systems serving elderly and handicapped trips with limited resources. Finally, VTD has maintained a very high productivity over all its services, achieving close to its maximum possible tripmaking impact within its available resources. The variety of services operated has been a key element in this accomplishment.

8. INSTITUTIONAL ISSUES

8.1 INTRODUCTION

This chapter addresses the relationships between VTD and transportation, regulatory, social service and health agencies in the Valley, as well as some interactions with private transportation operators in the Valley. Chapter 3 has described the primary agencies and organizations involved in Valley transportation, and outlined their basic roles and responsibilities. This chapter discusses the key issues that have arisen in the Valley due to the existence and services of VTD with all the other organizations.

8.2 ISSUES INVOLVING PRIVATE OPERATORS

8.2.1 School Bus Operators

There are several private operators in the VTD service area which have been affected by the establishment of VTD. In particular, there are two private operators who have been active in opposing VTD services. Of the three school bus operators in the Valley, the Blake Bus Company of Ansonia has been the primary opponent, and the one taxi company in the Valley, Royal Cab of Ansonia, has also opposed VTD strongly.

This opposition has taken the form of requesting hearings before the Connecticut Public Utilities Control Authority (PUCA) on several occasions to restrict VTD's operating rights, and some efforts in 1974, when local funding was required to continue the demonstration, to block local funding.

The school bus operators provided much of the contract service to senior centers and other social service agencies in the Valley, in addition to their school bus services, prior to the establishment of VTD. The four Valley senior centers, which had been served by the school bus operators, are now served almost exclusively by VTD. Consequently, the school bus operators, upset by the loss of business to VTD, appeared before the PUCA on several occasions in opposition to the VTD services. The school bus operators (and the taxi operator) argue that because their operations are not subsidized as are VTD's, VTD has an unfair price advantage when competing for service. However, proponents of VTD contend that the senior contract service is only a small portion of the school bus operator's total business and that VTD's serving senior center clients' trips is an expression of user preference for VTD vehicles. The school bus operators were only willing to operate very limited contract services for the senior centers, and stated publicly that they were not interested in providing more service; VTD provides considerably more service than the school bus operators, including certain less profitable runs which they would not operate. VTD also holds that there is some public subsidy of the school bus operators, since full vehicle capital costs are normally allocated to the school services, and none to charters.

According to the owner of one of the bus companies, the operators are not opposed to VTD's service to the elderly and handicapped trips when specially designed vehicles are required and went on record to this effect at a PUCA hearing in April, 1977. However, there is a strong

feeling among the operators that VTD is exceeding its operating authority by soliciting trips, both school and contract, that are within the capabilities of the school bus operators. VTD contends that the services it offers, including the contract services, are not within the capabilities of the school bus operators, but require special vehicles, driver training, and scheduling which only VTD can provide.

The issues raised by the school bus operators have been resolved in VTD's favor in several PUCA actions, aided by strong testimony from social service agencies and VTD users. However, a hearing in March, 1974, resulted in VTD being enjoined from operating services outside the Valley.

8.2.2 Taxi Operator

The one taxi company in the Valley, Royal Cab of Ansonia, has had similar reactions as the school bus operators toward possible losses of ridership. Royal Cab served work trips, school trips and elderly and handicapped trips prior to the establishment of VTD. The owner of Royal Cab estimates that 20 percent of his business was formerly school and work trip services that have been lost to VTD, and that some elderly tripmakers have also been attracted to VTD. Royal Cab contends that work trips in particular should not be subsidized since the people using these services are obviously able to afford the taxi fare, although VTD is offering subsidized competition to all aspects of the taxi business. While the taxi operator claims ridership losses due to VTD operation, he does cite a multiplicity of reasons for the loss, including increased

fares initiated during the fuel crisis, personnel turnover, and the fact that the elderly riders die, presumably replaced by other elderly who have alternative modes of transport. The taxi operator states that "new" elderly are using VTD service, and the elderly in senior housing projects have largely stopped cab use in favor of VTD.

The owner of Royal Cab claims that his total revenues decreased from 1973 to 1976 and his total fleet has been reduced from seven to five vehicles, only four of which operate. Most of this loss must be in pre-arranged services, because the number of daily call-in trip requests handled by Royal Cab was reported to be 175 in 1973, 150 in 1974, and 175 again in 1977, based on limited data.¹ Total revenues in 1976 were estimated at slightly less than \$60,000 by the operator, and costs (excluding the owner's salary or return on investment) were \$43,000. Total costs in 1973 were \$60,000, indicating a much larger scale of operations, but no reliable revenue figures are available. The owner's contention that the 20 percent of his business that was work and school trips was lost would indicate that 1973 revenues were near \$75,000, but he claims his revenues were near \$200,000 that year. All of this taxi data must be regarded as quite uncertain and unsupported.

Royal Cab currently operates six days per week, including evenings; there is no Sunday or holiday service. It carried about 45,000 passengers in 1976 (about 150 per day) at an average fare of \$1.30 and an average cost of 94 cents per trip. The average passenger trip length is

¹ 1973 and 1974 data based on Reference 1; 1976 and 1977 data based on an interview with the taxi operator.

1.5 miles, and the average number of passengers per trip is 1.3. Average operating speed is near 20 mph.

Royal Cab's services continue to be predominantly for elderly, handicapped and poor persons (approximately 75 percent of ridership) even though the absolute number of trips may have declined. While the taxi service is more expensive than VTD's service, the travel and wait times are lower, since VTD requires a two-hour advance call and has longer travel times because it serves several people on each trip. However, Royal Cab feels that VTD's lower fare is the more important factor and consequently, the number of riders who use Royal Cab because of VTD's longer wait times is really minimal. However, VTD handles only about 25 dial-a-ride trips a day; thus the diversion from taxi ridership must be limited.¹

Although Royal Cab's business has been decreasing since the establishment of VTD, the company has never actively sought business from the social service agencies. The owner was of the opinion that these agencies are aware of the existence of Royal Cab and should therefore be the ones to take the initiative if they wanted service. Additionally, the owner of Royal Cab has never seriously considered the possibility of shared ride services since he feels that the demand does not exist in the Valley for this type of service.

VTD has attempted in the past to work out an arrangement with Royal Cab so that those trips not requiring large vehicles, or any

¹It is possible that some contract senior center and shopping trips were also diverted, but this is unlikely to be a very large number, based on the surveys administered to VTD users.

trips which VTD could not accommodate, could be served by the cab company. According to VTD, the owner of Royal Cab was not amenable to receiving payment on a monthly basis as was being proposed by VTD, instead of on an immediate payment basis. However, Royal Cab understood the situation differently and felt that VTD had only made a preliminary inquiry and never offered a formal proposal. The owner of Royal Cab, reacting to the additional paperwork that would be involved and the deferred payment, rejected VTD's inquiry. VTD, reacting to Royal Cab's negative response, did not contact Royal Cab again. Subsequently, a taxi company in New Haven has been retained by VTD to provide trips to medical facilities outside the Valley originally offered to Royal Cab as part of the proposed cooperative arrangement.

Royal Cab has testified at PUCA hearings along with the school bus operators; the results were described in the previous subsection.

8.2.3 VTD Regulatory Considerations and Impact on Other Carriers

Although the VTD has the prerogative of assuming PUCA regulatory authority for all carriers within their district, there are several reasons why the VTD has not chosen to do this. Of primary consideration is the fact that VTD has a very small staff and their current operations consume all of the staff's available time. VTD does not have sufficient funds to expand its staff for the purpose of managing other operations and the PUCA will not make any funds available for these activities. VTD is also aware of the adverse sentiments of other carriers towards VTD operations and sees no reason to further aggravate this situation. However, VTD must continue to expect opposition from carriers that feel

threatened by VTD. It appears that some of the private carriers may once again seek PUCA action against VTD if, as one of the school bus operators stated, VTD continues to solicit trips that were previously being served by the school bus operators.

Now that VTD seems almost certain to continue and to expand its services even though its demonstration grant has expired, the private operators are reacting in different ways. One school bus operator seems inclined to continue a large scale opposition campaign against VTD's services for other than the elderly and handicapped. The taxi company, on the other hand, feels that all its opportunities are lost and appears resigned to a gradual erosion of its business as VTD continues to expand. This attitude by the taxi operator is consistent with his attitude of not adopting an aggressive marketing effort with social service agencies or any other facet of his business.

8.3 ISSUES INVOLVING TRANSPORTATION AGENCIES

8.3.1 Valley Municipalities

For the most part, the agencies within the Valley and those at the state level with involvement in the Valley appear to work cooperatively. The elected officials of the municipalities are kept informed of regional issues through the Valley Council of Governments. In addition, representatives of these and other local and state agencies are members of several policy and technical committees that have been set up by the Valley Regional Planning Agency. Transit is only one of many issues that is addressed by the agencies and in general, except among those

persons and agencies specifically involved in VTD's operations and services, transit is not an issue of high priority or high visibility within the region. VTD is only occasionally the subject of discussion at VCOG.

The mayors and first selectmen of the four Valley towns are part-time officials and their familiarity with the VTD includes a basic understanding of the services the VTD provides. The municipalities have not provided financial support to VTD beyond an initial contribution of \$10,000 for each town when VTD was first created and a total of \$37,750 in 1974 to continue VTD operation. While the elected officials interviewed acknowledge the value of VTD services, they also feel that the towns are operating under tight budgets and the likelihood of allocating scarce municipal funds to VTD is very small. Consequently, VTD has not pursued this option, also acknowledging that municipal support is unlikely.

The VTD Board of Directors, which is appointed by the elected officials of each of the four towns, has complete independence on all VTD decision making. The public officials neither request nor suggest particular actions that the Board members should pursue, nor is there much communication between the Board members and the elected officials during the member's tenure on the VTD Board. The towns' general feeling is that if they are not financially involved with VTD, there is little reason for them to be any more involved than is currently the case. As one official commented, the towns must be generally supportive of VTD since it is difficult to oppose services to the elderly and handicapped.

8.3.2 Valley Regional Planning Agency (VRPA)

The relationship between VRPA and VTD has been workable since VTD's establishment; however, there are some basic philosophic differences between the two agencies regarding the kinds of service VTD should be providing. VRPA has been an advocate of additional fixed route service for the general public and maintains that VTD's fixed route services have been less than successful in the past due to poor planning and insufficient marketing. VTD, on the other hand, contends that their primary objective is to serve the elderly and handicapped, and that further resources to expand or improve fixed route services are not justifiable within VTD's priorities. VRPA is also of the opinion that the small size of VTD's professional staff precludes the agency from having the necessary planning skills required to maximize VTD's operating efficiency.

Finally, there appears to be some subtle competition between VRPA and VTD about which agency has the stronger role in establishing VTD's service priorities. Legally, the VTD Board has the mandate to provide directives to the VTD staff. However, the executive director of VRPA does on occasion interact with the VTD Board members and appears at Board meetings when an issue in which VRPA is interested is to be discussed. Additionally, VRPA is currently conducting a study of the VTD's future alternatives through an UMTA planning grant and feels that the recommendations of this study should have significant bearing on VTD's future actions. VTD plans to review the recommendations of the VRPA report but any controversial points will require substantial interagency discussion before implementation can take place.

8.3.3 State of Connecticut

Conn. DOT, which is the state agency having most involvement with the VTD, appears to be very satisfied with VTD's operations, particularly with their services for the elderly and handicapped. In support of the VTD, the State is currently subsidizing 100 percent of VTD's deficit, although as of July, 1978, it is anticipated that VTD will be subject to the formal state subsidy policy.¹ The state is an active participant on the VRPA transit committees but, in general, does not concern itself with the day-to-day operating and service issues which are a more local concern.

VTD works well with Conn. DOT, but is upset with the evolution of the state's subsidy policy. They feel that equity problems occur when the state subsidizes 100 percent of the deficit of some transit operations, particularly in the large cities, while other operators must attain a specified level of fare box revenues. Even though VTD is currently receiving the 100 percent subsidy, they anticipate the time again when they will be subject to the formal state policy.

8.4 INTERACTION OF SOCIAL AND HEALTH SERVICE AGENCIES WITH VTD

8.4.1 Funding Issues in Valley Social Service Programs

To serve as a reference for the following discussion, Table 8-1 presents a summary of major Federal funding sources for elderly transportation projects, several of which have been used in the VTD project.²

¹The policy is not yet determined, but is likely to cover 50 percent of total operating cost, plus 50 percent of any remaining deficit.

²This table is drawn from Reference 22.

The lead agency in searching for funding sources to encourage the use of VTD has been the Lower Naugatuck Valley Community Council (LNVCC) which recognized the importance of transportation services in the delivery of social services and, in conjunction with other local agencies, submitted a proposal for a transportation program to the State Department of Community Affairs in 1969; this proposal was rejected. In 1970, LNVCC, in coordination with the Valley Regional Planning Agency (VRPA), surveyed the transportation needs of Valley agencies. On the basis of this information, VRPA and COG applied for and received an UMTA demonstration grant in 1971. VTD was then created as the instrument for achieving Valley transportation objectives.

As the implementation of the transportation project progressed, the importance of a high level of agency participation and inter-agency cooperation to the success of the project became apparent. In 1972, LNVCC submitted a grant application under Title IV of the Older Americans Act to the Social and Rehabilitation Service of HEW. A two-year demonstration grant entitled, "Integration of Social and Rehabilitation Services for the Disabled and Disadvantaged by Means of a Coordinated Transportation System," was awarded totalling \$258,000. The HEW demonstration project, or Health Transportation Project as it came to be known, had two basic components. The first was to enlist agency support and coordination and to provide funding through a user-side subsidy mechanism so that the transportation could reach as many eligible members of the population as possible. To help meet this objective, LNVCC

TABLE 8-1

Potential Major Federal Funding Sources for Elderly Transportation Projects - August, 1975

Department Statute Title & Section	Description	Provides Transport For	Elderly Share	User Eligibility Restrictions			Area Coverage	Capital Purchase
				Age	Income Work Status ¹	Health/ Educ./Other		
A. DEPARTMENT OF HEALTH, EDUCATION & WELFARE								
1. Older Americans Act of 1965 as Amended, Title III, All Sections except 308	State & Community Programs on Aging	Broad Social Services	Exclusive	60+ ²⁰	Priority: DOC		Planning and Service Areas	Prohibited
Title III, Section 308	Model Projects	Model Projects	Exclusive	60+ ²⁰	None		Varies ²	Prohibited
Title IV, Section 412	Transportation Study & Demonstration Projects	Demonstrations & Studies	Exclusive	60+ ²⁰	None		Rural Emphasis ³	Possible ⁴
Title VII	Elderly Nutrition	Nutrition Sites	Exclusive	60+ ⁵	One Criterion DOC ⁶		Urban or Rural ⁷	Possible
Title IX	Elderly Community Service	Project Activities	Exclusive	55+	OMB/Unemployed		Community	Possible
2. Public Health Service Act of 1944 as Amended, Title III, Section 314(d)	Comprehensive Health Services	Broad Health Services	Moderate	None	None		Community	Allowable
Title III, Section 314(e)	Community Health Centers	Health Sites	Moderate	None	None ⁸		Community ⁸	with Approval
Title XII	Emergency Medical Services	Emergencies	Moderate	None	None	Critical Condition	Established Service Area	Approval
3. Social Security Act of 1935 as Amended, Title XIX	Medicaid	Medical	Aged, Blind Disabled, AFDC		SSI eligibility criteria or more restrictive criteria at State option ⁹		State	Prohibited
Title XX	Services to individuals and families	Projects State elects ¹⁰	Varies	None	SSI Recipient, AFDC Recipient ¹¹		Established areas within State	Prohibited
4. Vocational Rehabilitation Act of 1973	Vocational Rehabilitation	Any vocational rehabilitation services (incl. medical)	Small ¹²	None	Unemployed	Handicapped but Employable	State	Allowable
5. Appalachian Regional Development Act of 1965 as Amended Title II, Section 202	Health Demonstrations	Comprehensive Health Services	Large	None	None	None	Counties of 13 States in Appalachia	Allowable
Title III, Section 302(a)	Research, Demonstrations	Demonstrations Only		None	None	None		
B. DEPARTMENT OF TRANSPORTATION								
1. Urban Mass Transportation Act of 1964 as Amended Section 3	Capital Grants						Urban ¹³	Allowable
Section 5*	Capital and Operating Assistance Formula Grants						Urban 200,000 plus & minus	Allowable
Section 6	Research & Demos						Urban ¹³	Allowable
Section 9	Technical Studies						Urban	Allowable
Section 16(b)(2)	Grants to private non-profit bodies	Elderly and Handicapped					Urban ¹³	Allowable
2. Federal-Aid Highway Act of 1973 as Amended, Section 147	Rural Highway Demonstrations						Rural	Allowable except Rail
C. DEPARTMENT OF AGRICULTURE								
1. Consolidated Farm and Rural Development Act of 1972 Title III, Section 360(a)	Loans for essential community facilities		Moderate				Rural up to 10,000	Allowable
D. DEPARTMENT OF LABOR								
1. Comprehensive Employment and Training Act of 1973: Title III	National Older Workers Program	Work Duties	Exclusive	55+	CSA/"Chronically Unemployed"	None	Varies: primarily city or county wide	Prohibited
E. COMMUNITY SERVICES ADMINISTRATION (CEO)								
1. Community Services Act of 1974 as Amended Title II, Sections 212 and 221	Community Action Programs (CAP)	Broad Social Services	Moderate	None	CSA, but broad	None	Urban or Rural	Allowable with approval ¹⁴
Title II, Section 222(a)(5)	Emergency Food & Medical Serv.	Broad nutritional & medical services	Substantial ¹⁵	None	None	Suffering from hunger	Most are run by CAP's	Allowable ¹⁶
Title II, Section 222(a)(7)	Senior Opportunities & Services	Broad Social Services	Exclusive	61+ ¹⁷	CSA, but flexible	None	Urban or Rural	Possible, use 221 monies
Title II, Sections 232(a) & (e)	Research and Pilot programs	Special Needs	Moderate	61+	CSA	None	Rural Focus	Allowable with approval

TABLE 8-1 (continued)

Department Statute Title & Section	Description	Provides Transport For	Elderly Share	User Eligibility Restrictions			Area Coverage	Capital Purchase
				Age	Income Work Status ¹	Health/ Educ./Other		
F. ACTION								
1. <u>Domestic Volunteer Service Act of 1973, Title II, Section 201</u>	Retired Senior Volunteer Program	Volunteer Stations	Exclusive	60+	None/Retired	Able to Work	Community	Allowable with prior approval
Title II, Section 211(a)	Foster Grandparents Program	Program Duties	Exclusive	60+	OEO/Retired	Able to help children	One or more Communities	Allowable with prior approval
G. DEPARTMENT OF HOUSING & URBAN DEVELOPMENT								
1. <u>Housing and Community Development Act of 1974, Title I</u>	Community Development	Funds can be used for a range of purposes ¹⁸	Varies	None	None	None	States and local jurisdictions	Allowable if funds unavailable from other federal sources.
H. REVENUE SHARING								
1. <u>State and Local Fiscal Assistance Act of 1972</u>	Revenue Sharing	Funds can be used ¹⁸ for any purpose	Varies by State & Locality				States, and Local Jurisdictions	Allowable

SOURCE: Much of the data and material for this table was initially collected by Susanne Brooks of the Atlanta Regional Office of the Department of Health, Education & Welfare. This material was expanded to include a number of Acts not included in that compilation.

FOOTNOTES

1. The following symbols are used:
 - "DOC" - Department of Commerce poverty guidelines, based on Census Bureau Statistics
 - "OMB" - Office of Management and Budget poverty guidelines
 - "CSA" - Community Services Administration poverty guidelines (OEC)
 - "SSI" - Supplemental Security Income levels
2. May be statewide or community-wide. Regulations specify that project area must have "large number" of elderly
3. At least 50% of projects must be in States predominantly rural
4. AoA policy is to encourage capital purchase for demonstrations through joint DOT participation
5. Plus spouse of any age
6. Regulations allow the elderly to qualify on any or all of four grounds:
 - (1) cannot afford to eat "adequately"
 - (2) lacks skills to prepare well-balanced meals
 - (3) has "limited mobility"
 - (4) feels lonely and rejected
7. Both must have high proportion of elderly poor
8. Since these projects originated in the Office of Economic Opportunity, most are located in areas of low-income population
9. Categorically needy; no upper income limit when deducting incurred medical expenses (medically needy)
10. State services vary, and transportation is optional
11. Includes potential, and formers at State option, and those having State supplemental payments.
12. An estimated 2.5% of those rehabilitated are age 65+
13. Flexibly interpreted on a project basis but when was below 2500, not generally considered
14. Survey of existing resources must first be taken. Equipment costing \$500 or more must have regional approval
15. Focus is on elderly and children, although program also includes families and individuals generally
16. But only if vehicles extend the coverage of existing service programs. Emphasis is on better use of existing vehicles
17. For general services. For employment and volunteer services, the age requirement drops to 55+
18. The list of "supportive social services" includes "transportation and escort services, including capital assistance (if unavailable from DOT) or operating assistance". Funds can be used as payment of the non-federal share required in connection with a federal grant-in-aid program undertaken as part of a Community Development Program.
19. State and local governments are allowed broad use of available funds. Two of eight suggested priority categories are "Public Transportation" and "Social Services for the Poor or Aged". These two categories accounted, respectively, for 15% and 3% of funds expended in the only period thus far reported, January 1, 1972 - June 30, 1973
20. While no set age limits are established under these provisions of the Act, generally the act applies to the age group 60+.

sponsored organization and registration sessions for agencies and senior centers to describe VTD operations and point out potential uses of VTD for agencies and individuals. The second objective of the demonstration was to evaluate the transportation services provided by VTD as they related to agency needs.

To ensure that VTD would become an ongoing transportation agency providing services to the elderly and handicapped, LNVCC applied for a second grant under Title IV of the Older Americans Act which was awarded by HEW for the period 1974-76. In addition, a small amount of Project Mobility funding (Title III of the Older Americans Act) was obtained from the State of Connecticut through the South Central Connecticut Area Agency on Aging to provide transportation services to the elderly.

During the second phase of the Health Transportation Project, LNVCC sought to make transportation available to a larger number of agencies and individuals by again providing financial assistance and by resolving institutional and other barriers that inhibited VTD from reaching more people. With an eye to the post-demonstration period, LNVCC worked to establish agency funding on an ongoing basis.

As a result of these efforts, VARCA has had a transportation element incorporated in its rate structure, which is covered by funds under Title XIX of the Social Security Act. Project Manna, funded under Title VII of the Older Americans Act, provides meals at central locations to which transportation is provided by VTD contract service. Meals on

Wheels, for which VTD operates two vehicles, is also funded by Title VII and provides hot meals at home for the elderly. Project Life, which is a \$1,000,000 project funded 75 percent by Title XX of the Social Security Act and 25 percent by the State of Connecticut, seeks to help the elderly to live outside institutions; it purchases services from other programs such as Project Manna, Meals on Wheels, and senior day care. It thus also supports VTD indirectly through its use and partial support of contract and dial-a-ride services needed for these activities. While Project Manna and Meals on Wheels are continuing funding sources, they cover only minor parts of VTD's operations. Project Life is not a continuing program; thus LNVCC has not achieved the goal of the HEW demonstration to locate ongoing funding sources for the bulk of VTD's services to social service and health agency clients. LNVCC has successfully located long-term funding for VARCA, however, by placing a transportation component in its rate structure. This is important, as VARCA is the single largest VTD user.

Although no new funding sources have been found for senior centers, they have always had transportation budgeted in the funds they receive from their respective towns. With the advent of the Health Transportation Project in 1972, and the subsidy monies it provided for transportation, senior centers were able to make more transportation service available to their clients without increasing their budget or having to ask their towns for more money. All senior centers indicated that they would continue to purchase transportation services from VTD after the current subsidies run out. They will try to provide as much

transportation as possible, but feel that without additional grants they will have to cut back.

One source of additional grants is Title XX of the Social Security Act. Under Title XX, any social service agency can apply for a grant based on the number of potential welfare recipients in the population and the amount of staff time spent on Title XX related work. The money becomes part of the town's general fund and is spent as the town sees fit. VTD and LNVCC have been trying to apply for these funds using a consortium of the four Valley towns as the recipient and eliminating the requirement that all individual recipients fill out Form W2000, which is objectionable to many people as it asks income and other sensitive questions. Although the cutoff point for eligibility for these funds is an annual income of \$11,500 for a family of two and very few Valley elderly have incomes near that level, the State of Connecticut has not been willing to accept a group qualification document to eliminate the need for the Form W2000. Efforts continued for a long period to have the consortium concept recognized but were finally dropped in 1978. The Ansonia Senior Center was the only social service agency in the Valley known to have applied for these funds, and the general fund of Ansonia received \$13,000 due to the efforts of its senior center's director. Presumably, some of this money will be turned over to the center.

The 50 percent user-side subsidies for trips to health service agencies through the HEW demonstration grant ended on November 1, 1977. At present there are no funds available to reduce the cost to the individual of medical trips. The impact of the subsidy loss is to make VTD

trips twice as expensive to the individual. Many of the health programs provide referral service to health facilities but have no funds in their budgets to provide transportation. Some programs have been funded through demonstration grants (Valley Health Services to the Elderly, Project Life) which provide funds for transportation, but these are obviously not continuing sources. At present no ongoing funding has been found. Valley health service agencies see transportation as an integral part of their programs, and efforts are being made to locate ongoing funding which has a transportation component.

Low income, non-elderly people, although a part of the target population, constitute virtually none of VTD's ridership. The primary reason is that funding has not been provided to subsidize their travel. The HEW grants have covered transportation for the elderly (and hence the elderly poor), but no funding was available for low-income people. In 1975, VTD did obtain a Medicare provider number and has been able to cover transportation costs for medical trips of the low income general public.

Valley programs for low income individuals have little to no money for transportation. If funding were available, the day care centers, in particular, would use VTD. Now individuals are responsible for their own children's transportation. The Headstart summer programs have some provision for transportation in their budgets. Transportation has been contracted on a competitive basis with VTD and school bus operators. In the summer of 1977, VTD's bid was accepted for the only transportation program it bid on (Derby). VTD bid on the Derby program because it had

served that program in the past; it did not bid on the Ansonia, Seymour, and Shelton programs due to a desire not to compete unnecessarily with the school bus operators.

In addition to lacking financial assistance to use VTD, monthly billing is also seen as a deterrent to use of VTD by low income individuals. Some low income people have been dropped by VTD because of an inability to pay their monthly bills and have gone back to taxis on which they travel only when they can afford to.

8.4.2 Coordination Among Social Service Agencies and VTD

The major role by LNVCC in the transportation area has been one of a coordinating agent or a broker for transportation services supplied to social service agencies and individual members of the target population. During the first demonstration period, LNVCC mediated individual complaints and schedule problems. As VTD became more established and the system began to function more smoothly, it was felt that longer range scheduling and complaint mediation could best be handled at VTD. LNVCC therefore helped establish a program within VTD to represent agency and individual special needs. The position of transportation coordinator was created to perform this liaison function. During the period of the second HEW grant (and continuing until July, 1978, with Project Mobility funding), LNVCC purchased approximately 10 percent of the VTD operations manager's time to act as transportation coordinator. The role of transportation coordinator has been an extremely effective one in coordinating scheduling, mediating problems, and helping agencies to be more sensitive to the special needs of the elderly and handicapped. The high

degree of cooperation that exists between VTD and Valley social service agencies is due in large part to the efforts of the transportation coordinator. The basic broker role, however, has remained at LNVCC.

The broker role that LNVCC plays is a limited one in that LNVCC deals only with VTD to provide transportation services. Thus, if there is some service that VTD cannot itself provide (e.g. service outside the Valley prior to April, 1977), VTD contracts with another organization (in this example, the Red Cross and later a New Haven taxi firm) to provide the service. LNVCC does not select from alternative providers of service. This arrangement was chosen in the Valley for two key reasons. First, it offered the maximum potential to coordinate special services, a major LNVCC objective. Second, it was felt to be more beneficial to the target population to utilize and support VTD's special vehicles and range of services even though other providers could have been chosen to provide certain services on a strict lowest-cost basis. To prevent any fragmentation of services of "cream-skimming" by other operators, it was decided to make VTD the sole service provider for LNVCC. Thus, LNVCC's brokerage role is an indirect one, with its major influence being on the types of service VTD operates rather than on the selection of the service provider.

LNVCC's formal influence over VTD is through its control of user-side funds, which are required to support much of VTD's contract service, as well as smaller portions of VTD's other services. However, the basis for LNVCC's interactions with VTD has, in fact, been a similarity in viewpoint and cooperation between the two agencies. LNVCC could

control the allocation of user-side subsidy funds to achieve desired changes in VTD service, again a departure from the other "broker" concepts. In this project VTD and LNVCC agreed on user-side subsidy proportions to favor contract service (generally a 50 percent subsidy to the sponsoring agency) due to its high productivity, and to favor medical trips on dial-a-ride service (a 50 percent subsidy to the individual) due to their necessity. A 20 percent subsidy rate was applied to other elderly dial-a-ride and subscription trips. By varying this structure and the amount of funding, the broker agency could influence the operating agency strongly.

In summary, LNVCC defined a unique broker role for itself in the demonstration that appears to have many advantages in a setting such as the Valley in which a specialized public transit agency has been formed to provide services. This broker concept is very supportive of the transit operator, which is necessary to achieve coordinated, stable services, but also retains some control and direction of the services operated.

A final aspect of LNVCC's broker role has been in representing the special transportation needs of the elderly and infirm in a variety of forums outside VTD. These have included areawide planning boards, meetings, and public hearings at the local, state and federal levels.

LNVCC's financial involvement with VTD ended in June, 1978, when the remaining Health Transportation Program funds were expended. LNVCC's primary goal was the establishment of a transportation system in the Valley for the elderly and handicapped, which has been met by the

successful operation of VTD. Now that VTD is established, LNVCC will not need to play as central a role, but it will continue to be an active advocate for the transportation needs of the elderly and handicapped.

There is some concern on LNVCC's part that it might not be an effective advocate for the elderly and handicapped after its transportation grants are expended. The decrease in transportation funds for the elderly and handicapped might mean that VTD will look more and more to serving the general public in order to increase revenues which could result in a lower level of service to the target population in post-demonstration period. VRPA goals reinforce this possibility. However, current VTD management is committed to service to the elderly and handicapped as its first priority, and no real problems in this area are foreseen.

Because of the roles that have evolved over the history of VTD, the senior centers now look to VTD and LNVCC to locate funding sources for them. Also, the distinction between the HEW and UMTA demonstration grants has not been understood by most social service agencies. The UMTA grant was to provide transportation service, while part of the HEW grant was to provide funds to subsidize the cost of transportation to individuals and to agencies. Due to this misconception and even though VTD's demonstration grant is over, the tendency remains to view VTD as a social service agency as well as a transit operating agency.

Agency personnel have worked fairly well with VTD in coordinating and planning services, and dealing with problems and modifications as they arise. Most agencies are rather inflexible in scheduling appointments and activities (e.g. Griffin Hospital clinic hours are at 8 am),

and this leads to many problems in agency relations. VTD has been unable to convince most agencies to contact it before scheduling an appointment with an individual using VTD. Many appointments fall during VTD peak hours, when vehicles to provide dial-a-ride service are not generally available. In general, though, problems in scheduling are viewed by social service and health agencies as a result of constraints on VTD, rather than as a failure of VTD management to be responsive. The role of the transportation coordinator is seen as invaluable by all parties in maintaining communications and resolving problems.

As a final note, the U.S. General Accounting Office performed a telephone survey of 30 Valley agencies to explore their major sources of funding and their use of transportation services.¹ Fourteen of the agencies received Federal funds and provided some transportation for their clients; five of these agencies did not use VTD, citing scheduling problems, high costs, or restrictions on trips outside the Valley. No agency cited Federal restrictions on program eligibility as a reason for not using VTD services for its clients, even though there are a large number of eligibility criteria associated with each Federal program (see Table 8-1). It is also believed, although it was not stated by any agency, that uncertainty over VTD's continued existence has made several agencies unwilling to change from using taxi or school bus service, for fear of lowered service levels or higher cost if forced to return to the original provider by the end of VTD service. VTD's strong performance in the last two years should have overcome this reason for non-utilization of its services by some agencies.

¹See reference 23 in Appendix A.

9. SUMMARY AND POLICY RECOMMENDATIONS

9.1 SERVICE TO THE ELDERLY, HANDICAPPED, AND LOW INCOME

The Valley Transit District has oriented its services to emphasize meeting the needs of its target population, and particularly the elderly component of that population. VTD has had a large impact on approximately 600 individuals, or 5 percent of the total target population of 12,000. These are individuals who use the service more frequently than once a month. For the 500 of these regular users who are elderly, trip frequency is self-estimated to be 27 percent greater than without VTD; this amounts to the difference between 2.2 and 3.0 average round trips per week for these heavy users. About 1,000 additional individuals in the target population use VTD less frequently; the total target population user pool is thus near 1,600, or 13 percent of the target group. The system has had its heaviest impact on elderly households with low incomes and low auto availability; these households tend to be small (one or two persons) as well. VTD users are also disproportionately agency clients and senior center attendees who have been made aware of the service, are subsidized to use it, and have services tailored to these trips. In many ways these users have the most need for VTD services.

VTD registration records follow a similar pattern to users, with VTD achieving high market penetration (in terms of registered persons) in lower income, low auto ownership, and smaller households. This penetration is well over 50 percent for these less mobile households, but

drops off quickly as auto ownership, household size, and income increase.

Use of VTD is focused on senior center, shopping, and medical trips. Current users of VTD are making more trips to senior centers than before, although overall impact on senior center attendance is difficult to ascertain. Shopping travel for VTD users has also increased, although VTD users still make fewer shopping trips than VTD nonusers. Since VTD contract shopping services operate to different shopping centers weekly, and the dial-a-ride service is ubiquitous, there has been some expansion of shopping opportunities for these users. Medical travel frequency or destinations have not been affected by VTD, although it has made these trips easier and less expensive for its users.

Impact on non-elderly handicapped is centered on approximately 100 clients of the Valley Association for Retarded Children and Adults (VARCA) sheltered workshop transported on VTD contract services. Impact on the low-income is even more restricted; 32 of the 100 VTD subscription users have incomes less than \$5,000 per year, and are the major low-income users of the system.

In summary, VTD's current organization and operations serve primarily the agency-oriented elderly market, and primarily through contract services. VTD has penetrated little of the more general elderly travel market, for several reasons:

- Early problems with vehicle capacity and reliability resulted in the loss of some ridership. Table 6-1 shows a strong decline in

the number of individuals using VTD services until 1976, when vehicle problems were resolved, and the trend was reversed.

- Little marketing was done by VTD outside the agencies; although most Valley residents (more than 90 percent) are aware of the system, there are barriers to use such as registration and a two-hour advance request that appear to limit use of the system.
- VTD's dial-a-ride services appear to have diverted few trips from the taxi service, which carries approximately 130 elderly or handicapped passengers per day with immediate service on an average fare of \$1.30, versus VTD's 25 dial-a-ride passengers per day with a two-hour advance request and an average fare near 90 cents. (The taxi service is also available evenings and weekends, while VTD is not.) There appears to be a small enough difference in taxi and dial-a-ride service, in the consumer's view, that overall demand changes due to the dial-a-ride service are quite small.
- VTD fixed route services could not provide a high enough level of service within VTD's financial constraints to attract any significant ridership.

However, VTD has done an effective job of serving the maximum number of trips within its financial and fleet size constraints. Each VTD vehicle (except the autos and station wagons) operates approximately nine hours out of each twelve-hour (6 am to 6 pm) operating day, and carries more than seven passengers per hour on the average, which is quite high for door-to-door services. Thus, the limited impacts VTD

has had on elderly travel must be related to the VTD's potential to accommodate greater tripmaking. Viewed in this manner, VTD has been very effective in the amount of travel it does carry and, to the extent it is concentrated on the less mobile elements of the population, VTD has achieved close to maximum effectiveness in serving the target population within its resources.

9.2 SERVICE TO THE GENERAL PUBLIC

VTD has provided limited service to the general public through its subscription and fixed route operations. The subscription services carry less than 1 percent of the total daily intra-Valley work trips, although VTD does not possess enough vehicle capacity to increase its market share in this area. Furthermore, VTD regards this service as an adjunct to its target population services and thus operates it to meet the needs of workers without autos or licenses. Fixed route services operated by VTD, since they operate in the offpeak and to nonwork destinations, are little used by the general public. About 100 individuals are served regularly by subscription service.

One of VTD's goals was to provide transportation to the general public at a price and productivity level that would help to support the services to the target group. In 1975 and 1976, this required that general population services operate at a revenue/cost ratio over 60 percent, VTD's required systemwide operating ratio to maintain full state funding without a local share. General population services operating over the 60 percent operating ratio could then be used to offset some

amount of specialized service operating at an operating ratio lower than 60 percent to allow the system to maintain its required average; this is termed "cross-subsidy." In 1977 and 1978, the state is covering all of VTD's deficit, subject to certain conditions which VTD is expected to be able to meet.

While the impacts of general population revenues on VTD's ability to offer specialized services at a low operating ratio are less well defined currently, it is still true that there is a tradeoff in the use of subsidy funds between the two groups and that less need for general population service subsidies clearly leaves more funds available for the target group.

Even in 1977-78, and more so in 1975 and 1976, VTD's general population services, principally subscription, are not meeting revenue/cost ratio goals. In fact, target group services are cross-subsidizing the general public service, since its operating ratio is only 20 to 30 percent, far less than the system average which has varied from 40 to 55 percent.

The general public service and the contract services do have some conflicts in peaking patterns, although they are complementary in general. Subscription usage is heavy from 6 to 8 am; as this decreases after 8 am, contract services to VARCA utilize a major portion of the vehicle fleet. The midday period is relatively slack, but subscription and contract demands are heavy between 3 and 5 pm when there is a conflict between serving the target population and general public. In contrast to most transit systems, VTD travel diminishes sharply between

5 pm and 6 pm when the system ceases operation.

The extent to which operational economies are obtained through the unified provision of service to both groups is difficult to estimate. Vehicle utilization is relatively high, with each VTD vehicle being used nine hours per day on the average. This leads to lower operating (administration, garage, and deadheading) costs and lower capital (vehicle and garage) costs than separate systems for the two groups, which would see lower utilization of equipment. The exact savings cannot be determined, but to provide separate services to the general public and the elderly, a doubled vehicle fleet would be required.

To sum up, the addition of services to the general public has not subsidized VTD target group services to date, although new VTD services like the Sikorsky work trip service to Bridgeport, which is maintaining an operating ratio over 60 percent, may alter this situation. While there are reductions in VTD operating cost due to the improved utilization of equipment, the overall impact of these services on VTD's finances is still negative, contrary to its objectives. A final issue in providing VTD services to the general public is that competition is possible between this and the target group for service, and this factor has become a large concern for social service agencies whose clients utilize VTD. If social service funding of VTD decreases from its present level, VTD could be forced to change its services and de-emphasize service to the target group.

9.3 COMPARISON OF FIXED ROUTE, DIAL-A-RIDE, SUBSCRIPTION AND CONTRACT SERVICES

VTD provides much experience in operating different types of service as shown in the data contained in section 7.2. Several key inferences can be drawn from this data.

First, contract services to group activities and shopping trips are an extremely productive and efficient means of meeting these travel needs for the target population. VTD has probably achieved the maximum level of contract operations possible in the Valley at current agency funding levels. Also, VTD's method of operating contract service is very flexible for users and requires no dispatcher involvement. Thus, the operating statistics shown for VTD's contract service (average productivity near 13 passengers per hour, an operating ratio of 1.2, and carrying approximately one trip per capita per month for members of the elderly and handicapped target groups) are near the maximum performance to be expected for the Valley's population and area. It is the VTD service that has had the most impact on the target group.

The performance of VTD dial-a-ride service is more difficult to assess. Much potential ridership appears to have been lost due to reliability problems early in the project, only part of which seems to have been regained. Also, the two-hour call-in time has some impact on ridership. The effect of requiring registration on ridership is not known. A system operating in an area similar to the Valley should be able to expect somewhat higher dial-a-ride patronage than VTD, especially if vehicle problems could be avoided. VTD's current dial-a-ride produc-

tivity is between one and two passengers per hour, and its operating ratio is near 10 percent. With the more regular door-to-door trips being handled by contract (and sometimes subscription) service, however, this is still a relatively good productivity for a system serving the elderly and handicapped.

VTD pricing of the dial-a-ride service (but not the subscription service) is set very close to the revenue maximizing level, as evidenced by the fare elasticities near -1.0 for this service derived from survey and billing data.¹ Either increases or decreases from the present VTD fare structure would probably result in lowered revenues. Thus, the only means for VTD to increase its dial-a-ride operating ratio is to increase its productivity, but even a doubling of productivity would only produce a 20 percent operating ratio. VTD recognizes that this service is unremunerative in the Valley, and therefore restricts the total resources it allocates to the service, although service is provided for all essential trips of regular VTD users known to be dependent on VTD for transportation.

VTD fixed route service has been the least effective of its service modes, with very little ridership being carried. The VTD fixed routes serving the Valley towns (excluding the Bridgeport work trip service) had operating ratios under 10 percent and productivities of two or fewer

¹ A theorem in economics states, under general conditions, that the revenue maximizing fare is that at which the fare elasticity is -1.0, if the elasticity is proportional to fare, as is typically assumed. This elasticity could potentially be affected by marketing or improved service, but is also quite limited by low disposable income of potential users.

passengers per hour.

Even the Connecticut Transit fixed route, which is long established, charges only a 35¢ fare as opposed to VTD's 50¢, and traverses the highest density area of the Valley, has a productivity of only seven passengers per operating hour; this can be regarded as an upper limit for such services in the Valley under present conditions.

The area coverage provided by fixed routes in the Valley for elderly users is not large, as 80 percent of VTD fixed route users reported walking one block or less to the bus stop. Most Valley trips are relatively short, and densities are moderate (1,000 - 3,000 persons per square mile). Thus, it appears that fixed routes are not an effective means of serving target group travel in the Valley. VTD has not operated significant peak period fixed route service for the general public, and sheds no light on this type of service. However, the provision of such services would require a substantial expansion of the vehicle fleet (presuming existing services are not curtailed), and a reorientation of resources and management effort that would be viewed by VTD management as inconsistent with VTD's primary goal of serving the elderly, handicapped and low-income.

Subscription service is the only current VTD service provided primarily for the general public. This service has probably not attained its maximum possible ridership or revenue-producing ability, due mostly to vehicle fleet size constraints. In some sense there is a choice between subscription service and fixed route service as the basic service element for the general public, and VTD has not made a strong commitment

to either, although some subscription service has been developed.

Subscription service currently carries approximately 150 of the 30,000 daily intra-Valley work trips.¹ There has been little marketing of the service in the Valley in general, even though there are two employers with more than 1,000 employees, three with 300 to 500 employees, and 20 with 100 to 300 employees, which would appear to have some potential for the service. The current operating ratio is near 25 percent and the productivity is between four and five passengers per hour.

During earlier periods, the productivity of subscription service was as high as six or seven passengers per hour, partly due to the effects of the fuel shortage in 1973-74 and due to the presence of a third large Valley employer, now closed. The operating ratio for the service would have been near 40 percent at current VTD operating costs. Furthermore, the current Sikorsky service is operating with a productivity over 15 passengers per hour, and at an operating ratio over 60 percent. This potential may be attainable by VTD in other segments of its subscription service and is competitive with or superior to fixed route service in cost-effectiveness in the Valley. Expansion of subscription service is constrained by vehicle availability in the afternoon peak period; however, increases in the patronage of the existing service may also be possible.

VTD subscription service fares are based on the dial-a-ride fares,

¹Of the remainder, about 20,000 are auto drivers, 5,000 are auto passengers, and 5,000 walk.

although heavily discounted monthly passes are available. (Interestingly, the discount on these passes is higher than the user-side subsidy amount on target group dial-a-ride trips.) The basic monthly pass cost of \$16 is consistent with the monthly pass charge of most transit systems, and there appears to be some potential for increasing the operating ratio through fare increases, although this study did not address the issue explicitly.

Thus, VTD provides an interesting perspective on the relative roles and performance of these four service types in a low-to-medium density setting. VTD's experience should be strongly indicative of the experience other similar systems would have, with the exceptions noted above. In general, VTD has achieved much of the potential performance of these four service types within the tight constraints of a small vehicle fleet (one vehicle per 6,000 people or four square miles) and limited resources (maximum operating deficit of approximately \$2.00 per year per person in the Valley).

Systems with less tight constraints may achieve greater impacts particularly with subscription or fixed route services, which were beyond VTD's resources to operate at a large scale.¹ Finally, systems with fewer vehicle problems and more resources for outreach and marketing programs may impact a larger number of individuals than VTD has been able to.

¹A third alternative to providing peak period work trip service to the general public that should not be overlooked in such systems is employer-based vanpooling, which could be coordinated and marketed through the transit system broker. This would remove the need for vehicle fleet expansion, provide service at a low deficit (if any), and still allow the system to concentrate its energies on the target population. Obviously, sufficient social service agency funding would have to exist to allow this.

9.4 FARE COLLECTION AND PRICING INNOVATIONS

While this area is perhaps the one for which the VTD demonstration is best known, it must be recognized that it is only one element in a host of innovations present in the VTD system and that it has generally not been viewed as a critical issue at the local level. A brief review of fare collection issues reveals monthly postpayment has been the most successful and enduring of the innovations, and the user-side subsidy concept has also produced some benefits. The actual, physical use of credit cards and onboard service recorders (fareboxes that read credit cards) was not successful, and neither was the original pricing structure in which trip cost could vary for the same ride based on vehicle occupancy, boardings and alightings, and other factors.

Monthly post-payment has been used by VTD for the entire demonstration and following period. It was computerized based on service recorder data from March, 1973, through June, 1975, purely manual from July, 1975, to July, 1977, and computerized with manual entry of the ride data from August, 1977, through the present. The cost of bill preparation has varied from 11 cents per ride (subscription and dial-a-ride) for the first period, of which 5 cents was computer cost; to approximately 25 cents per ride in the second period; to nearly 20 cents per ride in the third period, of which 10 cents is computer costs on VTD's dedicated minicomputer.¹ The error

¹The computer cost for the first period is based on extremely low rates charged VTD by a large industry in the Valley which did the processing; ten cents or 15 cents would reflect a more typical cost level. Costs for the third period are expected to be reduced substantially when the dispatcher begins entering ride requests into the minicomputer instead of bookkeeping personnel working from written ride slips.

rate (almost entirely missing rides) was 3 to 5 percent in the first period, and less than 1 percent in succeeding periods; this loss of revenue in the first period is also a "cost" which can be attributed to the post-payment arrangement. A final "cost" of post-payment is the nonpayment of bills by users, although this is only 1 percent of the total amount billed. Thus, the costs of monthly billing are significant elements of providing dial-a-ride and subscription services.

The benefits of monthly billing are not large. The monthly billing is required to provide adequate records for the payment of user-side subsidies provided by HEW grants. This data also is of significant value in determining system impacts on tripmaking of its target population. Only 22 percent of the target population users surveyed indicated they preferred monthly billing to cash payment for each ride, and 56 percent clearly preferred cash payment over monthly billing. Monthly billing has also been cited as a source of problems with low-income users of VTD. On the positive side, however, a majority of the general public VTD users did prefer monthly payment. A final, intangible benefit of the post-payment is that it has served, more strongly than any other element of the VTD system, to differentiate it from conventional transit operations in the perceptions of its users, and planners reviewing the system. It has contributed strongly to the image of VTD as specialized transportation, and it is very likely that this has influenced the evolution, planning and regulation of the system.

The use of credit cards and on-board service recorders, as pointed out in section 4.13 is redundant in a demand-responsive system, and VTD

has eliminated their use in the system, replacing them eventually with direct entry of billing data by the dispatcher from each telephoned ride request. The difficulties with VTD's variable fare policy are also discussed in section 4.13, and the current system uses a fixed, zone-to-zone fare table. VTD's difficulties in achieving satisfactory operation of its variable pricing structure indicate the need to have a well-developed, theoretically sound, and practical pricing policy before developing a computerized billing system. Also, it appears that a fixed zonal fare policy, perhaps with peak period surcharges, can achieve most, if not all, the advantages claimed for the variable fare formula FAIRTRAN^R system. Consumer reaction to the variable fare policy was somewhat negative, with about 20 percent of both VTD users and nonusers finding it objectionable; the second most important annoyance factor (after vehicle unreliability) in an on-board survey of VTD patrons was "not knowing the exact fare when riding." These surveys (which were not part of this evaluation effort) understate the impact of the variable fare policy, however, since most of the respondents to these surveys used only contract services for which they were not billed. In summary, while VTD's experience does not rule out the use of variable fare policies by other systems, careful design is required to ensure understanding and acceptance by system users. Agencies liked the variable fare structure because it provides a basis for equitable cost allocation, a key concern. However, agencies seem equally satisfied with the current fixed fare structure.

9.5 RELATIONSHIP OF VTD WITH SOCIAL SERVICE AGENCIES

VTD has developed a very close level of cooperation with the Valley social service agencies for whose clients it provides transportation; this relationship appears to be much closer than with the transportation agencies with which VTD must deal. VTD refers to its users as "clients", and, in fact, is even seen (mistakenly) by some Valley social service agencies as a social service agency itself. This misunderstanding arises primarily from the large number of funding sources used by VTD during the demonstration (some provided by HEW) whose roles were not clearly differentiated (e.g. UMTA demonstration versus HEW demonstration).

The role of coordinating social service agency use and payment for VTD services was taken by the Community Council (LNVCC), which was one of the key initiators of the VTD system. LNVCC helped to determine service needs, plan and allocate VTD services, mediate complaints and difficulties, administer the user-side subsidy grants, and search for ongoing social service funding to support VTD after its demonstration grants expired. VTD and LNVCC developed a very close working relationship and held very similar positions on the emphasis and goals of the VTD system.

The "broker" role that LNVCC plays is a limited one in that LNVCC deals only with VTD to provide transportation services. Thus, if there is some service that VTD cannot itself provide (e.g. service outside the Valley prior to April, 1977), VTD contracts with another organization (in this example, the Red Cross and later a New Haven taxi firm) to

provide the service. LNVCC does not select from alternative providers of service. This arrangement was chosen in the Valley for two key reasons. First, it offered the maximum potential to coordinate special services, a major LNVCC objective. Second, it was felt to be more beneficial to the target population to utilize and support VTD's special vehicles and range of services even though other providers could have been chosen to provide certain services on a strict lowest-cost basis. To prevent any fragmentation of services of "cream-skimming" by other operators, it was decided to make VTD the sole service provider for LNVCC. Thus, LNVCC's brokerage role is an indirect one, with its major influence being on the types of service VTD operates rather than on the selection of the service provider.

LNACC's formal influence over VTD is through its control of user-side funds, which are required to support much of VTD's contract service, as well as smaller portions of VTD's other services. (However, the basis for LNACC's interactions with VTD has, in fact, been a similarity in viewpoint and cooperation between the two agencies.) LNACC could control the allocation of user-side subsidy funds to achieve desired changes in VTD service, again a departure from the other "broker" concepts. In this project, VTD and LNACC agreed on user-side subsidy proportions to favor contract service (generally a 50 percent subsidy to the sponsoring agency) due to its high productivity, and to favor medical trips on dial-a-ride service (a 50 percent subsidy to the individual) due to their necessity. A 20 percent subsidy rate was applied to other elderly dial-a-ride and subscription trips. By varying this structure and the amount

of funding, the broker agency could influence the operating agency strongly.

In summary, LNVCC defined a unique broker role for itself in the demonstration that appears to have many advantages in a setting such as the Valley in which a specialized public transit agency has been formed to provide services. This broker concept is very supportive of the transit operator, which is necessary to achieve coordinated, stable services, but also retains some control and direction of the services operated.

9.6 EXPERIENCE WITH VEHICLE FLEET

Section 4.7 outlines the basic experience VTD has had with its vehicles, and many other sections refer to vehicle problems as partial causes of higher costs, lower ridership, lower reliability, agency dissatisfaction, and other issues. The single largest threat to the use of actual VTD operating experience as a guide to expected performance of similar systems is the potential negative effect of VTD's vehicle fleet which has still not been entirely overcome.

VTD's experience shows that, before sophisticated service planning and implementation can be undertaken, basic vehicle and operation questions have to be well in hand. While the service concepts, pricing policies, interior vehicle amenities, and other items were probably handled in a more sophisticated way in the period from 1973-74 than in the present, VTD nearly ceased operation due to its inability to provide a functioning, reliable service. In the period 1974-77, many of these "extras" were eliminated (although basic concepts were retained) while

attention was focused on providing a working, reliable service. In 1977, VTD was showing a strong performance.

One of the key needs for specialized transit operations is small bus vehicles which can perform reliably and at a reasonable operating and maintenance cost. VTD is in many respects a leading example of the problems with current and past small bus vehicles.

9.7 MANAGEMENT TECHNIQUES FOR SERVING A LARGE AREA

Early VTD planning documents exhibit a large degree of concern about providing service to a large (56 square mile) service area. A sophisticated dispatching technique was developed for this situation, the two-hour lead time for service was adopted to allow for shifting ride times to improve scheduling, and a pricing policy was developed to deal with equity issues among all the trips over the service area.

Much of this concern turned out to be irrelevant, as more than 90 percent of all VTD dial-a-ride and subscription trips have origins and destinations within a 14-square mile core area. Several reasons exist for this concentration of travel. First, VTD's pricing policy sets the fare for most outlying trips between \$3 and \$5 exclusive of any user-side subsidies; this discourages many trips, even though it is cheaper than the taxi fare. Second, service levels for outlying trips are necessarily lower than those for core trips, and this further lessens demand. Third, most of the population with limited mobility (no automobile or driver's license) lives in the core, and this has formed the bulk of VTD ridership. Thus, the effective size of the VTD service area has been reduced by several factors, both within and beyond VTD's control.

Even the core service area is relatively large, though, and VTD has developed dispatching techniques for operations in this setting that are described in Section 4.6. These techniques allow a single dispatcher to control the entire VTD system, and include aids to forming dial-a-ride vehicle tours. Another key element is the design of contract services to operate without any dispatcher involvement. The two-hour requirement for ride requests is rarely used to shift a user's time of travel to improve a vehicle tour, as the dial-a-ride demand density is not high enough in general to allow this.

One can, in general, conclude that systems like VTD, when serving a large area with varying densities, will concentrate their services on these core areas. Several forces, including the concentration of target population members, cost, and service level considerations, will influence the system to focus on core areas. If more uniform service is desired over a wider area, strong, explicit steps (such as higher user-side subsidies for outlying trips) must be taken to counteract these other factors, and the resulting equity issues dealt with as well. Even in a system with advance planning aimed at this issue like VTD, limited service to outlying areas has resulted.

9.8 LOCAL ATTITUDES TOWARD VTD

VTD has provided an interesting case study in the reactions and positions of many actors in the Valley toward a specialized transit system. Sections 8.2 through 8.4 describe these issues in detail. In summary, while VTD has had strong support from social service agencies with which it is directly involved, it faces conflicting forces from other

quarters. The regional planning agency (VRPA) advocates greater service to the general public, which VTD sees as a potential threat to its specialized services in an environment with limited resources. The school bus and taxi operators in the Valley oppose those elements of VTD service they feel compete with services they are adequately able to offer. VTD has been called before the Connecticut Public Utilities Control Authority (PUCA) on several occasions to answer complaints. The Valley municipalities, while generally supportive of VTD, are reluctant to provide any local funding, although they have done so at two points in the past. Finally, the Connecticut DOT is supportive of VTD and has agreed to a more generous operator subsidy policy than its basic agreement. VTD has preserved and expanded its role in Valley transportation in this institutional setting, although several conflicts (particularly the one between VRPA's goals and the social service agency goals) are still in the process of being worked out.

9.9 VTD TRANSITION FROM DEMONSTRATION TO OPERATIONAL STATUS

VTD began its preparations for transition to operational status in 1975 when it negotiated with the state to be included under its basic subsidy policy for transit districts. At that time a 60 percent operating ratio was required to receive full state deficit funding. UMTA demonstration funds were phased out of VTD's operating budget fairly quickly, with only some administrative costs due to the demonstration being charged against it. VTD then began planning a service mix and fare structure that would allow it to cover approximately 60 percent of its operating costs. The critical element in this transition was VTD know-

ing the criterion for its continued operation nearly three years in advance of the date it would make its transition.

LVNCC's second HEW grant (for the years 1974-76) had a parallel emphasis to VTD's effort in that a major objective of the HEW demonstration was to locate ongoing sources of social service transportation funding that could be tapped by VTD and Valley social service agencies and municipalities. This effort, somewhat isolated from day-to-day operating problems that sometimes divert attention from longer term issues, expended a great deal of energy and achieved some success. VARCA has incorporated a transportation element in its rate structure at the urging of LVNCC and based on an audit showing VTD could provide better service at a slightly lower cost than VARCA could provide for itself; as VARCA is VTD's largest contract user, this is an important element in VTD's continued viability. However, VARCA had to be actively convinced that VTD would provide a cost-effective solution to its transportation needs through an audit study. An effort was made by LVNCC to anticipate the end of the subsidy to the senior centers, and to encourage them to allocate a portion of their operating budgets to take over the funding of the transportation services. This also achieved moderate success. Other lesser sources of some continued funding beyond the demonstration were found, although LVNCC was disappointed in the overall result. Finally, LVNCC had to push the four Valley senior centers to prepare for the transition from large HEW transportation subsidies to reliance on their own budgets only. These efforts by LVNCC were critical in VTD's transition.

VTD also needed to demonstrate that it was fully operational at the end of the demonstration period to avert efforts to discontinue the project at that point. This had nearly occurred at the end of the first UMTA demonstration grant in June, 1974. In June, 1977, however, this was not an issue.

Finally, VTD had to be flexible enough to alter its service levels or mix during transition if prior or expected funding or revenue sources did not materialize. An example of this is the end of user-side subsidies for all individuals and agencies (except senior centers) in late 1977. VTD expects a decrease in contract service use due to the higher prices of its services to users. While LNVCC has eased the problem by arranging to carry over unexpended funds from previous years, VTD negotiated a supplemental state subsidy agreement and is prepared to reduce or restructure some of its services if necessary.

VTD's priority is still to provide services to the target population in the Valley, although there may be both political and financial pressures to change this emphasis. The resolution of this issue under current funding possibilities will be the most difficult test of whether VTD's demonstration concept will fully become established in the post-demonstration stage.

APPENDIX A

Annotated References

Due to the large number of previous reports on the Valley Transit District, there is a need to place them in proper perspective, and also to discuss some of the conflicts that arise among the results reported in previous reports and in this evaluation report. Almost all the reports referenced contain some conflicts with one another and with this evaluation report. All major conflicts have been investigated using original sources if possible to attempt to resolve these issues in this report. Key conflicts are noted in this section.

There is also some confusion over terminology, and the terms "general public", "regular (rider)", "door-to-door" and others are used inconsistently from reference to reference.

1. RRC International, Inc., Valley Transit District: Operations, Fare System, and Vehicle Design, prepared for Valley Transit District, Derby, Connecticut, September, 1975, 294 pages.

This report covers the period through June 1974, and is divided into three sections: System Operations, Fare System, and Vehicle Design. In the first section, a basic description of the system's history, revenues, ridership, and costs is given, along with many projections which, of course, have been superseded. Many features described, such as the use of V-cards on fixed route buses, were never in fact implemented. The second section describes the original FAIRTRAN^R system in detail. The third section gives a review of VTD's first six vehicles, which were

taken out of service in 1975 - 1976. The report does not mention the crises with finances and vehicles that occurred in early 1974, which is a serious bias.

2. Valley Transit District, Valley Transit District: Routes, Fares, Facts, March 1976, pamphlet.

This is the only document which describes the fixed route services operated from November 1975 through February 1977, in detail. It was developed as promotional literature.

3. Institute of Public Administration, General Notes from Naugatuck, Connecticut, Field Trip, memorandum prepared by Ralph E. Rechel, March 1974, 6 pages.

These notes are in three sections. The first, titled "Social Services", gives a good overview of the potential social benefits of VTD on users and other individuals in close contact with users. They are not discussed in any detail, however. The second section, "Basic Economics", outlines several problem areas (such as low dial-a-ride use) that were evident even at this date. The third section, "Organization and Administration", is a good review of VTD operations at that date, pointing out both the positive and negative aspects.

4. RRC International, Inc., Valley Transit District Demonstration Project Interim Summary Report, prepared for Valley Transit District, July 1973, 25 pages.

This report is a concise summary of demonstration objectives and operations early in the project.

5. Valley Transit District, Application for an Amendment to Demonstration Grant CT-06-0003, Submitted to Urban Mass Transportation Administration, Washington, DC, May 1974, 56 pages.

This document outlines the objectives and operational changes for the second UMTA demonstration (1974-1977), the first period being covered in Reference 1. The key objective was to expand VTD to become a general public transportation service, including the initiation of fixed route services, integration of cash payment into the credit card system, centralization of the billing system, new dispatch strategies, and pricing tests. As events unfolded, none of these elements of system operations were addressed (except the use of a minicomputer for billing) during this period, attention being focused instead on maintaining VTD's existence and in continuing its services to the target population.

6. Cambridge Systematics, Inc., Evaluation Plan for the Valley Transit District Service and Methods Demonstration Project, prepared for Transportation Systems Center, US DOT, Cambridge, Massachusetts, November 1976, 135 pages.

This report is a required step before the evaluation of a demonstration project can proceed, and it outlines the basic objectives and measures of effectiveness to be addressed, data collection, and analysis techniques.

7. US DOT, Transportation Systems Center, Service and Methods Demonstration Program Annual Report, November 1975, 238 pages.

This document includes a description of the VTD system as Appendix M. While giving a good general overview of the system, much of the data

included is based on preliminary and incomplete analysis which is superseded by this report.

8. Institute of Public Administration, Case Studies: Valley Transit District, Naugatuck Valley, Connecticut, September 1974, 63 pages.

This draft report, partly based on the findings of Reference 3, summarizes VTD results to June 1974. Much of the material overlaps with Reference 1. The sections of this study are labelled:

Background: site characteristics

VTD Project: objectives, funding, services, and results of the first demonstration grant

Project Planning and Development: brief history

Operating Experience: further results on ridership, revenues, costs, and funding

Project Appraisal and Findings: an overall assessment of VTD operations, social benefits, and recommended changes

The 1 cent gasoline tax discussed in this report was not in fact levied, and no vehicle problems are mentioned, probably due to the fact that much of the information is based on a March 1974 trip which obtained vehicle data from an even earlier point, at which vehicle performance was still satisfactory. The discussion of other issues is quite good, and the data reported is quite accurate.

9. RRC International, Inc., Valley Transit District: Elderly/Handicapped Transportation, Evaluation and Impact, prepared for Lower Naugatuck Valley Community Council, Ansonia, Connecticut, July 1974, 184 pages.

This is the official evaluation report for the first HEW demonstration. User-side subsidy data for the project is given, although it does not correspond with either VTD or LNVCC audit records (a problem faced by this evaluation also). A large survey effort was engaged in to determine VTD's impact on tripmaking. One thousand individuals were chosen to be surveyed in both January 1973 and January 1974; only 294 usable responses were obtained. Furthermore, since the fuel shortage was at its height in January 1974, this completely obscured any effects VTD may have had. Thus, the survey was not reported in this evaluation report, but interested readers can find it in the RRC volume.

An experimental group of 100 individuals was to have been given free use of all VTD services as a test of demand response; however, less than half of this group even chose to receive V-cards, and very few trips were made by this group on VTD, a result mostly attributable to the lack of service capacity and reliability that existed at this point.

An onboard survey was also conducted, but because the results are not separated by service type (contract, subscription, dial-a-ride), they are difficult to interpret.

Chapter V of this report has an excellent discussion of the needs, former transportation, and use of VTD for almost all Valley social and health service agencies. Chapter VI reports a cost-benefit analysis which has serious shortcomings. Appendix III reports interesting interviews with VTD's nine wheelchair users who held V-cards.

10. Pearson, David, J. Tanenbaum, G. Bisbee, S. Webb, The Attitudes of Lower Naugatuck Valley Health Care Practitioners and Programs toward the VTS Dial-a-Ride Program, prepared for Lower Naugatuck Valley Community Council, June 1974, 55 pages.

This study reports the results of a mailback survey of all Valley health practitioners and programs on their knowledge, attitudes and perceived needed improvements of VTD.

11. Pearson, David, and six other authors, The Effect of the Valley Transit System on the Utilization of Selected Health Services in the Naugatuck Valley, prepared for Lower Naugatuck Valley Community Council, June 1974, 103 pages.

This study gathered records from the two Valley hospitals, and police and ambulance medical trips for 1972 (see reference 13) and 1973. This "before and after" data was then compared to examine the impact of VTD services which began in early 1973 on medical tripmaking. There are many exogenous factors, and much missing and inconsistent data which made it difficult for this study to draw any conclusions on VTD's impact. The study discusses a decrease in ambulance trips in great detail, and suggests that much of the apparent decline may not be due to VTD. The overall conclusion is that VTD has had little impact on medical trips.

12. Bisbee, Gerald, and five other authors, Valley Transit District - Utilization Patterns and Satisfaction Levels Among Health Service Consumers, prepared for Lower Naugatuck Valley Community Council, June 1974, 65 pages.

This study analyzed all V-card holders, separated into users and non-users, in the period November 1973 to January 1974. The demographic data contained in the V-card file was used as the basis for the analysis,

along with a mailback survey of 422 VTD users and nonusers (all holding V-cards) containing questions about their medical trips. This survey is affected by the fuel shortage and by VTD fleet capacity and reliability problems, so it is difficult to draw any conclusions, except that VTD was used for very few medical trips, and only when no other alternative was available.

13. Pearson, David, S. Webb, J. Udelson, G. Bisbee, Utilization of Health Services and Related Transportation Patterns, prepared for Lower Naugatuck Valley Community Council, August 1973, 71 pages.

This study collected the baseline, "before VTD" data for the analysis reported in Reference 11.

14. Lower Naugatuck Valley Community Council, Inc., Application for a Change in Project Scope and Duration, Grant 93-P-55, prepared for HEW Administration on Aging, Office of Human Development, Washington, DC, May 1974, 71 pages.

This application reviews the results of the first HEW demonstration (to the extent they were available at that time) and outlines six task areas for the second two-year period:

- continuation of the user-side subsidy program,
- establishment of health and social service agency transportation coordinator at VTD,
- study of institutional barriers affecting Valley agencies and VTD operations,
- seminars on barrier solutions for VTD,
- comparative evaluation of institutional barriers and solutions,
- evaluation of integrated versus separate transportation systems to serve both agency and general public needs.

Reference 20 is the final report covering this project.

15. DeBlasio, Allan, and G. Walters, DISPATCH: A Demand-Responsive Dispatching Algorithm for the Valley Transit Demonstration Project, Master of Engineering thesis, Rensselaer Polytechnic Institute, Troy, New York, August, 1974, 245 pages.

A computerized dispatching algorithm was programmed that could be used by VTD on its minicomputer (yet to be acquired at the time of this thesis). The thesis describes the algorithm, and reports the results of one test run, which indicated that computer dispatching could increase VTD's door-to-door (dial-a-ride and subscription) productivity from four to six or seven passengers per hour.

16. Valley Transit District, Valley Transit District Transportation Development Plan, January, 1976, 8 pages.

This report summarizes VTD services in late 1975 (just after introduction of the fixed route services). Fixed route ridership statistics presented in the TDP conflict with VTD statistics. The TDP does mention VTD's vehicle problems, however, one of the few sources to do so. Revenue and cost figures are preliminary and have been superseded by audited reports.

17. Valley Regional Planning Agency, Transportation Improvement Program, July, 1976, 17 pages.

This document lists all transportation projects in the Valley region, including VTD operating assistance and capital grant requests for the period through fiscal year 1980. VTD operating assistance required is estimated at \$200,000 for FY1978, and \$250,000 in FY1979 and FY1980.

18. Valley Regional Planning Agency, Valley Transportation through (19)76, with Recommendations for the Future, no date, 65 pages.

This report reviews all transportation modes in the Valley, both freight and passenger. Only a minor section deals with VTD; plans for a multimodal terminal in the Valley are included.

19. Lower Naugatuck Valley Community Council, The Executive Director Reports, June, 1976, 18 pages.

This summarizes the structure of LNVCC and its role in Valley health and social programs.

20. RRC International, Inc., Consolidating Transportation Resources for Elderly, Handicapped, and Human Services' Clients, prepared for Lower Naugatuck Valley Community Council, June, 1976, 141 pages plus separate volume with appendices, 119 pages.

This report summarizes the results of the second HEW demonstration project. Limited success in coordination of agencies and in securing on-going funding was attained; Chapters III and IV describe these attempts in detail. Appendix A gives an estimate of the total target population which is superseded by the evaluation report. The discussion in Appendix B of alternative user-side subsidy proposals for the future is moot since these funds have been curtailed.

21. U.S. Department of Health, Education, and Welfare, Public Health Service, Health Resources Administration, Limitation of Activity and Mobility Due to Chronic Conditions, United States - 1972, November, 1974, 56 pages.

Table E of this reference was utilized to develop estimates of the handicapped target population in this evaluation report.

22. U.S. House of Representatives, Select Committee on Aging, Senior Transportation - Ticket to Dignity, May, 1976, 74 pages.

This report summarizes Federal involvement in transportation for the elderly. Hearings in the Valley (and many other sites) were conducted as a part of the preparation of this document.

23. U.S. General Accounting Office, Hindrances to Coordinated Transportation of People Participating in Federally Funded Transit Programs, CED-119, October, 1977, two volumes.

The second volume of this report includes case studies of several sites, VTD being one of these. It contains a good overview discussion of the system.

24. RCC International, Inc., Valley Transit District: Operations, Fare System and Vehicle Design, Phase II, prepared for Valley Transit District September, 1978, approx. 200 pages.

This is the final report of the second phase of the UMTA demonstration project, covering the period from July, 1974, through June, 1977. It describes the development of alternative service strategies and the modifications to the FAIRTRAN^R fareboxes and software that took place in 1975 and 1976. VTD essentially chose the "status quo" service policy, and the farebox and software changes were never implemented. Thus, while the report sheds some insights on the issues facing VTD during the period, it provides little information on the actual operation.

APPENDIX B

Survey Summaries

B.1 Home Interview Survey

The Home Interview Survey covered users of contract, door-to-door and fixed route modes. 83 completed surveys were obtained. The survey questions and responses follow.

- (1) We'd like to find out how often you travel and by what means of transportation you make your trips. Each round trip (e.g., from home to work and return home; from home to shopping and return home, etc.) counts as 1 trip.

Questions to be asked for each of the following trip purposes:

work
clinic/doctor
school/training
recreation/social
senior center
shopping/personal business

- a. "How often do you go to _____?"
(Responses should be by number of times per week, every two weeks, number of times per month, etc.)
- b. "How do you travel to _____?"
if VTD is not the sole means of transportation, ask
- c. "Why do you use _____ instead of VTD?"
(Interviewer to give respondent list of reasons VTD not used and ask respondent to choose one.)
1. drive myself
 2. VTD service not available at time I need it
 3. too difficult to carry packages on VTD
 4. can get ride with friend/relative and prefer it
 5. round trip wait time unacceptable
 6. can't be sure VTD will get me there when I need to be
 7. VTD two hour advance call in time is inconvenient
 8. VTD is too expensive
 9. other (specify)

If respondent uses VTD, ask

- d. "If VTD service were not available to you, would you be able to make: the same number of these trips; fewer of these trips; none of these trips?"

If "fewer" or "same number" of trips is indicated in (d), ask (e).

e. "How would you make these trips if VTD were not available?"

Responses by trip purpose were as follows.

	<u>Number</u>	<u>Percentage</u>
<u>Work Trips (8 respondents)</u>		
a. Average trip frequency per week (83 respondents):	.39	
b. Transportation mode		
Use VTD? yes	6	75.0
no	2	25.0
Other modes used?		
ride with friend	2	50.0
walk	1	25.0
drive self	2	25.0
c. Reason for not using VTD		
drive myself	1	33.3
VTD service not available when I need it	1	33.3
prefer to ride with friend/relative	1	33.3
d. If VTD service not available, would make		
same number of trips	3	50.0
none of these trips	3	50.0
e. Alternative mode if VTD not available		
taxi	2	66.7
drive self	1	33.3
<u>Clinic/Doctor Trips (26 respondents)</u>		
a. Average trip frequency per week (83 respondents):	.12	
b. Transportation mode		
Use VTD? yes	21	80.8
no	5	19.2
Other modes used?		
ride with friend	7	53.8
walk	2	15.4
drive self	2	15.4
other bus	2	15.4
c. Reason for not using VTD		
drive myself	2	20.0
prefer to ride with friend/relative	4	40.0
VTD not reliable	2	20.0
VTD is too expensive	1	10.0
other	1	10.0

	<u>Number</u>	<u>Percentage</u>
d. If VTD service not available, would make		
same number of trips	19	90.5
fewer of these trips	1	4.8
none of these trips	1	4.8
e. Alternative mode if VTD not available		
taxi	4	21.1
walk	1	5.3
ride with friend/relative	14	73.7

School/Training Trips (1 respondent)

a. Average trip frequency per week (83 respondents):	.01	
b. Transportation mode		
Use VTD? yes	1	100.0
Other modes used? drive myself	1	100.0
c. Reason for not using VTD		
drive myself	1	100.0
d. If VTD service not available, would make		
same number of trips	1	100.0
e. Alternative mode if VTD not available		
drive myself	1	100.0

Recreation/Social Trips (20 respondents)

a. Average trip frequency per week (83 respondents):	.3	
b. Transportation mode		
Use VTD? yes	9	45.0
no	11	55.0
Other modes used? ride with friend	10	83.3
drive self	2	16.7
c. Reason for not using VTD		
drive myself	2	16.7
service not available when I need it	1	8.3
prefer to ride with friend/relative	7	58.3
VTD too expensive	1	8.3
other	1	8.3
d. If VTD service not available, would make		
same number of trips	3	30.0
fewer of these trips	1	10.0
none of these trips	6	60.0

	<u>Number</u>	<u>Percentage</u>
e. Alternative mode if VTD not available		
walk	1	25.0
ride with friend	3	75.0

Senior Center Trips (61 respondents)

a. Average trip frequency per week (83 respondents):	1.62	
b. Transportation mode		
Use VTD? yes	52	85.2
no	9	14.8
Other modes used?		
ride with friend	7	33.3
walk	7	33.3
drive self	4	19.0
other bus	1	4.8
taxi	2	9.5
c. Reason for not using VTD		
drive myself	3	21.4
service not available when I need it	2	14.3
prefer to ride with friend/relative	5	35.7
VTD not reliable	3	21.4
other	1	7.4
d. If VTD service not available, would make		
same number of trips	20	38.5
fewer of these trips	14	26.9
none of these trips	18	34.6
e. Alternative mode if VTD not available		
taxi	3	9.1
walk	8	24.2
ride with friend/relative	16	48.5
drive self	2	6.1
other bus	3	9.1
don't know	1	3.0

Shopping Trips (69 respondents)

a. Average trip frequency per week (83 respondents):	.98	
b. Transportation mode		
Use VTD? yes	53	76.8
no	16	23.2
Other modes used?		
ride with friend	18	72.0
walk	2	8.0
drive myself	4	16.0
other bus	1	4.0

	<u>Number</u>	<u>Percentage</u>
c. Reason for not using VTD		
drive myself	5	21.7
service not available when I need it	3	13.0
prefer to ride with friend/relative	15	65.2
d. If VTD service not available, would make		
same number of trips	22	42.3
fewer of these trips	15	28.8
none of these trips	15	28.8
e. Alternative mode if VTD not available		
taxi	2	5.3
walk	3	7.9
ride with friend/relative	26	68.4
drive myself	1	2.6
other bus	3	7.9
don't know	3	7.9

- (2) We would like to find out which of VTD's services you use and your reactions to these services

A. Door-to-Door Service

A two hour advance notice telephone call to the VTD reservationist will result in a bus being radio dispatched to your door. You can travel anywhere within the four Valley towns. Service is available Monday through Friday, 6:00 AM to 6:00 PM. The cost of the ride is based on the distance travelled and varies from 75¢ to \$5.

	<u>Number</u>	<u>Percentage</u>	
1. Do you use VTD Door-to-Door Service?			(83 responses)
yes	52	62.7	
no	31	37.3	
If no, skip to Question 6.			
2. How often has VTD not been able to accommodate you for a particular trip you wanted to make?			(52 responses)
once or twice a week	2	3.8	
once or twice a month	6	11.5	
not at all	44	84.6	
3. If the call-in time for VTD service were reduced to 15 minutes, how many more rides would you make on VTD door-to-door service per week?			(24 responses)
one ride	12	50.0	
two rides	8	33.3	
three rides	2	8.3	
four rides	1	4.2	
six rides	1	4.2	
4. When you use VTD Door-to-Door Service, what portion of your trip is usually paid for by social service agencies?			(51 responses)
don't know	39	76.5	
20%	3	5.9	
50%	2	3.9	
none	7	13.7	
If subsidies are indicated, ask Question 5, otherwise skip to 6.			
5. If you had to pay the entire VTD fare, would you			(41 responses)
not be able to make these trips	5	12.2	
rely more on friends/relative for rides	4	9.8	
make the same number of these trips	20	48.8	
make fewer of these trips	12	29.3	
If fewer trips, what fraction			(11 responses)
quarter of these trips	1	9.1	
half of these trips	6	54.5	
three quarters of these trips	4	36.4	

	<u>Number</u>	<u>Percentage</u>	
5a.			Does the discount you receive encourage you to make more trips? (45 responses)
	27	60.0	yes
	18	40.0	no
6.			Which <u>one</u> of the following possible VTD improvements would you like to see made in the <u>Door-to-Door Service</u> ? (82 responses)
	8	9.8	reduce fares by 25¢ per ride
	26	31.7	add evening and weekend service
	1	1.2	service trips outside the Valley
	12	14.6	call-in time reduced to 1/2 hour
	1	1.2	coordination of VTD with other bus, rail and limousine services in the Valley
	3	3.7	more dependable pickup and drop off times
	1	1.2	better buses
	30	36.6	don't know

B. Contract Services

Under contract services, social service agencies (such as Senior Centers, VARCA, etc.) arrange with VTD for their clients to be picked up at their homes and taken to the center or to activities arranged for by the agencies elsewhere in the Valley. Contract service is available to the agencies Monday through Friday, 6:00 AM to 6:00 PM, as well as on a limited basis on evenings and weekends.

1.			Do you use VTD Contract Service? (83 responses)
	53	68.8	yes
	24	31.2	no

If "no," skip Question 2.

2.			Contract service is normally paid for by the agency sponsoring your trip. If the agency no longer paid and you were charged 50¢ per trip, would you (53 responses)
	0	0.0	not be able to make these trips
	27	50.9	make the same number of these trips
	26	49.1	make fewer of these trips

3.			Which <u>one</u> of the following possible improvements would you like to see the most in VTD <u>Contract Service</u> ? (75 responses)
	1	1.3	more contract runs
	8	10.7	better buses (better heating, lighting, smoother ride, etc.)
	1	1.3	more help getting on and off the bus
	11	14.7	more evening, weekend contract runs
	6	8.0	contract service outside the Valley
	48	64.0	don't know

C. Fixed Route Bus Service

Regularly scheduled buses operate Monday through Friday during the hours of 9:30 AM to 3:00 PM on a single route at two hour intervals in each of the four Valley towns. In addition, there is a fixed route bus operating hourly from 10:00 AM to 5:00 PM on a route which connects the four towns. The cost of this service is 50¢ to the general public, with 25¢ fares for seniors and students.

	<u>Number</u>	<u>Percentage</u>	
1. Do you use VTD Fixed Route Bus Service?			(77 responses)
yes	32	41.6	
no	45	58.4	

If "no," skip Question 2.

2. How many blocks do you walk from your home to get the fixed route bus?			(15 responses)
1 block	12	80.0	
2 blocks	1	6.7	
4 blocks	1	6.7	
5 blocks	1	6.7	

3. Which <u>one</u> of the following possible improvements would you like to see the most in VTD <u>Fixed Route Service</u> ?			(73 responses)
cut fares in half	2	2.7	
have buses run twice as often	3	4.1	
better connection with other bus routes	2	2.7	
route deviation	8	11.0	
don't know	54	74.0	
other (better knowledge of routes, times, etc.)	4	5.5	

(3) A few final questions,

1. Which do you prefer:			(83 responses)
monthly billing	18	21.7	
cash payments for each ride	47	56.6	
doesn't matter	18	21.7	
2. If your monthly bill difficult to understand?			(50 responses)
yes	3	6.0	
no	47	94.0	
3. Have you had any billing problems?			(50 responses)
yes	8	16.0	
no	42	84.0	

	<u>Number</u>	<u>Percentage</u>	
4. Are VTD drivers pleasant?			(83 responses)
yes	83	100	
no	0	0	
5. Are VTD dispatchers pleasant?			(78 responses)
yes	76	97.4	
no	2	2.6	
6. Do you have a hard time getting through to VTD on the phone?			(76 responses)
yes	6	7.9	
no	70	84.3	
7. When you telephone VTD, do you get all the information you need?			(76 responses)
yes	74	97.4	
no	2	2.6	
8. Do you have difficulty negotiating the steps of the bus?			(82 responses)
yes	23	28.0	
no	60	72.0	
9. Do you need the help of another person in getting around inside or outside the house?			(82 responses)
yes	4	4.9	
no	79	95.1	
10. Do you need the help of some special aid, such as a cane or wheelchair in getting around?			(82 responses)
yes	5	6.1	
no	78	93.9	
If no, do you have trouble getting around freely?			(81 responses)
yes	6	7.4	
no	76	92.6	
11. Do you have an illness that requires you to make periodic trips to a doctor or medical facility?			(82 responses)
yes	21	25.6	
no	62	74.4	
12. Do you have a handicap which makes it difficult for you to get around?			(83 responses)
yes	11	13.3	
no	72	86.7	
13. If VTD were not available, how much harder would it be for you to get around?			(83 responses)
very	50	60.2	
somewhat	24	28.9	
not at all	9	10.8	

Number of unduplicated individuals responding "yes" to one or more of questions 8-12

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B.2 Subscription Survey

The VTD subscription survey was handed out to riders as then entered the bus in the morning, with the request that the survey form be returned to the driver the following morning. Approximately 110 surveys were handed out; eighty completed surveys were returned. The survey form and responses follow.

VALLEY TRANSIT DISTRICT SURVEY

Good morning!

Valley Transit District is conducting a survey of Valley residents to better understand their transportation needs, how VTD meets these needs and how people feel about the service provided by VTD. The results of this survey will help VTD to better meet the transportation needs of Valley residents.

We have identified you as a user of VTD's subscription service (pre-arranged travel on a regular basis). We would appreciate it if you could take the time to answer some questions about VTD, in general, and about the round trip from home that you are making on VTD today, in particular.

Please return the completed questionnaire to your driver tomorrow morning. Thank you for your assistance.

	<u>Number</u>	<u>Percentage</u>	
1. Please check the place to which you are going on <u>this</u> trip.			(80 responses)
work	65	81.3	
school/training	11	13.7	
other	4	5.0	
2. On your trip <u>this</u> morning, were you <u>picked up</u> :			(80 responses)
more than 15 minutes early	8	10.0	
5-15 minutes early	9	11.2	
0-5 minutes early	3	3.7	
when you expected	53	66.2	
0-5 minutes late	3	3.7	
5-15 minutes late	2	2.5	
more than 15 minutes late	2	2.5	
3. On your trip <u>this</u> morning, were you <u>dropped off</u> :			(79 responses)
more than 15 minutes early	5	6.3	
5-15 minutes early	15	19.0	
0-5 minutes early	13	16.5	
when you expected	39	49.4	
0-5 minutes late	5	6.3	
5-15 minutes late	1	1.3	
more than 15 minutes late	1	1.3	

	<u>Number</u>	<u>Percentage</u>
4. How satisfied are you with the timing of <u>this</u> ride?		(80 responses)
very satisfied	42	52.5
acceptable	37	46.3
displeased	1	1.2
5. What time does VTD <u>usually</u> get you to your destination in the morning?		(75 responses)
5:30 AM	1	1.2
6:00 AM	2	2.7
6:30 AM	16	21.3
7:00 AM	16	21.3
7:30 AM	8	10.7
8:00 AM	11	14.7
8:30 AM	4	5.3
9:00 AM	12	16.0
9:30 AM	2	2.7
10:30 AM	3	4.0
What time do you want to be there?		(66 responses)
5:30 AM	1	1.5
6:30 AM	12	18.2
7:00 AM	13	19.7
7:30 AM	6	9.1
8:00 AM	14	21.2
8:30 AM	6	9.1
9:00 AM	11	16.7
10:00 AM	1	1.5
10:30 AM	2	3.0
Difference between desired and actual AM dropoff time		
more than 12.5 minutes early	8	11.9
about 10 minutes early	4	6.0
about 5 minutes early	9	13.4
on time	25	37.3
about 5 minutes late	12	17.9
about 10 minutes late	1	1.5
more than 12.5 minutes late	8	11.9
If there is a time difference, is it		(70 responses)
annoying	15	21.4
acceptable	55	78.6
6. What time does VTD <u>usually</u> pick you up and take you home in the afternoon or evening?		(56 responses)
1:30 PM	2	3.6
2:30 PM	18	32.1
3:00 PM	12	21.4
3:30 PM	21	37.5
4:00 PM	3	5.4

	<u>Number</u>	<u>Percentage</u>
What time do you finish work?		(54 responses)
2:00 PM	1	1.9
2:30 PM	23	42.6
3:00 PM	6	11.1
3:30 PM	22	40.7
4:00 PM	1	1.9
6:00 PM	1	1.9
Difference between desired and actual PM pickup time		
more than 12.5 minutes early	1	1.9
on time	19	35.8
about 5 minutes late	7	13.2
about 10 minutes late	7	13.2
more than 12.5 minutes late	19	35.7
If there is a time difference, is it		(56 responses)
annoying	14	25.0
acceptable	42	75.0
7. If VTD service were not available, how would you make this trip? (76 responses)		
I wouldn't be able to	16	21.1
drive a car that I already own	7	9.2
purchase an additional car	2	2.6
be taken by friend/relative	24	31.6
take a taxi	7	9.2
carpool	2	2.6
walk	14	18.4
use another bus service	2	2.6
other	2	2.6
8. Are you riding on a family pass? (77 responses)		
yes	9	11.7
no	68	88.3
If you are, how often do other members of your family use the pass?		
never	7	77.7
once a month	1	11.1
daily	1	11.1
9. If you use VTD for any trips besides the type you indicated in Question 1, please check the type(s) from the list below: (76 responses)		
medical	13	17.1
shopping	6	7.9
recreation/social	0	0
other	2	2.6
none	55	72.4

	<u>Number</u>	<u>Percentage</u>	
10. Which <u>one</u> of the following possible VTD improvements would you like to see the most? (63 responses)			
lower fare by 25¢ per trip	18	28.6	
more direct, faster trip	9	14.3	
more reliable pickup and drop off times	13	20.6	
better buses (better lighting, heating, seats, smoother ride, etc.)	13	20.6	
"straggler" service (e.g., if you miss your scheduled run, a VTD door-to-door vehicle will pick you up	8	12.7	
other	2	3.2	
11. Which do you prefer: (72 responses)			
monthly billing	46	63.9	
cash payments for each ride	4	5.6	
doesn't matter	22	30.6	
12. Is your monthly bill difficult to understand? (62 responses)			
yes	2	3.2	
no	60	96.8	
13. Have you had any billing problems? (61 responses)			
yes	6	9.8	
no	55	90.2	
14. Are VTD drivers pleasant? (77 responses)			
yes	74	96.1	
no	3	3.9	
15. Are VTD dispatchers pleasant? (74 responses)			
yes	73	98.6	
no	1	1.4	
16. Do you have a hard time getting through to VTD on the phone? (73 responses)			
yes	9	12.3	
no	64	87.7	
17. When you telephone VTD, do you get all the information you need? (72 responses)			
yes	68	94.4	
no	4	5.6	
18. Do you have difficulty negotiating the steps of the bus. (75 responses)			
yes	7	9.3	
no	68	90.7	
19. Do you have any medical condition that requires you to make periodic trips to a doctor or medical facility? (72 responses)			
yes	11	15.3	
no	61	84.7	

Number of unduplicated individuals responding "yes" to one or more of questions 18-19

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B.3 Non-User Surveys

Non-user surveys were mailed out to approximately 900 members of the general public and to 400 seniors. The following types of people were excluded from the general population sample: those who work either at home or outside the Valley, students, those retired or unemployed or who walk to work, and businesses. Responses were received from 76 seniors and 133 members of the general population. Survey questions and their responses follow.

VALLEY TRANSIT DISTRICT SURVEY

		<u>Seniors</u>		<u>General Population</u>	
		<u>#</u>	<u>%</u>	<u>#</u>	<u>%</u>
1.	Before this survey arrived, had you heard of VTD?				
	yes	70	93.3	129	98.5
	no	5	6.7	2	1.5
		<u>75</u>		<u>31</u>	
2.	Have you ever used VTD?				
	yes	5	6.8	11	8.4
	no	69	93.2	120	91.6
		<u>74</u>		<u>131</u>	
3.	Do you know people who use or have used VTD?				
	yes	60	81.1	94	72.9
	no	14	18.9	35	27.1
		<u>74</u>		<u>129</u>	

	Seniors		General Population	
	#	%	#	%
What were their reactions to VTD?				
very satisfied	29	52.7	44	48.4
acceptable	23	41.8	45	49.5
displeased	3	5.5	2	2.2
	<u>55</u>		<u>91</u>	

4. Please check below how often you make the following types of trips:

- work
- clinic/doctor
- shopping/personal business
- school/training
- recreation/social
- senior center

Trip Purpose	Seniors 76 Respondents	General Public 133 Respondents
	Average # Weekly Trips	Average # Weekly Trips
Work	.22	3.87
Clinic/doctor	.36	.16
Shopping	1.33	1.96
School/training	-	.42
Recreation/Social	.52	1.09
Senior Center	.28	--

5. Please check below the way you make these trips:

- VTD
- drive my car
- walk
- ride with others
- train
- carpool
- taxi

Results of this question by trip purpose are as follows.

		Seniors		General Population	
		#	%	#	%
<u>Work</u>	drive self	4	66.7	96	90.6
	walk	1	16.7	3	2.8
	ride with others	1	16.7	6	5.7
	carpool			1	0.9
		<u>6</u>		<u>106</u>	
<u>Clinic/doctor</u>	drive self	23	69.7	43	95.4
	walk	1	3.0	2	4.6
	ride with others	7	21.2		
	carpool	1	3.0		
	taxi	1	3.0		
		<u>33</u>		<u>45</u>	

		Seniors		General Population	
		#	%	#	%
9.	Do you have a V-card?				
	yes	8	11.8	5	4.0
	no	68	88.2	128	96.0
10.	What town do you live in?				
	Ansonia	22	31.9	43	35.2
	Derby	9	13.0	23	18.9
	Seymour	12	17.4	22	18.0
	Shelton	26	37.7	34	27.9
		<u>69</u>		<u>122</u>	
11.	What is your age?				
	20-30	-	-	12	10.2
	30-40	-	-	18	15.3
	40-50	-	-	20	16.9
	50-60	-	-	52	44.1
	60-65	13	19.1	16	13.6
	older than 65	55	80.9	-	-
		<u>68</u>		<u>118</u>	
12.	Please indicate your income range.				
	less than 2,000	7	12.7	1	0.9
	2,000-4,000	14	25.5	3	2.6
	4,000-6,000	13	23.6	4	3.4
	6,000-8,000	7	12.7	6	5.2
	8,000-10,000	6	10.9	12	10.3
	10,000-12,000	4	7.3	23	19.8
	12,000-15,000	2	3.6	18	15.5
	more than 15,000	2	3.6	49	42.2
		<u>55</u>		<u>116</u>	
13.	Please indicate the number of persons in your household.				
	1	17	24.6	11	9.0
	2	35	50.7	34	27.9
	3	10	14.5	30	24.6
	4	5	7.2	23	18.9
	5	-	-	15	12.3
	6	1	1.4	8	6.6
	7	1	1.4	1	0.8
		<u>69</u>		<u>122</u>	
14.	Does your family own a car?				
	yes	59	83.1	123	98.4
	no	12	16.9	2	1.6
		<u>71</u>		<u>125</u>	
15.	If your family has a car, are you a car driver?				
	yes	43	62.3	114	93.4
	no	26	37.7	8	6.6
		<u>69</u>		<u>122</u>	
16.	If your family does not have a car, do you travel with friends and relatives?				
	yes	11	91.7	2	100.0
	no	1	8.3	-	-

*These individuals are employed

Mobility questions, seniors only:

1.	Do you need the help of another person in getting around inside or outside the house?		
	yes	6	7.9
	no	70	92.1
2.	Do you need the help of some special aid, such as a cane or wheelchair in getting around?		
	yes	9	11.8
	no	67	88.2
3.	Do you have an illness that requires you to make periodic trips to a doctor or medical facility?		
	yes	16	21.1
	no	60	78.9
4.	Do you have a handicap which makes it difficult to get around?		
	yes	10	13.2
	no	66	86.8
5.	Do you have negotiating the steps of a bus?		
	yes	8	10.5
	no	68	89.5

Figures B.1 through B.6 plot the distributions of tripmaking by purpose obtained from the user and nonuser surveys.

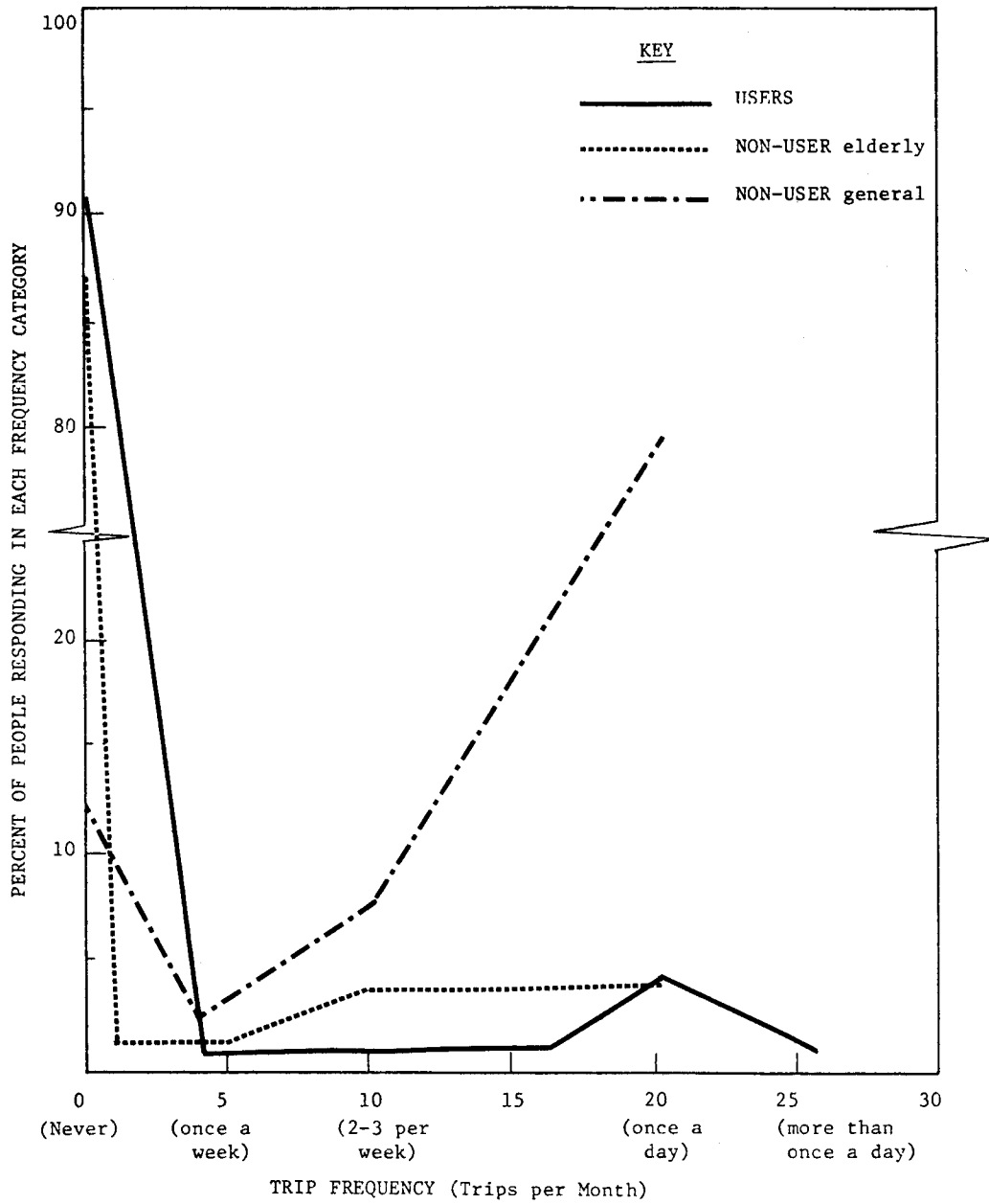


FIGURE B.1

Work Trip Frequency Distributions

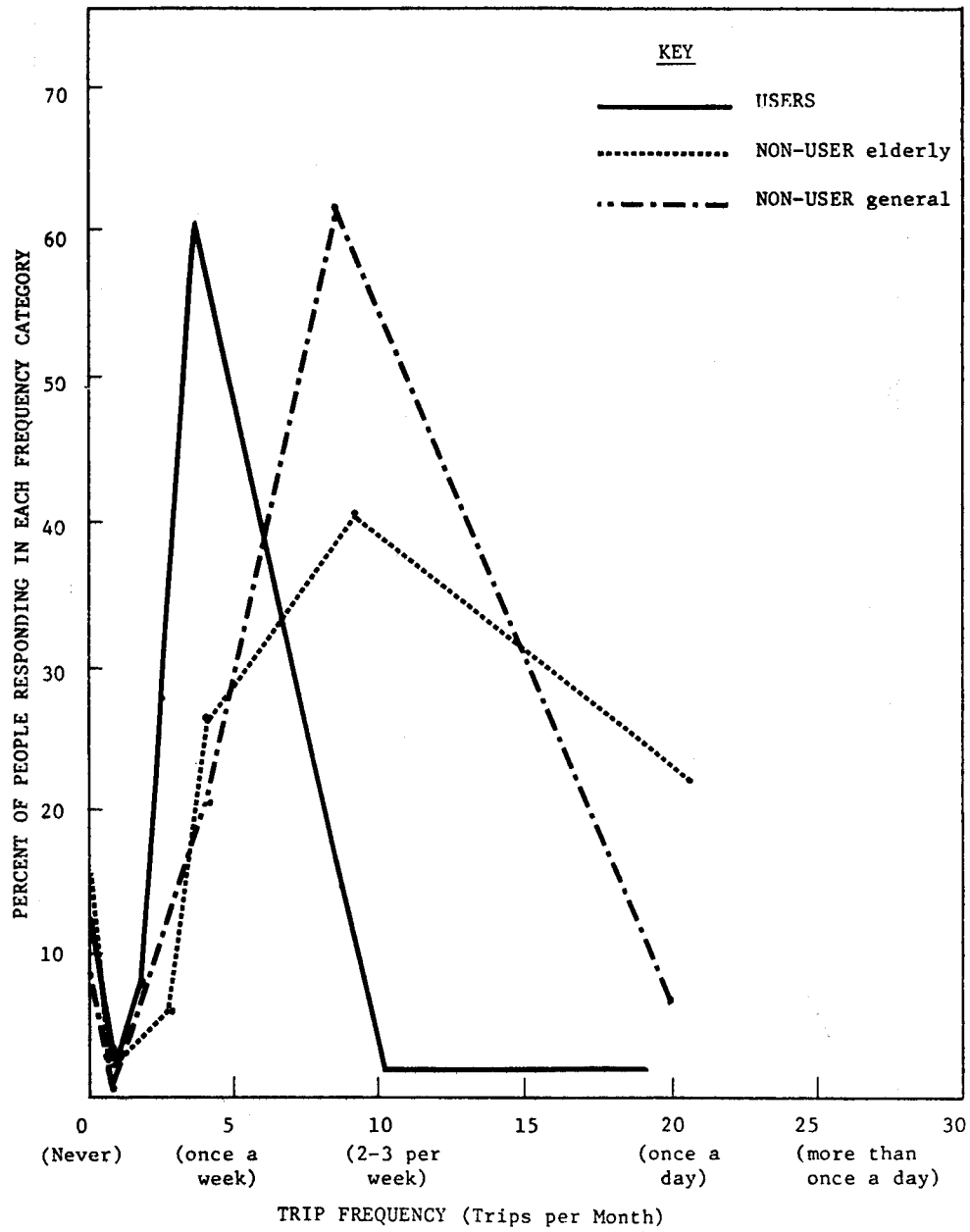


FIGURE B.2

Shopping Trip Frequency Distributions

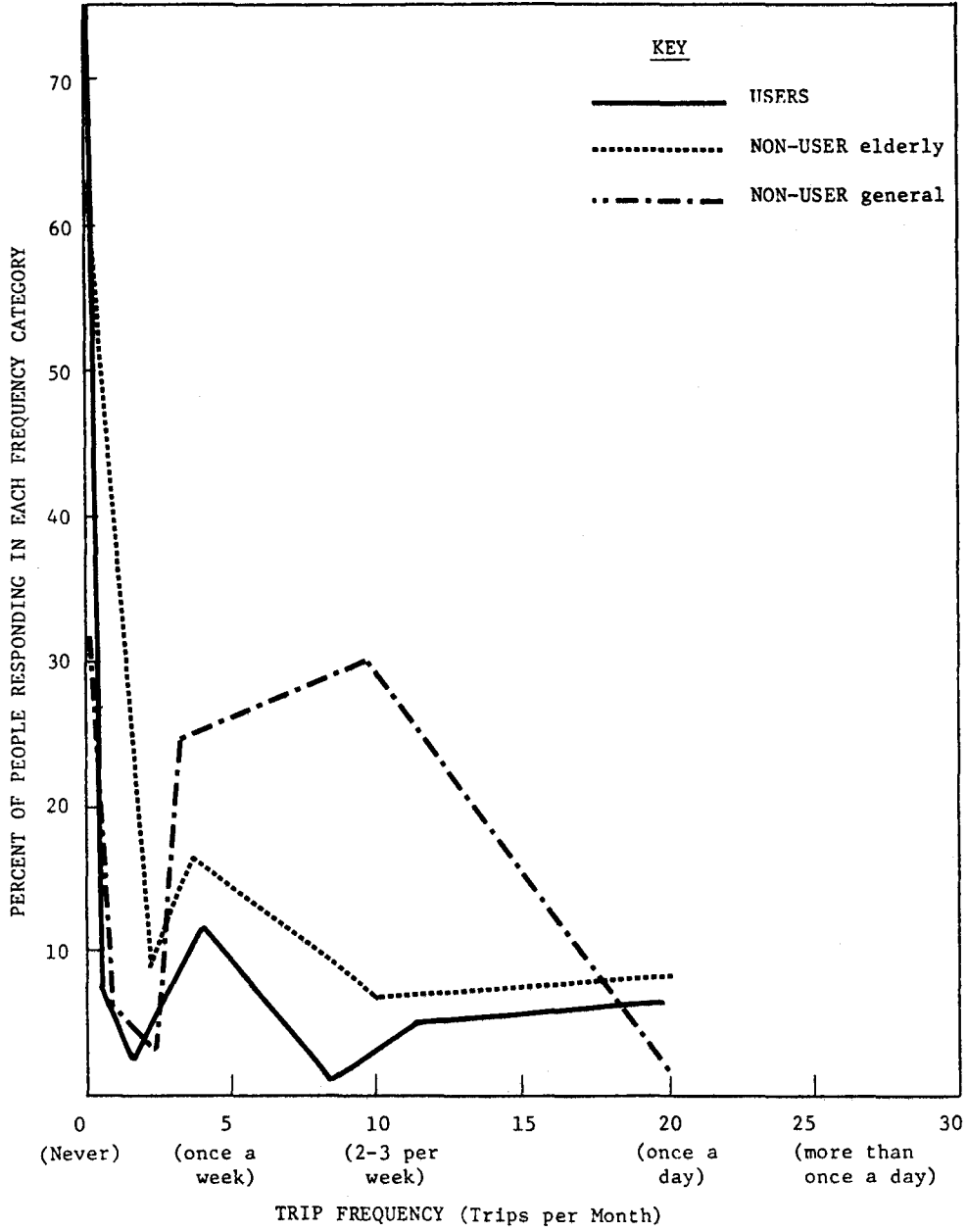


FIGURE B.3

Social-Recreation Trip Frequency Distributions

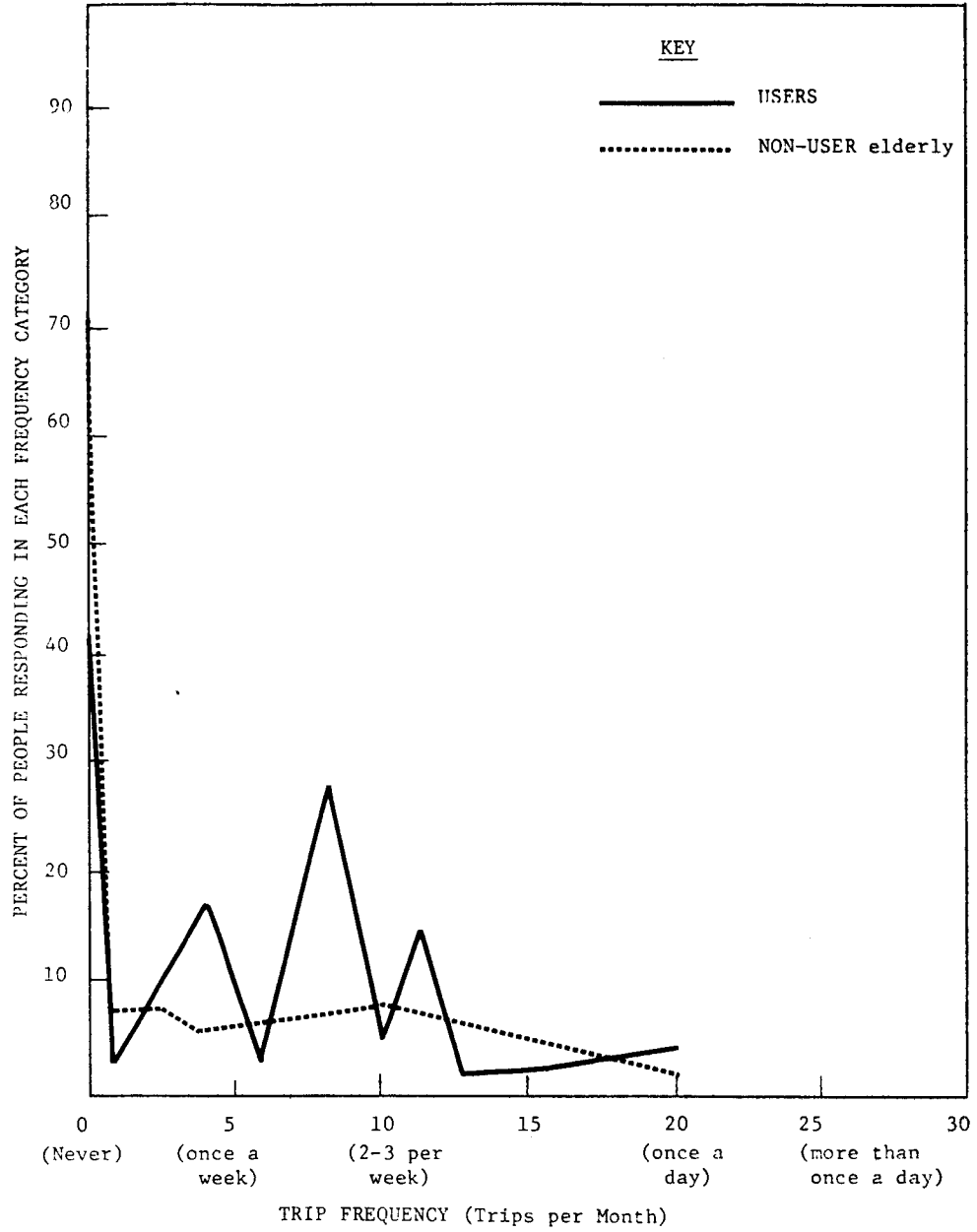


FIGURE B.4

Senior Center Trip Frequency Distributions

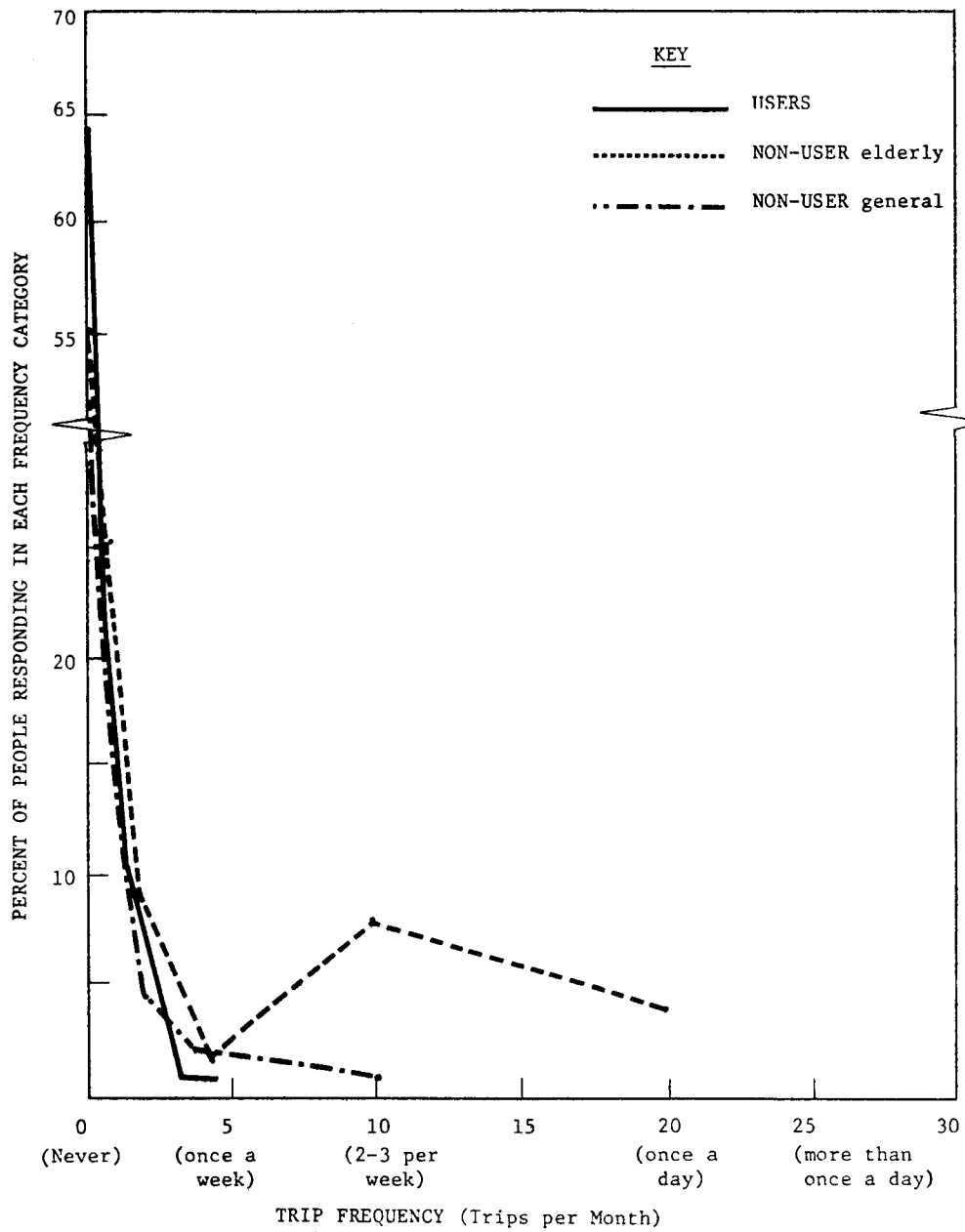


FIGURE B.5

Medical Trip Frequency Distributions

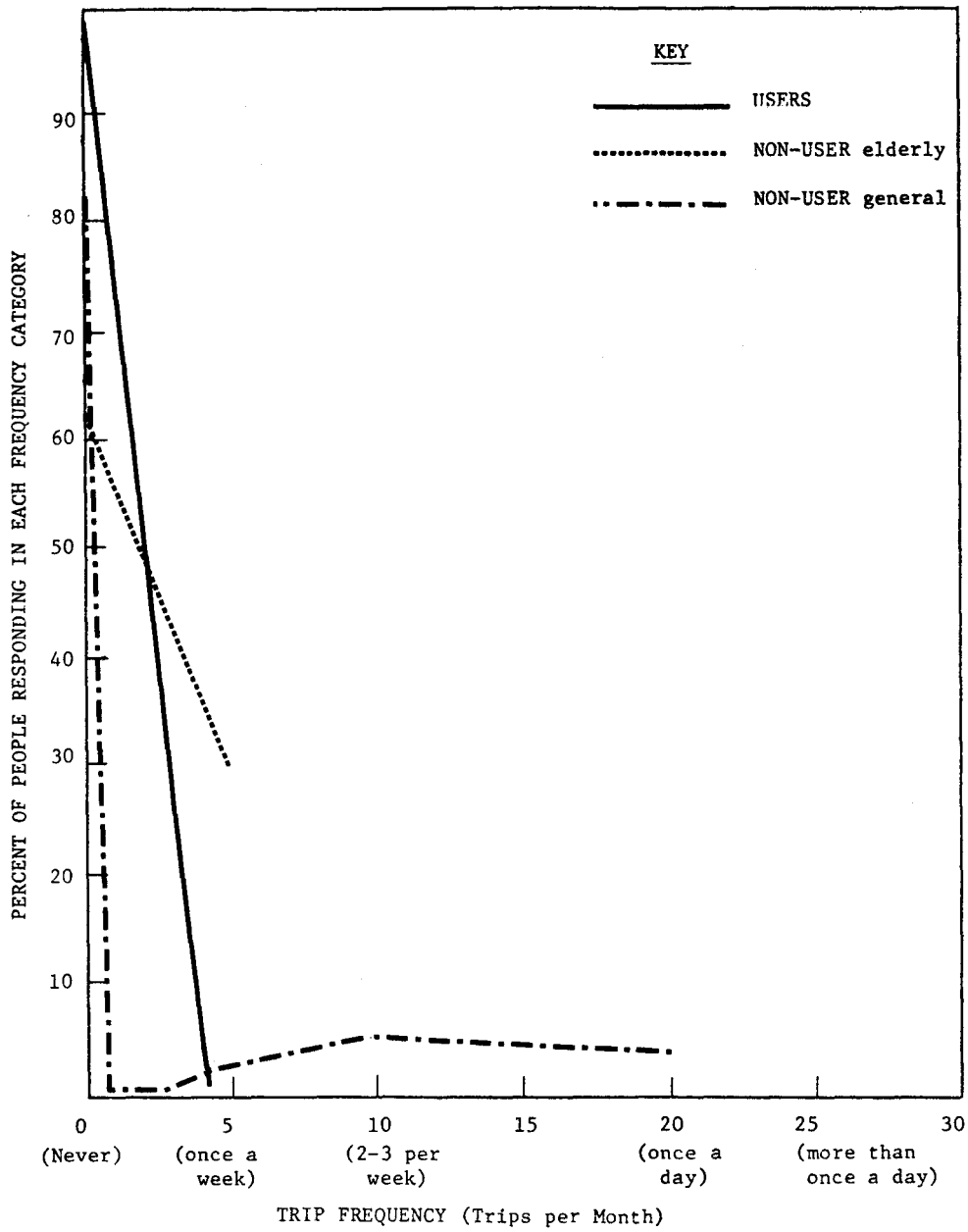


FIGURE B.6

School Trip Frequency Distributions

APPENDIX C

Modelling Methodology and Results

C.1 ASPECTS OF MULTINOMIAL LOGIT MODELS

The multinomial logit model (call MNL or just plain "logit" in this appendix) takes the general form

$$P(a \in A) = \frac{\exp U_a}{\sum_{a' \in A} \exp U_{a'}} \quad (1)$$

where

$P(a \in A)$ = probability of an individual choosing alternative a from a set of available alternatives A ,

$U_a, U_{a'}$ = utility associated with the choice of alternative a, a' .

Equation (1) is very general in form. The definition of the alternative a and the set of available alternatives A includes conditional and joint events. For example, the alternative may be the use of transit given that a trip is made from origin i to destination d ; or it may be a joint choice of destination and mode from origin i , with the set of alternatives being the full set of feasible combinations of mode and destination for trips with an origin at point i .

In application of the MNL to specific cases of transportation choice, the notation of equation (1) is specialized to make the identity of the choice set more clear. For example, the MNL model for the choice of mode m conditional on a trip being made from origin i to destination d could be written as

$$P(m \in M | d) = \frac{\exp U_m | d}{\sum_{m' \in M} \exp U_{m'} | d}$$

where

M = set of available modes,

$U_m | d$ = utility of mode m given a decision to travel to destination d,

while the MNL model for the joint choice of both mode m and destination d would look like

$$P(md \in MD) = \frac{\exp U_{md}}{\sum_{m'd' \in MD} \exp U_{m'd'}}$$

where

MD = set of all available mode and destination pair choice alternatives,

U_{md} = utility of mode and destination pair md.

For a more detailed discussion of multinomial logit models, see Richards and Ben-Akiva (A1). Readers not familiar with disaggregate demand models should read this reference before proceeding as the remainder of this appendix deals with special topics in this area that affect this report.

The utilities U_a are meaningful to within an additive constant, i.e., a constant could be added to each U_a without changing the choice probabilities. This property follows from the fact that

$$P(a \in A) = \frac{\exp (U_a + \delta)}{\sum_{a' \in A} \exp (U_{a'} + \delta)} = \frac{\exp \delta \exp U_a}{\sum_{a' \in A} \exp \delta \exp U_{a'}} = \frac{\exp U_a}{\sum_{a' \in A} \exp U_{a'}}$$

Hence the absolute level of utility for a given alternative has no meaning, nor is the sign of U_a of any particular significance.

As a restriction on the form of U_a , it is here assumed that the function U_a is linear in parameters, that is, U_a has the form

$$U_a = \sum_{i=1}^n \theta_{ia} X_{ia} + \text{constant}_a$$

where θ_{ia} are the parameters and X_{ia} is an independent variable or any known function of one or more independent variables, that describe an alternative a . The linear property of U_a enables the analyst to apply existing MNL estimation programs to estimate the parameters of U_a . Note that, as in any linear model, the X_{ia} can be non-linear in the sense that the X_{ia} can be transformed by taking logs, powers, roots, etc.

Elasticities - the direct and cross point elasticities of the logit model defined by equations (1) and (2) are derived in Richards and Ben-Akiva as

$$E_{X_{ia}'}^{P(a \in A)} = (\delta_{aa'} - P(a' \in A)) \theta_{i'ia'} \quad (3)$$

where

$$E_{X_{ia}'}^{P(a \in A)} = \text{elasticity of the probability of choosing alternative } a \text{ with respect to changes in the value of the } i^{\text{th}} \text{ independent variable of alternatives } a'$$

$$\delta_{aa'} = \text{delta function } \begin{cases} = 0 & \text{if } a \neq a' \\ = 1 & \text{if } a = a' \end{cases}$$

The reference discusses the theoretical properties of equation (3) and presents graphical displays of the variation of the elasticity with

respect to X_{ia} and $P(a \in A)$ for the mode choice models estimated with a data set. In particular, note that direct elasticity ($a = a'$) approaches zero as $P(a \in A)$ approaches 1 and approaches $\theta_1 X_{ia}$ as $P(a \in A)$ approaches zero. This means that the direct elasticity is greatest when probability of choice is lowest, and vice versa. Cross elasticities behave just the opposite; the cross elasticity of the probability of choosing alternative $a \in A$ is a minimum when $P(a \in A)$ is a minimum. This behavior has great intuitive appeal.

Equation (3) says that the direct elasticity for alternative a depends only on the attributes of alternative a , while for cross elasticities, only the attributes of alternative a' enter the formula. Note in particular that equation (3) also says that the cross elasticity for all alternatives a to alternative a' is the same.

The arc elasticity for an individual can also be calculated for equation (1) by calculating the probabilities at two different levels, X_{ia} and X'_{ia} , of the independent variables using the differences rather than the differentials to express elasticity:

$$\begin{aligned} \text{direct: } \frac{-P(a \in A)}{E_{X_{ia}}} &= \frac{P(a \in A: X'_{ia}) - P(a \in A: X_{ia})}{X'_{ia} - X_{ia}} \Bigg/ \frac{P(a \in A: X_{ia})}{X_{ia}} \\ \text{cross: } \frac{-P(a \in A)}{E_{X_{ia}'}} &= \frac{P(a \in A: X'_{ia}') - P(a \in A: X_{ia}')}{X'_{ia}' - X_{ia}'} \Bigg/ \frac{P(a \in A: X_{ia}')}{X_{ia}'} \end{aligned}$$

Arc elasticities rather than point elasticities must be used as the basis of discussion whenever the change in the explanatory variable produces a change in the probability calculated by equation (1) that is not "small."

Aggregate elasticity, which describes the behavior of a group of individuals, can also be defined for either point or arc elasticity. Aggregate elasticity can be calculated by first calculating the response of each individual to the change in explanatory variable and then summing over individuals to obtain aggregate response.

C.2 RESULTS OF TRAVEL DEMAND MODELS

The model of mode choice is shown in Figure C-1. This is a disaggregate model estimated on individual behavior. The model predicts the probability that VTD versus driving or riding in an automobile will be chosen to make a trip, as a function of income, auto ownership, travel time, travel cost, and a constant term.

Choice of mode in the Valley could not be statistically related to travel time and cost; thus, these variables were assigned coefficient values a priori based on the elasticities derived from the home interview survey and observed data. This was not unexpected, as travel time and cost differences for the short trips in the Valley are not large, and other factors which either do not vary over the population (e.g., VTD call-in time) or are unmeasurable (e.g., effects of past VTD unreliability) have large impacts on mode choice. In any event, the model predicts mode choice by trip purpose for the four major trip purposes for the elderly group: senior center, medical, shopping, and social/recreational trips. The coefficients on auto ownership and income are very high, and indicate that auto use increases sharply as these variables increase. Thus VTD is serving the low-income, low-auto ownership trips.

FIGURE C-1

Elderly Mode Choice Equation

$$P_T = \frac{e^{U_T}}{e^{U_T} + e^{U_A}}$$

Where

P_T = probability of an individual using VTD for a given trip purpose

$$U_T = K_T - 0.05TT - 0.0125TC$$

(*) (*)

$$U_A = 0.0015I + 2.90A - 0.05AT - 0.0125AC$$

(28.7) (28.5) (*) (*)

$$K_T = 8.64 \text{ for senior center trips}$$

(24.7)

$$= 3.48 \text{ for medical trips}$$

(2.0)

$$= 4.58 \text{ for shopping trips}$$

(8.2)

$$= 0.48 \text{ for social/recreational trips}$$

(8.0)

(...) - "t" statistic

I = annual household income, in dollars

A = household auto ownership (number of autos)

TT = round trip transit travel time, in minutes, from home to most common destination for each purpose

TC = round trip transit fare, in cents, as above

AT = round trip auto travel time, in minutes, as above

AC = round trip auto out-of-pocket cost, in cents, as above (10 cents per mile)

* = no t statistic available; constrained coefficient

Figure C-2 then shows the model of elderly tripmaking frequency. This is a linear regression model, although still on an individual (disaggregate) level. Tripmaking by all modes is predicted by this model for each of four trip purposes as a function of income, household size, auto ownership, and a generalized travel cost variable based on travel time and fare of all modes available to an individual. This generalized cost variable (see the references at the end of this appendix for more detail) is computed from the utilities in the mode choice model and reflects the "value" of each mode for each individual and each trip purpose. The results of the model are best seen in Table 6-9, which shows the elasticities computed from it.

The general population mode choice model is shown in Figure C-3; it is a disaggregate model based on individual behavior. Three modes are included: VTD, drive alone, and shared ride as either a driver or passenger. The model shows that auto ownership, possession of a driver's license, and income are strong factors in the choice to use an auto mode. Also, travel time has a very high coefficient, which will again favor the auto modes. Travel cost is the least important of the variables in the model. The model results are discussed further in Chapter 6.

FIGURE C-2

Model of Elderly Tripmaking Frequency per Person per Week

<p>Note B</p>	<p>Note A</p>
$F_{sctr} = 0.55 - .00049I + .136H - .533A + .342 \ln (e^{8.64 - .05TT - .0125TC} + e^{.0015I + 2.9A - .05AT - .0125AC})$	
$F_{mdel} = 0.51 - .00049I + .136H - .533A + .342 \ln (e^{3.48 - .05TT - .0125TC} + e^{.0015I + 2.9A - .05AT - .0125AC})$	
$F_{shop} = 1.97 - .00049I + .136H - .533A + .342 \ln (e^{4.58 - .05TT - .0125TC} + e^{.0015I + 2.9A - .05AT - .0125AC})$	
$F_{srec} = 1.19 - .00049I + .135H - .533A + .342 \ln (e^{0.48 - .05TT - .0125TC} + e^{.0015I + 2.9A - .05AT - .0125AC})$	

C-8

t_{sctr}	(72.0)	-	-	-	-	(24.7)	-	-	-	-	-
t_{mdel}	(98.6)	-	-	-	-	(2.0)	-	-	-	-	-
t_{shop}	(60.0)	-	-	-	-	(8.2)	-	-	-	-	-
t_{srec}	(73.3)	-	-	-	-	(8.0)	-	-	-	-	-
t_{joint}	-	(16.3)	(16.1)	(12.4)	(20.0)	-	*	*	(28.8)	(28.5)	* *

$R^2 = .50$
 S.E. = 1.09
 No. of Observations = 188

$\rho^2 = .94$
 -1 log likelihood ratio = 51179
 No. of Observations = 188

*Constrained coefficient; no t value estimated.

FIGURE C-2, continued

- F_{sctr} = round trips per week to and from a senior center or other group activity
- F_{mdel} = round trips per week to and from a medical service
- F_{shop} = round trips per week to and from a shopping service
- F_{srec} = round trips per week to and from a social or recreational activity (excluding senior center and other group activities)
- $t \dots$ = statistic for model coefficient; t_{joint} means the same t-value holds for all purposes
- I = annual household income, in dollars
- H = household size (number of persons)
- A = household auto ownership (number of autos)
- TT = round trip transit travel time, in minutes, from home to most common destination for each purpose
- TC = round trip transit fare, in cents as above
- AT = round trip auto travel time, in minutes as above
- AC = round trip auto out-of-pocket cost, in cents, as above (10¢/mile)

Note A: This section of the model is the sum of the exponentiated utilities of the elderly mode choice equation (see Figure C-1). This sum is the generalized cost of travel for an individual over all available modes, and is used as the measure of transportation service quality in the trip frequency model.

Note B: This section of the model is the actual trip frequency equation, with the coefficient 0.342 being applied to the generalized cost variable (Note A) derived from the mode choice model.

FIGURE C-3

General Public Mode Choice Equation

$$P_T = \frac{e^{U_T}}{e^{U_T} + e^{U_A} + e^{U_S}}$$

where

P_T = probability of an individual using VTD for a work trip in the Valley

U_T = utility of VTD

U_A = utility of driving alone

U_S = utility of shared ride in auto

$$U_T = 6.978 - 0.02478TC - 1.275TT$$

(9.86) (2.59) (10.83)

$$U_A = 0.0003304I + 4.467A + 2.573L - 0.02478AC - 1.275AT$$

(6.77) (8.18) (8.08) (2.59) (10.83)

$$U_S = 0.0003780I + 6.370A + 2.573L - 0.02478SC - 1.275ST$$

(7.56) (6.19) (8.01) (2.59) (10.83)

TC, TT, AC, AT, I, A defined in Figure C-1.

SC = shared ride costs in cents (auto operating cost of 10 cents per mile divided by assumed occupancy of 2.5)

ST = shared ride travel time in minutes (auto drive-alone time plus five minutes pickup and drop-off time)

L = 1 if individual has driver's license
0 otherwise

$$\rho^2 = 0.84$$

-2 log likelihood ratio = 29697

No. of observations = 120

REFERENCES - APPENDIX C

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APPENDIX D

Report of New Technology

Diligent review of the work under this contract has revealed no significant innovations, discoveries, or improvements of inventions at this time. In addition, all methodologies and models employed are available in the open literature. The report does, however, present new findings and address several new issues involving the Valley Transit District.

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