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Benchmarking Best Practices of Demand Responsive Transit Systems

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Benchmarking Best Practices of Demand Responsive Transit Systems

Final Project Report

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Abstract

Over the past 10 years, operating expenses for Demand Responsive Transit have more than doubled as demand for this mandated service has expanded. Many advanced technologies and management practices have been proposed and implemented to improve the efficiency of the service; but, evidence for the effectiveness of these actions has been based upon projections or small pilot studies. We present the results of a nationwide study involving 62 large transit agencies and 13 small transit agencies. We evaluate the impact of implemented technologies and practices upon productivity and operating cost.

Executive Summary

We have conducted a survey of transit agencies providing Demand Responsive Transit (DRT) service in medium sized and large urban centers throughout the United States. The survey has provided information regarding the implementation of advanced technologies and management practices for 62 agencies that responded. Our survey also obtained information for 13 agencies from California that service small urban areas. We have evaluated the impact of the implemented technologies/practices on productivity and operating cost measures derived from information available in the 1997-1999 National Transit Database (NTD).

Our analysis indicates that use of a Paratransit Computer Aided Dispatching (CAD) system provides a productivity benefit of approximately 12,000 passenger miles per vehicle annually. Since the majority of CAD implementers reported using their systems for the automated scheduling and automated dispatching functions, we interpret this productivity impact as being related to improvements in these functions. However, there is no corresponding cost impact. These results suggest that policy makers should continue to implement Paratransit CAD systems, but should also monitor cost impacts that offset the expected benefits from productivity improvement.

Agency Service Delivery was also found to have a beneficial impact on productivity of approximately 1,300 passenger trips per vehicle annually. Here again, there is no corresponding cost impact. Policy makers should consider the decision between direct operation and contracted service to be cost neutral, and should consider other factors when making the decision.

The use of Advanced Communications technology was found to have a beneficial impact on operating cost of approximately $3.00 per passenger trip in 1998. However, the impact was diminished in 1999 and there is no corresponding productivity impact. These results suggest that policy makers should continue to implement Advanced Communications, but should be alert to offsetting costs that erode the labor savings.

The use of Financial Incentives was found to have a detrimental impact on productivity of approximately 7,000 passenger miles per vehicle annually. Many agencies use of financial incentives is linked only to on–time pick–up performance. It is possible that contractors are dispatching vehicles in a relatively unproductive way in order to satisfy the on–time performance criteria established in their contracts. Additionally, the use of Financial Penalties was found to have a detrimental impact on operating cost of approximately $2.00 per passenger trip. Policy makers should exercise caution when using these practices in contracts for service.

Finally, the Revenue Mile was found to be a poor representation of service output, as related to evaluation of productivity. Productivity measures based upon the Revenue Mile should be avoided. Policy makers should support the inclusion of Loaded Miles and Trip Requests Serviced in the NTD Reporting Requirements.

1 Introduction

Demand Responsive Transit (DRT) systems are the means by which 'comparable transportation services' are provided to mobility impaired individuals. The Americans with Disabilities Act (ADA) mandates that all transit agencies receiving federal funds must provide such services. Since the enactment of the ADA in 1991, DRT has expanded from a national total of 42.4 million passenger trips for the year to a total of 73.2 million passenger trips in 2000. Over the same period, the annual operating expense for DRT has gone from less than 3% to more than 6% of the total for public transportation services nationally, becoming a $1.2 billion industry in 2000 (Federal Transit Administration 2000).

In the last ten years, many advanced technologies have been proposed to improve the performance of DRT systems. Computers and advanced algorithms have been offered to improve the dispatching and scheduling of paratransit systems (Stone, Nalevanko, and Gilbert 1994). The implementation of Automatic Vehicle Location (AVL) and advanced scheduling has been credited as the primary factor in increasing efficiency by 10.3% for Houston's METROLift Service (Higgins, Laughlin, and Turnbell 2000). Use of the Internet has also been discussed as a means to improve productivity (Stone, Ahmed, and Nalevanko 2000).

There have been studies that outline the impact of Advanced Public Transportation Systems (APTS) on service productivity and cost. A study sponsored by the U.S. Department of Transportation quantifies expected benefits of APTS based on future forecasts (Goeddel 1996). A survey of paratransit customers in southeastern Michigan concludes that APTS has ample potential to increase customer satisfaction when reserving a trip (Wallace 1997). A study in Santa Clara County, California, reports the productivity gains realized by of use of APTS technology (Chira–Chavala and Venter 1997). However, the deployment of APTS may place additional stress on transit employees due to the need to learn how to use the new technology (Schweiger and McGrane 1999).

In addition to technological implementations, a variety of management practices such as type of service, use of financial incentives for good performance, and use of ridesharing have been discussed as methods to influence productivity, efficiency levels, and costs. There are numerous paratransit delivery methods such as single contracts, multiple contracts, or direct service (Simon 1998). A

Federal Transit Administration Study found that 7.6% of total expenditures by transit operators was spent on purchased transportation (Gilbert and Cook 1999). A case study in Portland, Oregon, showed that the service cost for demand responsive transit decreased by a half when switching from direct service to contract service primarily due to labor cost differences (Rufolo, Strathman, and Peng 1997).

However, the evidence for the effectiveness of these technologies and practices has been based either upon projections or small pilot studies. We present the results of a nationwide benchmarking study involving an analysis of data from 62 transit agencies serving large and medium sized urban areas. Our intent is to evaluate the impact of several advanced technologies and management practices upon the productivity and operating cost of DRT systems. The advance technologies that we consider include advanced communications, automated vehicle location, automated fare payment, automated transit information, and paratransit CAD systems. The management practices that we consider include financial incentives, financial penalties, ridesharing, agency administration, contracted administration, agency service delivery, contracted service delivery, and consumer choice.

The performance measures we use are Passenger Miles per Vehicle, Passenger Trips per Vehicle, Operating Expense per Passenger Trip, and Operating Expense per Passenger Mile. Notice that none of the performance measures relies on the Revenue Mile, a measure commonly used in the industry. Our analysis of productivity measures based upon the Revenue Mile reveals a substantial flaw in the definition of the Revenue Mile, as it relates to assessment of productivity. Consequently, we select alternative productivity measures for use in this work. We also discuss the need for a data source that addresses the flaw in the Revenue Mile.

Throughout the study, we have sought to make use of existing data sources, such as the National Transit Database (NTD), where possible, and collect new data only as necessary. The intention of the study has been to obtain information regarding operational characteristics from a sample of transit agencies serving urban areas in all parts of the United States and to identify statistically significant relationships between technologies/practices and performance. In Section 2, we describe the steps taken to assure that the data used is representative of the industry and indicative of performance. In Section 3, we present the analysis of the performance data. In Section 4, we summarize our conclusions from the analysis.

2 Design of the Benchmarking Study

Data regarding the performance of DRT systems is available online from the NTD. For this study, we used NTD data for the three most recent years available at the beginning of the study: 1997, 1998, and 1999. A survey regarding the implementation of APTS technologies had been reported (John A. Volpe National Transportation Systems Center 1999). However, the survey only included implementations as of the fall of 1998 by agencies listed in the 1996 NTD. Also, little information was available regarding implementation of management practices. In order to obtain information regarding technology and practice implementations that coincided with the most recent performance data, a new survey of transit agencies was required.

2.1 The Implementation Survey

The 1999 NTD lists 413 transit agencies that report providing a DRT service to their constituents. Of these agencies, 180 serve urban areas with a population of 200,000 or more. The 180 agencies that serve these so–called large and medium sized urban areas provided 97% of all Passenger Trips reported (includes modes other than DRT). To concentrate on agencies providing the vast majority of service, we selected these 180 agencies as the primary target organizations for our survey. We also surveyed the remaining 25 agencies from California listed in the 1999 NTD who serve areas with a population less than 200,000.

The initial distribution of the survey was conducted via the U. S. Postal Service. Survey forms were mailed during the first week of July 2001 and agencies were requested to reply to the survey by July 20, 2001. Follow–up contact with non–responsive agencies was conducted via electronic mail. By the end of September 2001, we had received responses from 62 of the large national agencies and 13 of the small California agencies.

Of course, it is well known that a survey with self–selecting respondents can produce biased results. To combat this problem, we designed a strategy of segmenting the surveyed large national agencies according to industry demographic variables and focusing our e–mail follow–up activities on obtaining responses from agencies belonging to under–represented segments. The demographic variables that we selected are the Population Density of the urban area serviced by an agency and the Passenger Trips per Capita.

The Population Density is determined as the ratio of the population to the square miles for the agency's service area. Passenger Trips per Capita is the ratio of unlinked passenger trips for the DRT service to the population of the service area. The number of unlinked passenger trips is reported as the number of passengers who board DRT vehicles. A single request for service would generate more than one unlinked passenger trip if more than one person boarded the vehicle at the pick–up location. A passenger would also be counted as making more than one unlinked trip if transfers between vehicles occurred during a journey from origin to destination.

Figure 1 shows the results of a cluster analysis for the surveyed agencies' demographic variables. The clusters were formed using the average linkage method of agglomerative hierarchical clustering (Massart and Kaufman 1983, SAS Institute 1988). The similarity measure was the Euclidian distance based upon values of the demographic variables that had been scaled by their mean and standard deviation. We arbitrarily chose to create five clusters from the agencies represented in the figure. There are an additional 19 agencies not represented in the figure that were considered outliers for the cluster analysis: 12 agencies have ridership greater than 0.99 Passenger Trips per Capita and 7 agencies serve areas with Population Density greater than 8000 persons per square mile. The clusters were used as the basis for the segmentation of the survey group.

Table 1 shows the number of surveyed agencies in each of the demographic segments. Our goal for the survey was to achieve 30% response rate, both overall and for each segment. By focusing the e–mail follow–up messages to agencies in under–represented segments, we were able to achieve our response rate goal.

The advanced technologies that we investigate through the survey include

- Advanced communications — digital radio or wireless personal communication systems used to transmit voice and/or data between the vehicle and the dispatch center

Table 1: Responses by Segment

Segment	Surveyed	Responses
Cluster 1	41	15
Cluster 2	29	9
Cluster 3	48	20
Cluster 5	29	9
Cluster 4 and Outliers	33	9

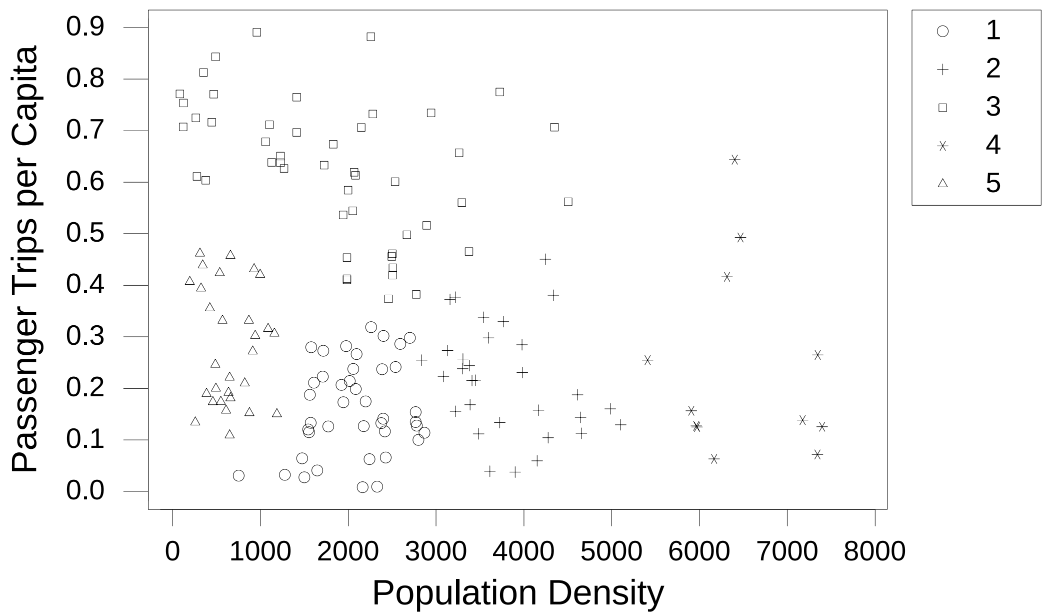

Figure 1: Clusters of Surveyed Agencies

- Automated vehicle location — a computer–based tracking system that includes a method of determining vehicle location (such as global positioning system, active signposts, ground–based radio) and a method of transmitting data from the vehicle to the dispatch center

- Automated fare payment — a system that allows customers to use magnetic stripe cards, smart cards, credit cards, or debit cards for fare payment via in-vehicle readers, telephone, or the internet

- Automated transit information — a computer-based system for disseminating real–time information (such as vehicle location or anticipated arrival times) to customers via kiosks, the internet, or interactive telephone systems

- Paratransit CAD System — a single software package, or integrated collection of software products, that provides Computer Aided Dispatching capabilities used to deliver transit service to individuals in accordance with the requirements of the ADA. The system is capable of performing one or more of the following functions:

  Automated administration: the software determines ADA eligibility or distributes service requests to transportation contractors or collects data on contractor performance

Automated reservations: the software accepts input from customers via telephone and/or the internet regarding requests for service

Automated scheduling: the software determines passenger pick-up and drop–off times

Automated routing: the software provides road directions between passenger stops

Automated dispatching: the software determines passenger assignments to a vehicle/driver and revises the schedule or route based on updated information such as no–shows, cancellations, or traffic congestion

Automated reporting: the software collects and displays, or exports, data regarding service performance such as: actual pick–up time, actual drop–off time, time in motion, dead end time

The management practices that we investigate include

- Financial incentives — payments to contractors, in addition to the base fee, contingent upon service performance results
- Financial penalties — charges to contractors, deducted from the base fee, contingent upon service performance results
- Ridesharing — a vehicle simultaneously serves trip requests from more than one customer by use of a carpooling strategy
- Agency administration — the agency named on the survey performs the following functions: determines ADA eligibility, arranges for use of vehicles and services of drivers, monitors service performance, and distributes funds in payment for transportation
- Contracted administration — the agency named on the survey contracts another organization(s), most likely a private operator, to perform the functions listed above
- Agency service delivery — the agency named on the survey directly operates vehicles that fulfill trip requests

- Contracted service delivery — the agency named on the survey contracts another organization(s) to fulfill trip requests
- Consumer choice — customers are allowed a selection of providers (among the agency and its contractors) to service a trip request

An additional concern regarding the characteristics of the responding agencies was related to their history of implementing the advanced technologies and management practices. If an overwhelming majority of the responding agencies had not implemented a particular technology or practice, it would not be possible to evaluate the performance impact because there would be too little evidence of the performance after implementation. A similar problem would occur if an overwhelming majority of agencies had implemented a technology or practice. There would be too little evidence in the 1997-1999 NTD of performance prior to implementation. Table 2 shows the state of technology/practice implementations, as reported by agencies responding to the survey. For the Consumer Choice management practice, as well as the Automated Vehicle Location, Automated Fare Payment, and Automated Transit Information technologies, the number of implementations is so few that a large difference in average performance would be required to demonstrate statistical significance. For the Contracted Service Delivery practice, the number of agencies that have not implemented the practice is so few that demonstration of a statistically significant impact on performance may also be problematic.

A correlation analysis (Draper and Smith 1981) of the practice/technology implementations was performed to determine whether or not agencies tend to implement pairs of practices or technologies concurrently. If a large portion of the responding agencies implement two practices or technologies concurrently, then it is not possible to separate the impacts of the two on performance via the regression techniques that we use. The correlation analysis revealed that the implementation of Financial Incentives and Financial Penalties is inter–related. Among the 26 agencies that use Financial Incentives, 25 also use Financial Penalties. As a result, it is not possible for us to determine the impact of using Financial Incentives in the absence of Financial Penalties. All other pairwise combinations of the practices and technologies are uncorrelated. Their impacts upon performance can be assessed independently.

A final issue connected to implementation history was the timing of the implementation. If a

Table 2: Implementation by Responding Agencies

	No	Yes	Implemented 1996-1999
Management Practices —			
Financial Incentives	36	26	12
Financial Penalties	25	37	14
Ridesharing	25	37	2
Agency Administration	19	43	7
Contracted Administration	37	25	1
Agency Service Delivery	39	23	0
Contracted Service Delivery	6	56	0
Consumer Choice	57	5	1
Advanced Technologies —			
Advanced Communications	33	29	8
Automated Vehicle Location	57	5	2
Automated Fare Payment	58	4	3
Automated Transit Information	61	1	0
Paratransit CAD System	29	33	16

practice/technology was implemented during the time frame of our performance evaluation, the performance measures reported during the transition could not be considered to be representative of typical pre– or post–implementation performance. Consequently, as part of the survey we solicited information from the responding agencies regarding the year of implementation for each practice/technology in use. If a practice/technology had been implemented within the 1996-1999 time frame, the performance measures for the year of implementation were removed from the analysis. Table 2 shows the amount of data loss for this cause.

2.2 The Performance Data

The selection of performance measures required some preliminary analysis of data available from the NTD. We preferred using existing data from the NTD for two reasons: (1) to reduce the amount of information requested in the survey and (2) to allow the selection of performance measures based upon a review of information describing all of the surveyed agencies. Our first task was to identify a set of performance measures that could be associated with the characteristics of productivity and operating cost. While we did consider measures reported in the National Transit Profiles, we also considered additional measures of our own design. The preliminary analysis determined the number and formulation of performance measures to be used.

The first performance measures that we considered dealt with the productivity of the DRT service. Initially, we proposed four productivity measures:

- Revenue Miles per Vehicle, $RevMil/Veh$
- Revenue Miles per Total Vehicle Mile, $RevMil/VehMil$
- Passenger Miles per Revenue Mile, $PassMil/RevMil$
- Passenger Trips per Revenue Mile, $Trip/RevMil$

Revenue Miles represent the distance traveled by a vehicle while available to carry passengers, whether or not a passenger is actually in the vehicle. Total Vehicle Miles include both Revenue Miles and deadheading. Deadheading is defined as the distance from a dispatch location to the first passenger pick–up location or the distance from the final passenger drop–off location back to a dispatch location, as well as any distance traveled between dispatch, storage, and maintenance locations. The number of Vehicles used is the number reported as the maximum actually operated to provide service on an average weekday. Passenger Miles are the total of distances traveled by each passenger.

A principal components analysis (Johnson and Wichern 1992) was performed separately for each year of NTD data (1997, 1998, and 1999). The three analyses produced consistent results. The results revealed that these measures were most naturally arranged into two groupings. The first group, consisting of $RevMil/Veh$ and $RevMil/VehMil$, we interpreted as representing the portion of miles traveled by the vehicle that was productive. We refer to this characteristic as mileage productivity. The second group, consisting of $PassMil/RevMil$ and $Trip/RevMile$, was interpreted as representing the number of passengers travelling simultaneously in the vehicle. We refer to this characteristic as people loading productivity.

$$AMP \equiv \left(\frac{RevMil/Veh - 30498}{11559} + \frac{RevMil/VehMil - 0.8431}{0.1092} \right) \div 2 \qquad (1)$$

Table 3: Average Mileage Productivity Regression Results

y: $(AMP + 3)^2$

	1999		1998		1997	
Term	Coeff. Est.	p–value	Coeff. Est.	p–value	Coeff. Est.	p–value
Ridesharing	−2.74	0.020	−2.77	0.024	−2.82	0.021
Financial Penalties	4.58	0.002	—	—	2.17	0.071
Financial Incentives	−3.09	0.037	—	—	—	—

An Average Mileage Productivity (AMP) value was calculated for each of the responding transit agencies, for each year of NTD data. As an example, Equation 1 shows the calculation for 1999. First, an agency's $RevMil/Veh$ and $RevMil/VehMil$ values were separately scaled. The values 30498 miles and 11559 miles represent the mean and standard deviation, respectively, of $RevMil/Veh$ for all 180 of the surveyed agencies. Similarly, 0.8431 and 0.1092 are the mean and standard deviation of $RevMil/VehMil$. Then, the AMP was defined as the mean of the scaled performance measure values.

Linear regression techniques were used to evaluate the statistical significance of the relationships between the AMP and the practices/technologies. A Box–Cox power transformation of the AMP was used to improve the normality of the residuals (Draper and Smith 1981, Myers and Montgomery 1995). Separate maximum likelihood estimates of the power transformation exponent were calculated for each year of NTD data. The estimates were found to be consistent; so, a single value for the exponent ($\lambda = 2$) was selected for uniform application across all years of NTD data. Finally, a stepwise regression procedure was used to select the terms in the model for each year.

Table 3 shows the results of the regression analysis. The terms in the models are indicator variables representing implementation of the respective management practices. The terms shown are the only ones found to be significant at the 10% level. Since the purpose of these models is to identify statistically significant relationships between the AMP and the practices/technologies, the intercept estimates are omitted from the table.

The results shown in Table 3 were troubling to us because the sense of the relationship between AMP and ridesharing is negative. In other words, the data indicate that agencies that have implemented ridesharing have a smaller portion of productive miles traveled than those agencies that do not use ridesharing. This result did not agree with our intuition regarding the likely impact of ridesharing. However, upon further investigation, we came to understand the nature of the result.

Figure 2 shows alternative methods of servicing requests from two customers. Nodes P1 and P2 represent the pick–up points for each of the customers. Nodes D1 and D2 represent the drop–off points. The pick–ups are relatively close to each other, as are the drop–offs. However, the drop–off points are relatively far from the pick–up points. This is a typical case where ridesharing should be a productive practice. The arcs depicted with solid lines fall within the definition of Revenue Miles (Federal Transit Administration 1999, pp.240-241). The values along the arcs that connect the nodes indicate distance traveled. The side calculations show that the revenue miles fraction has decreased for the diagram 'with ridesharing'. This is the same impact observed in the regression analysis. It is due to the fact that, in the 'no ridesharing' diagram, the Revenue Miles definition admits the segment of the trip between D1 and P2, even though the vehicle is carrying no passengers.

Clearly, the diagram 'with ridesharing' shows a more productive method of servicing the customers than that shown in the 'no ridesharing' alternative. In the 'with ridesharing' diagram, both requests are satisfied while the vehicle travels a much shorter total distance. For the purpose of measuring productivity, performance measures that use the Revenue Mile to indicate system output are obviously misleading. Policy makers wishing to improve productivity should not rely on measures such as $RevMil/Veh$ or $RevMil/VehMil$ to gage the success of their efforts. Likewise, for our study, it is necessary to create a revised set of productivity measures.

The revised productivity measures are

- Passenger Miles per Vehicle, $PassMil/Veh$
- Passenger Trips per Vehicle, $Trip/Veh$

We interpret $PassMil/Veh$ as being related to mileage productivity, and $Trip/Veh$ as being related to people loading productivity.

While the formulation of the revised productivity measures was inspired by the concepts of mileage productivity and people loading productivity, we must admit that neither measure can be said to represent solely one or the other characteristic. For example, $PassMil/Veh$ can be increased by shortening trip segments when the vehicle carries no passengers, thereby allowing the

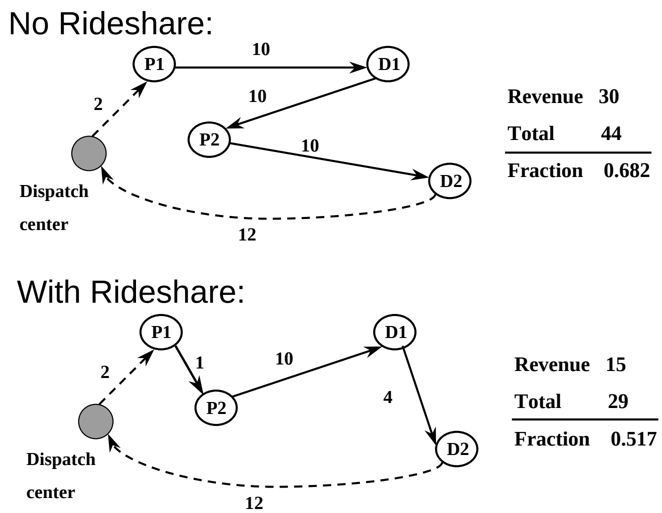

Figure 2: Revenue Miles Explanation

vehicle to service more requests over the same number of total miles. But, $PassMil/Veh$ can also be increased by carrying more than one passenger at a time, thereby multiple counting the miles when the vehicle is carrying passengers. Similarly, one could argue that both effects can influence the $Trip/Veh$ measure.

Ultimately, it would be useful to have access to information such as the Loaded Miles or the Trip Requests Serviced. The Loaded Miles would indicate the number of miles traveled when the vehicle contained one or more passengers, with no multiple counting of miles when the vehicle carries more than one passenger. The Trip Requests Serviced would indicate the number of calls for service satisfied, irrespective of the number of passengers per request. These measures would help to clarify the productivity picture. Measures defined as Loaded Miles per Total Vehicle Mile or Trip Requests Serviced per Vehicle would clearly represent the mileage productivity concept. A measure defined as Passenger Miles per Loaded Mile would clearly represent people loading productivity.

However, without incorporating Loaded Miles and Trip Requests Serviced within a mechanism such as the NTD Reporting Requirements, it is unlikely that academic researchers relying on voluntary reporting would be able to obtain this information for a large number of agencies. Policy makers interested in evaluating system productivity on a national basis should support the inclusion of these new variables in the NTD Reporting Requirements.

With regard to operating cost, we considered two performance measures

- Operating Expense per Passenger Trip, $OpExp/Trip$
- Operating Expense per Passenger Mile, $OpExp/PassMil$

A principal components analysis of these measures indicated that both represent the same performance characteristic. Consequently, an Average Operating Cost (AOC) measure was defined, see Equation 2 for an example based on the 1999 data. As in the case of the AMP, the AOC was formulated as the mean of the scaled performance measures. The values \$18.692 and \$9.909 are the mean and standard deviation of $OpExp/Trip$ for the 180 agencies surveyed. The values \$2.3992/mile and \$1.2946/mile are the mean and standard deviation of $OpExp/PassMil$.

$$AOC \equiv \left(\frac{OpExp/Trip - 18.692}{9.909} + \frac{OpExp/PassMil - 2.3992}{1.2946} \right) \div 2 \tag{2}$$

A principal components analysis of $PassMil/Veh$, $Trip/Veh$, and AOC, indicates that the productivity and operating cost measures do represent separate performance characteristics. Having formulated the performance measures, the next step is to identify statistically significant relationships between the performance measures and the practices/technologies.

3 Analysis of the Performance Data

We began by analyzing relationships to the $PassMil/Veh$ productivity measure. As in the case of the AMP, linear regression techniques were used to evaluate statistical significance. The first step was to scale the measure using its mean and standard deviation, see Equation 3 for the 1999 data example. A Box–Cox power transformation was applied to the scaled measure to improve the normality of the regression residuals. Table 4 shows the results of the regression analysis. The table shows all model terms found significant at the 10% level.

$$ScaledMiles = \frac{PassMil/Veh - 40429}{19334} \tag{3}$$

Table 4: Passenger Miles per Vehicle Regression Results

y: $(ScaledMiles + 3)^{0.2}$

	1999		1998		1997	
Term	Coeff. Est.	p–value	Coeff. Est.	p–value	Coeff. Est.	p–value
Paratransit CAD	0.07	0.003	0.05	0.034	—	—
Financial Incentives	−0.05	0.064	—	—	—	—

The strongest relationship to $PassMil/Veh$ is with the implementation of Paratransit CAD technology. This relationship was observed in both the 1999 and 1998 data. The sense of the relationship is positive, i.e. agencies that implement Paratransit CAD have a greater $PassMil/Veh$ value than agencies that do not. For the 1999 data, responding agencies that had implemented Paratransit CAD had a mean $PassMil/Veh$ value of 48700 miles/vehicle, while the responding agencies that had not implemented CAD technology had a mean value of 35800 miles/vehicle. For the 1998 data, the mean values are 48600 miles/vehicle for implementers versus 37000 miles/vehicle for non–implementers. Since the majority of CAD implementers reported using their systems for the automated scheduling and automated dispatching functions, we interpret this productivity impact as being related to improvements in these functions.

A relationship of marginal statistical significance is also observed in the 1999 data between $PassMil/Veh$ and use of Financial Incentives in contracts for service delivery. The sense of this relationship is negative, i.e. the agencies that use financial incentives have a lower average $PassMil/Veh$ value than those that do not. The mean values are 45600 miles/vehicle for non–implementers versus 38200 miles/vehicle for implementers. Many agencies use of financial incentives is linked only to on–time pick–up performance. It is possible that contractors are dispatching vehicles in a relatively unproductive way in order to satisfy the on–time performance criteria established in their contracts. Incentives based upon a single performance metric can induce this type of performance trade–off. Even so, an analysis of voluntarily reported on–time performance data from our survey indicates no relationship between on–time performance and any of the practices/technologies.

The next analysis was for relationships to the $Trip/Veh$ productivity measure. The scaling for the 1999 data is shown in Equation 4. The regression results are shown in Table 5. The observed relationships both deal with the selection of providers for service delivery. The sense of the rela-

Table 5: Passenger Trips per Vehicle Regression Results

y: $(ScaledLoading + 3)^{0.5}$

	1999		1998		1997	
Term	Coeff. Est.	p–value	Coeff. Est.	p–value	Coeff. Est.	p–value
Contracted Service Delivery	−0.30	0.006	—	—	−0.26	0.018
Agency Service Delivery	—	—	0.16	0.034	—	—

tionship to the use of Contracted Service Delivery is negative, i.e. agencies that do use contractors had a smaller mean $Trip/Veh$ value than those who did not. The sense of the relationship to use of Agency Service Delivery is positive, i.e. agencies that deliver the service themselves had a greater mean $Trip/Veh$ value than those who did not. For the 1998 data, responding agencies that do deliver service themselves had a mean $Trip/Veh$ value of 5620 trips/vehicle, while those that do not deliver service directly had a mean value of 4310 trips/vehicle. The impacts of Contracted Service Delivery in 1999 and 1997 are larger than the 1998 impact of Agency Service Delivery. However, since there is only a small number of the responding agencies that do not contract any delivery, we choose to exercise caution towards overstating the impact of these relationships.

$$ScaledLoading = \frac{Trip/Veh - 4948.8}{2050.6} \tag{4}$$

The $Trips/Veh$ regression results indicate that agencies that directly operate at least a portion of the service provided to their customers have a more productive overall service. This could be a result of the methods by which trip requests are directed to contractors. If requests are first handled by a central call receiving facility and then passed along to the contractors, it may not be possible for the contractors to effectively schedule the service. Alternatively, contracts may call for vehicles to be available for service, even in periods of low demand. Finally, this productivity impact may be a result of the relative priority given to DRT requests by contractors providing service at pre–negotiated rates. In any case, policy makers should be aware that there is an overall productivity benefit to agencies electing to directly operate DRT service.

Table 6 shows the regression results for relationships to the AOC measure, defined in Equation 2. The strongest relationship is that observed in the 1998 data with use of Advanced Communications technology. The sense of this relationship is negative, i.e. agencies that use advanced communications technology have a smaller mean AOC value than those that do not. The mean

Table 6: Average Operating Cost Regression Results

y: $(AOC + 3)^{-0.75}$

	1999		1998		1997	
Term	Coeff. Est.	p–value	Coeff. Est.	p–value	Coeff. Est.	p–value
Financial Penalties	−0.04	0.082	—	—	—	—
Advanced Communications	—	—	0.05	0.032	—	—

AOC value for responding agencies that use the technology translates to a mean $OpExp/Trip$ value of \$13.50/trip, and a mean $OpExp/PassMil$ value of \$1.75/mile. The mean AOC value for agencies that do not use the technology translates to a mean $OpExp/Trip$ value of \$16.50/trip, and a mean $OpExp/PassMil$ value of \$2.20/mile. Operating cost in transit services is primarily related to labor and fuel. It is most likely that the AOC impact of Advanced Communications is related to a reduction in labor cost. Since there is no corresponding productivity impact, we interpret the labor cost reduction as a reduction in supervisory or dispatch labor.

The cost benefit observed for Advanced Communications in the 1998 data is not evident in the 1999 data. A closer look at the 1999 data reveals that the sense of the relationship between AOC and Advanced Communications remained the same as that in 1998. The relationship is no longer statistically significant because the size of the impact diminished somewhat and the overall variability of the operating cost measure increased due to the rising impact of Financial Penalties. Consequently, policy makers should be alert to increasing costs that offset the benefits of Advanced Communications.

A marginally significant relationship between AOC and the use of Financial Penalties in service delivery contracts was observed in the 1999 data. The sense of this relationship is positive, i.e. agencies that use financial penalties in their contracts have a greater mean AOC value than those that do not. The mean AOC value for agencies that reported use of financial penalties translates to a mean $OpExp/Trip$ value of \$16.20/trip, and a mean $OpExp/PassMil$ value of \$2.08/mile. The mean AOC value for agencies that do not use the practice translates to a mean $OpExp/Trip$ value of \$14.00/trip, and a mean $OpExp/PassMil$ value of \$1.78/mile. This indicates that policy makers should assume that contractors will either avoid conditions that result in activation of financial penalty clauses or will bid at base rates that cover expected losses.

As important as those practices/technologies that do demonstrate relationships to AOC are some of those that do not. For example, implementation of Paratransit CAD technology has been shown to improve productivity, but there is no commensurate impact on cost. This indicates that the cost impact of improved productivity is being offset by an additional operating expense associated with introduction of the CAD systems. One might assume that this cost is related to initial operator training, and will not be present with continued operation. However, policy makers should continue to evaluate the cost impact of CAD implementations. Also, Agency Service Delivery has shown a beneficial impact on productivity, but no impact on cost. This indicates that there is no significant difference in cost between Contracted Service Delivery and Agency Service Delivery. Policy makers should base the decision to contract rather than directly operate on factors other than cost.

An analysis of the performance data including the small California agencies was also performed. The data for the small agencies was combined with the data from the large national agencies, and the analyses described above were repeated. In general, the significance of the identified relationships was somewhat diminished by the extra noise in the data. None of the relationships reported above was substantially effected.

4 Conclusion

We have conducted a survey of transit agencies providing DRT service in medium sized and large urban centers throughout the United States. The survey has provided information regarding the implementation of advanced technologies and management practices for 62 agencies that responded. We have evaluated the impact of the implemented technologies/practices on productivity and operating cost measures derived from information available in the 1997-1999 NTD.

Our analysis indicates that use of a Paratransit CAD system provides a productivity benefit of approximately 12000 passenger miles per vehicle annually. However, there is no corresponding cost impact. These results suggest that policy makers should continue to implement Paratransit CAD systems, but should also monitor cost impacts that offset the expected benefits from productivity improvement.

Agency Service Delivery was also found to have a beneficial impact on productivity of approximately 1300 passenger trips per vehicle annually. Here again, there is no corresponding cost impact. Policy makers should consider the decision between direct operation and contracted service to be cost neutral, and should consider other factors when making the decision.

The use of Advanced Communications technology was found to have a beneficial impact on operating cost of approximately $3.00 per passenger trip in 1998. However, the impact was diminished in 1999 and there is no corresponding productivity impact. These results suggest that policy makers should continue to implement Advanced Communications, but should be alert to offsetting costs that erode the labor savings.

The use of Financial Incentives was found to have a detrimental impact on productivity of approximately 7000 passenger miles per vehicle annually. While the use of Financial Penalties was found to have a detrimental impact on operating cost of approximately $2.00 per passenger trip. Policy makers should exercise caution when using these practices in contracts for service.

Our survey also obtained information for 13 agencies from California that service small urban areas. The data from these agencies does not substantially alter the results obtained from the analysis of the larger agencies.

Finally, the Revenue Mile was found to be a poor representation of service output, as related to evaluation of productivity. Productivity measures based upon the Revenue Mile should be avoided. Policy makers should support the inclusion of Loaded Miles and Trip Requests Serviced in the NTD Reporting Requirements.

5 Acknowledgement

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A Surveyed Agencies

Surveyed Large National Agencies

TRS ID	Agency Name	City	State
0001	King County Department of Transportation - Metro Transit	Seattle	WA
0002	Spokane Transit Authority	Spokane	WA
0003	Pierce Transit	Tacoma	WA
0007	Lane Transit District	Eugene	OR
0008	Tri-County Metropolitan Transportation District of Oregon	Portland	OR
0012	Municipality of Anchorage - Public Transportation Department	Anchorage	AK
0019	Intercity Transit	Olympia	WA
0020	Kitsap Transit	Bremerton	WA
0024	Clark County Public Transportation Benefit Area Authority	Vancouver	WA
0033	Senior Services of Snohomish County	Mukilteo	WA
1001	Rhode Island Public Transit Authority	Providence	RI
1003	Massachusetts Bay Transportation Authority	Boston	MA
1005	Lowell Regional Transit Authority	Lowell	MA
1008	Pioneer Valley Transit Authority	Springfield	MA
1014	Worcester Regional Transit Authority	Worcester	MA
1017	Greater Hartford Transit District	Hartford	CT
1049	The Greater New Haven Transit District	Hamden	CT
1050	Greater Bridgeport Transit District	Bridgeport	CT
1064	Greater Attleboro - Taunton Regional Transit Authority	Attleboro	MA
1069	The Regional Transportation Transit Authority	Portland	ME
1107	Milford Transit District	Milford	CT
2002	Capital District Transportation Authority	Albany	NY
2004	Niagara Frontier Transit Metro System, Inc.	Buffalo	NY
2007	Metropolitan Suburban Bus Authority, dba MTA Long Island Bus	Garden City	NY
2008	New York City Transit	Brooklyn	NY
2010	Dutchess County Division of Mass Transportation	Poughkeepsie	NY
2018	CNY Centro, Inc.	Syracuse	NY
2072	Suffolk County Department of Public Works - Transportation Division	Yaphank	NY
2076	Westchester County Department of Transportation	White Plains	NY
2080	New Jersey Transit Corporation (Consolidated)	Newark	NJ
2086	Transp Resources Intra-County For Physically Hand. and Sr. Cit.	Pomona	NY
2113	Regional Transit Service, Inc. & Lift Line, Inc.	Rochester	NY
2159	Atlantic Paratrans, Inc.	Staten Island	NY
2173	American Transit	Yonkers	NY
3001	Kanawha Valley Regional Transportation Authority	Charleston	WV
3004	Peninsula Transportation District Commission	Hampton	VA
3005	Tidewater Transportation District Commission	Norfolk	VA
3006	Greater Richmond Transit Company	Richmond	VA
3010	Lehigh and Northampton Transportation Authority	Allentown	PA
3014	Cumberland-Dauphin-Harrisburg Transit Authority	Harrisburg	PA

Surveyed Large National Agencies (cont.)

TRS ID	Agency Name	City	State
3015	Luzerne County Transportation Authority	Kingston	PA
3018	Red Rose Transit Authority	Lancaster	PA
3019	Southeastern Pennsylvania Transportation Authority	Philadelphia	PA
3023	Beaver County Transit Authority	Rochester	PA
3025	County of Lackawanna Transit System	Scranton	PA
3030	Washington Metropolitan Area Transit Authority	Washington	DC
3034	Mass Transit Administration, Maryland Dept. of Transportation	Baltimore	MD
3067	ACCESS Transportation Systems, Inc.	Pittsburgh	PA
3068	Fairfax Connector Bus System	Fairfax	VA
3075	Delaware Transit Corporation	Dover	DE
3082	Atlantic Paratrans of PA, Inc.	Philadelphia	PA
4003	Memphis Area Transit Authority	Memphis	TN
4004	Metropolitan Transit Authority	Nashville	TN
4008	Charlotte Public Transit Department	Charlotte	NC
4017	Transit Authority Lexington - Fayette Urban County Government	Lexington	KY
4018	Transit Authority of River City	Louisville	KY
4019	Transit Authority of Northern Kentucky	Fort Wright	KY
4022	Metropolitan Atlanta Rapid Transit Authority	Atlanta	GA
4025	Chatham Area Transit Authority	Savannah	GA
4026	Manatee County Area Transit	Bradenton	FL
4027	Pinellas Suncoast Transit Authority	Clearwater	FL
4028	Lee County Transit	Ft. Myers	FL
4029	Broward County Mass Transit Division	Pompano Beach	FL
4032	County of Volusia dba VOTRAN	South Daytona	FL
4035	Central Florida Regional Transportation Authority (LYNX)	Orlando	FL
4037	Palm Tran, Inc.	West Palm Beach	FL
4038	Escambia County Area Transit	Pensacola	FL
4040	Jacksonville Transportation Authority	Jacksonville	FL
4041	Hillsborough Area Regional Transit Authority	Tampa	FL
4042	Birmingham-Jefferson County Transit Authority	Birmingham	AL
4043	Metro Transit	Mobile	AL
4046	Sarasota County Transportation Authority	Sarasota	FL
4053	Greenville Transit Authority	Greenville	SC
4063	Space Coast Area Transit	Cocoa	FL
4074	Pasco County Public Transportation (PCPT)	Port Richey	FL
4078	Cobb Community Transit	Marietta	GA
4086	Metropolitan Bus Authority	San Juan	PR
4088	Spartanburg County Transportation Services	Spartanburg	SC
4106	COMSIS Mobility Services	Miami	FL
4110	Charleston Area Regional Transporta	Charleston	SC

Surveyed Large National Agencies (cont.)

TRS ID	Agency Name	City	State
5005	Madison Metro Transit	Madison	WI
5010	Metro Regional Transit Authority	Akron	OH
5011	Stark Area Regional Transit Authority	Canton	OH
5012	Southwest Ohio Regional Transit Authority	Cincinnati	OH
5015	The Greater Cleveland Regional Transit Authority	Cleveland	OH
5016	Central Ohio Transit Authority	Columbus	OH
5017	Miami Valley Regional Transit Authority	Dayton	OH
5022	Toledo Area Regional Transit Authority	Toledo	OH
5024	Western Reserve Transit Authority	Youngstown	OH
5031	Suburban Mobility Authority for Regional Transportation	Detroit	MI
5032	Mass Transportation Authority	Flint	MI
5033	Grand Rapids Area Transit Authority	Grand Rapids	MI
5036	Capital Area Transportation Authority	Lansing	MI
5038	Niles Dial-A-Ride	Niles	MI
5048	LCEOC, Inc.	Hammond	IN
5049	Tradewinds Rehabilitation Center, Inc.	Gary	IN
5050	Indianapolis Public Transportation Corporation	Indianapolis	IN
5066	Chicago Transit Authority	Chicago	IL
5094	Waukesha County Transit System	Waukesha	WI
5095	Lorain County Transit	Lorain	OH
5112	Milwaukee County Paratransit System	Milwaukee	WI
5113	Pace, Suburban Bus Division	Arlington Heigh	IL
5117	LAKETRAN	Grand River	OH
5119	City of Detroit Department of Transportation	Detroit	MI
5146	Madison County Transit District	Granite City	IL
5153	Laidlaw Transit, Inc.	Naperville	IL
5154	Metropolitan Council	St. Paul	MN
5155	Metro Mobility	St. Paul	MN
6006	Mass Transit Department - City of El Paso	El Paso	TX
6007	Fort Worth Transportation Authority	Fort Worth	TX
6008	Metropolitan Transit Authority of Harris County, Texas	Houston	TX
6011	VIA Metropolitan Transit	San Antonio	TX
6017	Central Oklahoma Transit & Parking Authority	Oklahoma City	OK
6018	Metropolitan Tulsa Transit Authority	Tulsa	OK
6019	Sun Tran of Albuquerque	Albuquerque	NM
6022	Capital Transportation Corporation	Baton Rouge	LA
6024	Shreveport Area Transit System	Shreveport	LA
6032	Regional Transit Authority of Orleans and Jefferson	New Orleans	LA
6041	Handitran Special Transit Division, City of Arlington	Arlington	TX
6048	Capital Metropolitan Transportation Authority	Austin	TX

Surveyed Large National Agencies (cont.)

TRS ID	Agency Name	City	State
6051	Corpus Christi Regional Transportation Authority	Corpus Christi	TX
6056	Dallas Area Rapid Transit Authority	Dallas	TX
6057	First Transit, Inc.	Dallas	TX
6072	Community Resource Group, Inc.	Springdale	AR
6087	Ryder/ATE, Inc.	Houston	TX
6088	Jefferson Parish Department of Transit Administration	Gretna	LA
7001	StarTran	Lincoln	NE
7002	Transit Authority of Omaha	Omaha	NE
7005	Kansas City Area Transportation Authority	Kansas City	MO
7006	Bi-State Development Agency	St. Louis	MO
7010	Des Moines Metropolitan Transit Authority	Des Moines	IA
7015	Wichita Transit	Wichita	KS
7035	Johnson County Kansas aka Johnson County Transit	Olathe	KS
8001	Utah Transit Authority	Salt Lake City	UT
8005	Colorado Springs Transit System	Colorado Spring	CO
8006	Regional Transportation District	Denver	CO
8022	Laidlaw Transit Services, Inc.	Commerce City	CO
9001	Regional Transportation Commission of Washoe County	Reno	NV
9002	City and County of Honolulu Dept of Transportation Services	Honolulu	HI
9004	Golden Empire Transit District	Bakersfield	CA
9006	Santa Cruz Metropolitan Transit District	Santa Cruz	CA
9008	Santa Monica's Big Blue Bus	Santa Monica	CA
9009	San Mateo County Transit District	San Carlos	CA
9010	City of Torrance Transit System	Torrance	CA
9012	San Joaquin Regional Transit District	Stockton	CA
9015	San Francisco Municipal Railway	San Francisco	CA
9016	Golden Gate Bridge, Highway and Transportation District	San Francisco	CA
9019	Sacramento Regional Transit District	Sacramento	CA
9022	Norwalk Transit System	Norwalk	CA
9023	Long Beach Public Transportation Company	Long Beach	CA
9026	San Diego Transit Corporation	San Diego	CA
9027	Fresno Area Express	Fresno	CA
9028	City of Vallejo: Vallejo Transit Vallejo - San Francisco Ferry	Vallejo	CA
9029	OMNITRANS	San Bernadino	CA
9030	North San Diego County Transit Development Board	Oceanside	CA
9031	Riverside Transit Agency	Riverside	CA
9032	City of Phoenix Public Transit Department	Phoenix	AZ
9033	City of Tucson	Tucson	AZ
9034	City of Glendale - Transit	Glendale	AZ
9035	South Coast Area Transit	Oxnard	CA

Surveyed Large National Agencies (cont.)

TRS ID	Agency Name	City	State
9036	Orange County Transportation Authority	Orange	CA
9041	Montebello Bus Lines	Montebello	CA
9042	City of Gardena Transportation Department	Gardena	CA
9062	Monterey-Salinas Transit	Monterey	CA
9078	Central Contra Costa Transit Authority	Concord	CA
9079	SunLine Transit Agency	Thousand Palms	CA
9086	City of Riverside Special Transportation	Riverside	CA
9089	Sonoma County Transit	Santa Rosa	CA
9095	San Diego Association of Government	San Diego	CA
9132	Maricopa County Special Transportation Services	Phoenix	AZ
9136	Regional Public Transportation Authority	Phoenix	AZ
9147	City of Los Angeles Department of Transportation	Los Angeles	CA
9152	ATC/VanCom	North Las Vegas	NV
9157	Access Services Incorporated	Los Angeles	CA
9158	Laidlaw Transit Services, Inc.	Sherman Oaks	CA
9160	Outreach & Escort, Inc. dba OUTREACH	San Jose	CA
9166	Los Angeles County Metropolitan Transportation Authority	Los Angeles	CA
9170	Intelitran	Oakland	CA
9173	Merced County Transit	Merced	CA
9185	San Diego Metropolitan Transit Development Board	San Diego	CA

Surveyed Small California Agencies

TRS ID	Agency Name	City	State
9007	Modesto Area Express	Modesto	CA
9017	City of Santa Rosa	Santa Rosa	CA
9024	City of La Mirada Transit	La Mirada	CA
9043	City of Commerce Municipal Buslines	Commerce	CA
9044	Arcadia Transit	Arcadia	CA
9050	Simi Valley Transit	Simi Valley	CA
9052	City of Corona Dial-A-Ride	Corona	CA
9061	Yuba-Sutter Transit Authority	Marysville	CA
9087	Santa Maria Area Transit	Santa Maria	CA
9088	City of Napa, Napa Valley Transit/The V.I.N.E.	Napa	CA
9091	City of Visalia - Visalia City Coach	Visalia	CA
9092	City of Fairfield, Fairfield/Suisun Transit	Fairfield	CA
9093	Redding Area Bus Authority (RABA)	Redding	CA
9121	Antelope Valley Transit Authority	Lancaster	CA
9144	Livermore/Amador Valley Transit	Livermore	CA
9148	Victor Valley Transit Authority	Hesperia	CA
9149	City of Lompoc-Lompoc Transit	Lompoc	CA
9159	Western Contra Costa Transit	Pinole	CA
9161	City of Union City	Union City	CA
9162	Eastern Contra Costa Transit	Antioch	CA
9164	Ventura Intercity Service Transit Authority	Ventura	CA
9165	Thousand Oaks Transit	Thousand Oaks	CA
9168	Roseville Transit	Roseville	CA
9171	Santa Clarita Transit	Santa Clarita	CA
9175	City of Lodi	Lodi	CA

B Survey Form

Demand Responsive Transit Service
Management Practices and Advanced Technologies Survey

NTD ID Number: 0001
Agency Name: King County Department of Transportation - Metro Transit Division

Management Practices -
(For all practices in use, please indicate year that practice was first implemented. If the year is uncertain, please indicate an estimate with an asterisk, eg: 1998*.)

_____ Financial incentives - payments to contractors, in addition to base fee, contingent upon service performance results

_____ Financial penalties - charges to contractors, deducted from the base fee, contingent upon service performance results

_____ Ridesharing - a vehicle simultaneously serves trip requests from more than one customer by use of a carpooling strategy

_____ Agency administration - the agency named on the survey performs the following functions: determines ADA eligibility, arranges for use of vehicles and services of drivers, monitors service performance, and distributes funds in payment for transportation

_____ Contracted administration - the agency named on the survey contracts another organization(s) to perform the functions listed above

_____ Consumer choice - customers are allowed a selection of providers (among the agency and its contractors) to service a trip request

1999 NTD reported Operating Expense for DR transit: $ 36,157,343
Vehicle Operator Training Expenditures (as a percentage of Operating Expense, circle one):

0% less than 0.5% 0.5% - 1.0% 1.1% - 1.5% more than 1.5%

Continued on next page…

Advanced Technologies -

(For all technologies in use, please indicate year that the technology became operational. If the year is uncertain, please indicate an estimate with an asterisk, eg: 1998*.)

_____ Advanced communications - digital radio or wireless personal communication systems used to transmit voice and/or data between the vehicle and the dispatch center

Please estimate the percentage of vehicles so equipped: _____%

_____ Automated vehicle location - a computer-based tracking system that includes a method of determining vehicle location (such as global positioning system, active signposts, ground-based radio) and a method of transmitting data from the vehicle to the dispatch center

Please estimate the percentage of vehicles so equipped: _____%

_____ Automated fare payment - a system that allows customers to use magnetic stripe cards, smart cards, credit cards, or debit cards for fare payment via in-vehicle readers, telephone, or the internet

Please estimate the percentage of fares paid this way: _____%

_____ Automated transit information - a computer-based system for disseminating real-time information (such as vehicle location or anticipated arrival times) to customers via kiosks, the internet, on-board voice annunciators, or interactive telephone systems

_____ Paratransit CAD System - single software package, or integrated collection of software products, that provide Computer Aided Dispatching capabilities consisting of one or more of the automated functions listed on the next page. The system is used to deliver transit service to individuals in accordance with the requirements of the Americans with Disabilities Act.

Please provide the Name and Version of the CAD software product(s) in use:

____

Please estimate the capital cost to install the technologies in use: $ _______________

Continued on next page…

Uses of Paratransit CAD System -

(For all uses that apply, please indicate year that system became operational for that use. If the year is uncertain, please indicate an estimate with an asterisk, eg: 1998*.)

_____ Automated administration - the software determines ADA eligibility or distributes service requests to transportation contractors or collects data on contractor performance

Please estimate the percentage of trip requests processed in this way: _____%

_____ Automated reservations - the software accepts input from customers via telephone and/or the internet regarding requests for service

Please estimate the percentage of trip requests processed in this way: _____%

_____ Automated scheduling - the software determines passenger pick-up and drop-off times

Please estimate the percentage of trip requests processed in this way: _____%

_____ Automated routing - the software provides road directions between passenger stops

Please estimate the percentage of trip requests processed in this way: _____%

_____ Automated dispatching - the software determines passenger assignments to a vehicle/driver and revises schedule or route based on updated information such as: no-shows, cancellations, traffic congestion

Please estimate the percentage of trip requests processed in this way: _____%

_____ Automated reporting - the software collects and displays, or exports, data regarding service performance such as: actual pick-up time, actual drop-off time, time in motion, dead end time

Please estimate the percentage of trip requests processed in this way: _____%

Continued on next page…

Please provide the following additional information about the agency's DR transit service -

Number of full-time vehicle operators (including contractors): __________

Number of part-time vehicle operators (including contractors): __________

Percentage of trips that vehicle arrives at the requested trip origination location no more than 5 minutes before or 10 minutes after the requested time (circle one):

85% or less   86% - 90%   91% - 95%   96% - 99%   100%

Percentage of eligible requests that cannot be served due to system congestion (circle one):

0%   1% - 2%   3% - 4%   5% or more

Among the technologies and practices specifically described above, please list those that your agency has found to be <u>most</u> beneficial in terms of improving efficiency or quality of service:

Among the technologies and practices specifically described above, please list those that your agency has found to be <u>least</u> beneficial in terms of improving efficiency or quality of service:

Please comment on any technologies or practices not specifically described above that your agency has found to be noteworthy as being either beneficial or detrimental to service:

Contact person (if not same as addressee):

Name: ____________________________________

Title: ____________________________________   Phone: ________________

Thank You.

C Responding Agencies

Responding Large National Agencies

TRS ID	Agency Name	City	State
0002	Spokane Transit Authority	Spokane	WA
0003	Pierce Transit	Tacoma	WA
0024	Clark County Public Transportation Benefit Area Authority	Vancouver	WA
1050	Greater Bridgeport Transit District	Bridgeport	CT
2008	New York City Transit	Brooklyn	NY
2080	New Jersey Transit Corporation (Consolidated)	Newark	NJ
3004	Peninsula Transportation District Commission	Hampton	VA
3010	Lehigh and Northampton Transportation Authority	Allentown	PA
3018	Red Rose Transit Authority	Lancaster	PA
3030	Washington Metropolitan Area Transit Authority	Washington	DC
3034	Mass Transit Administration, Maryland Dept. of Transportation	Baltimore	MD
3067	ACCESS Transportation Systems, Inc.	Pittsburgh	PA
4003	Memphis Area Transit Authority	Memphis	TN
4004	Metropolitan Transit Authority	Nashville	TN
4018	Transit Authority of River City	Louisville	KY
4029	Broward County Mass Transit Division	Pompano Beach	FL
4035	Central Florida Regional Transportation Authority (LYNX)	Orlando	FL
4037	Palm Tran, Inc.	West Palm Beach	FL
4038	Escambia County Area Transit	Pensacola	FL
4040	Jacksonville Transportation Authority	Jacksonville	FL
4046	Sarasota County Transportation Authority	Sarasota	FL
4053	Greenville Transit Authority	Greenville	SC
4063	Space Coast Area Transit	Cocoa	FL
4074	Pasco County Public Transportation (PCPT)	Port Richey	FL
4078	Cobb Community Transit	Marietta	GA
4110	Charleston Area Regional Transportation	Charleston	SC
5010	Metro Regional Transit Authority	Akron	OH
5033	Grand Rapids Area Transit Authority	Grand Rapids	MI
5038	Niles Dial-A-Ride	Niles	MI
5048	LCEOC, Inc.	Hammond	IN
5094	Waukesha County Transit System	Waukesha	WI
5112	Milwaukee County Paratransit System	Milwaukee	WI
5113	Pace, Suburban Bus Division	Arlington Heights	IL
5117	LAKETRAN	Grand River	OH
5155	Metro Mobility	St. Paul	MN
6008	Metropolitan Transit Authority of Harris County, Texas	Houston	TX
6011	VIA Metropolitan Transit	San Antonio	TX
6017	Central Oklahoma Transit & Parking Authority	Oklahoma City	OK
6022	Capital Transportation Corporation	Baton Rouge	LA
6056	Dallas Area Rapid Transit Authority	Dallas	TX

Responding Large National Agencies (cont.)

TRS ID	Agency Name	City	State
7001	StarTran	Lincoln	NE
7010	Des Moines Metropolitan Transit Authority	Des Moines	IA
7015	Wichita Transit	Wichita	KS
9002	City and County of Honolulu Dept of Transportation Services	Honolulu	HI
9006	Santa Cruz Metropolitan Transit District	Santa Cruz	CA
9015	San Francisco Municipal Railway	San Francisco	CA
9023	Long Beach Public Transportation Company	Long Beach	CA
9028	City of Vallejo: Vallejo Transit Vallejo-San Francisco Ferry	Vallejo	CA
9029	OMNITRANS	San Bernadino	CA
9034	City of Glendale - Transit	Glendale	AZ
9035	South Coast Area Transit	Oxnard	CA
9036	Orange County Transportation Authority	Orange	CA
9041	Montebello Bus Lines	Montebello	CA
9062	Monterey-Salinas Transit	Monterey	CA
9078	Central Contra Costa Transit Authority	Concord	CA
9079	SunLine Transit Agency	Thousand Palms	CA
9086	City of Riverside Special Transportation	Riverside	CA
9089	Sonoma County Transit	Santa Rosa	CA
9152	ATC/VanCom	North Las Vegas	NV
9157	Access Services Incorporated	Los Angeles	CA
9173	Merced County Transit	Merced	CA
9185	San Diego Metropolitan Transit Development Board	San Diego	CA

Responding Small California Agencies

TRS ID	Agency Name	City	State
9052	City of Corona Dial-A-Ride	Corona	CA
9061	Yuba-Sutter Transit Authority	Marysville	CA
9087	Santa Maria Area Transit	Santa Maria	CA
9093	Redding Area Bus Authority (RABA)	Redding	CA
9144	Livermore/Amador Valley Transit	Livermore	CA
9148	Victor Valley Transit Authority	Hesperia	CA
9149	City of Lompoc-Lompoc Transit	Lompoc	CA
9159	Western Contra Costa Transit	Pinole	CA
9161	City of Union City	Union City	CA
9162	Eastern Contra Costa Transit	Antioch	CA
9165	Thousand Oaks Transit	Thousand Oaks	CA
9168	Roseville Transit	Roseville	CA
9171	Santa Clarita Transit	Santa Clarita	CA

D Raw Survey Data

Management Practices

TRS ID	Financial Incentives	Financial Penalties	Ridesharing	Agency Admin.	Contracted Admin.	Consumer Choice	Operator Training
0002		1999	2001*	1990*	1992*		0.5% - 1.0%
0003	1998*	1991*	1980*	1980			1.1% - 1.5%
0024				1981			more than 1.5%
1050	1999	1999		1999	1999		
2008	1993	1993	1993	1993			1.1% - 1.5%
2080	2002*	1993	1993	1993	1993		more than 1.5%
3004			1990	1990	1996		less than 0.5%
3010	1996	1996	1988	1999			1.1% - 1.5%
3018	1996	1996	1981	1992*			less than 0.5%
3030	2000	2000	1994		1994		
3034		1995		1975			
3067	1992*	1987*	1979	1979	1979	1979	1.1% - 1.5%
4003							less than 0.5%
4004		2000			1981	1995	1.1% - 1.5%
4018	2000	1995		1992			more than 1.5%
4029	1996	1996		1996		1996	
4035	N/A	1996		1992	N/A	N/A	less than 0.5%
4037	1999*	1996*		1996	1996		0.5% - 1.0%
4038			1994*		1986		1.1% - 1.5%
4040	2001	2001			2001		less than 0.5%
4046			1999	1999	1999		0.5% - 1.0%
4053			yes		yes		less than 0.5%
4063	N/A	1995	1995	1975	N/A	1991	less than 0.5%
4074				1997			more than 1.5%
4078		1994			1994		less than 0.5%
4110	1999	1999	N/A	1989	1998	N/A	0.5% - 1.0%
5010		1995		1975*			less than 0.5%
5033		1999	1995*	1977	1981		less than 0.5%
5038	1974	1974		1974	1974		more than 1.5%
5048			1980		2000		more than 1.5%
5094			yes	yes			
5112	1998	1998	1980	1993	2000	1978	
5113	1988*	1987*	1987*	1987*			
5117		1985	1992				1.1% - 1.5%
5155	1994	1994	1994	1994			0.5% - 1.0%
6008	1990*	1985*	1979	1979	1979		more than 1.5%
6011			1988	1980			0.5% - 1.0%
6017			1992*	1988*			0.5% - 1.0%

Management Practices (cont.)

TRS ID	Financial Incentives	Financial Penalties	Ridesharing	Agency Admin.	Contracted Admin.	Consumer Choice	Operator Training
6022	1995	1995					0.5% - 1.0%
6056	1994	1994	1990*	1995			more than 1.5%
7001	1975			1975			less than 0.5%
7010			1978	1978			0.5% - 1.0%
7015	N/A	N/A	1986*	1990*	1990*	N/A	less than 0.5%
9002				yes			1.1% - 1.5%
9006			1992				
9015	2002	2002	2000	2000			
9023	1998	1976*	1976*				0.5% - 1.0%
9028	1996	1996			1980		less than 0.5%
9029	1988*	1998*	1976*		1976*		
9034	1999	1999	1975				0.5% - 1.0%
9035	2001	1995	1995	1995	1995		
9036	1976*	1976*	1976*	1995	1976*		1.1% - 1.5%
9041							0.5% - 1.0%
9052	1999*	1999		1977	1977		0.5% - 1.0%
9061				1982	1979		
9062		yes	yes	yes			
9078	1999	1999	1990	1990	1990		1.1% - 1.5%
9079			1991	1991			0.5% - 1.0%
9086							0.5% - 1.0%
9087				1990	1990		0%
9089				1990			
9093	1997	1997		1981	1981		less than 0.5%
9144	1991	1991	1987	1987			
9148		1998	1994	1994	1994		1.1% - 1.5%
9149	1998			1976	1976		0.5% - 1.0%
9152	1995	1995	1999*	1995	1995		1.1% - 1.5%
9157	1994	1994	1991	1991	N/A	N/A	1.1% - 1.5%
9159		1992			1977		
9161		1996		1997*			
9162	1993	1993	1984	1984			less than 0.5%
9165		1990		1992	1992		0.5% - 1.0%
9168	1997	1997	1988*	1970			less than 0.5%
9171	1991	1991	1991	1991			0.5% - 1.0%
9173	2001	2001		1996	1996		0.5% - 1.0%
9185	1995	1995	1995		1995		

Advanced Technologies

TRS ID	Advanced Communications	%Vehicles	Auto. Vehicle Location	%Vehicles	Auto. Fare Payment	%Vehicles	Auto. Transit Information
0002			2001	100			
0003							
0024	1995	100					
1050							
2008	1999*	100	2000*	3			
2080	1993	100	2002	100	2003	25	2002
3004							
3010							
3018	1992	100					
3030	1994						
3034	2002	100	2002	100	2002	100	
3067	2000	15	2000	10			
4003	1993	100					
4004	1998	100					
4018							
4029							
4035							
4037	1998*	70			1999	70	
4038					2001		
4040			2001	100			
4046	1999	100					
4053	1997	100					
4063	1985*	100	N/A		2000	2	N/A
4074							
4078	1994	100					
4110	1992	100	N/A		1996	100	N/A
5010	1975*	100	2001	100			
5033							
5038							
5048	1992	100					
5094							
5112							
5113							
5117	2001	100	1999	10			
5155	1994	100					
6008	1979	100	1993	100			
6011	1981	100	2001	100			
6017	1988*	90			1999	80	

Advanced Technologies (cont.)

TRS ID	Advanced Communications	%Vehicles	Auto. Vehicle Location	%Vehicles	Auto. Fare Payment	%Vehicles	Auto. Transit Information
6022							
6056	1994	100	2001	100			
7001							
7010	1978	100	1995	75			
7015	1990*	90	N/A		N/A		N/A
9002	yes	100	2000	100			
9006							
9015							
9023	1998	100					
9028							
9029							
9034	2000	100					
9035	2000	100					
9036	1976*	100					
9041							
9052	yes	100					
9061							
9062		0		0		0	
9078	1999	100					
9079							
9086			1992	100			
9087							
9089							
9093	1981	100			1995		
9144	1987	100					
9148	1994						
9149							
9152	2001	100	2001	100	1995	27	1995
9157	1991	100	1997	95	N/A		N/A
9159	1977	100					
9161	1997	100					
9162							
9165	1980	100	2001	100	1996	100	2001
9168							
9171							
9173	1996	100					
9185	1995	100					

Paratransit CAD

TRS ID	Implemented	Cost	Software
0002	1997	$490,000	Trapeze Software
0003	1992	$500,000	Trapeze PASS 4.5
0024			
1050			
2008	1998*		TransCAD 3.5
2080	2001	$9,300,000	Trapeze 4.51
3004	1999	$70,000	Trapeze (Contractor)
3010	1998	$180,000	Teleride/Transview
3018			
3030			
3034	1997	$125,000	PASS-ON-LINE Products/ Now: Trapeze Software
3067	2001	$150,000	MIDAS-PT
4003	1993		PTMS
4004	1999	$75,000	Multisystems – 1995 Midas PT
4018	1995	$78,000	Trapeze PASS-DOS version 3.9.2h
4029	1996	$250,000	MIDAS PT v. 3.6 Windows, multisystem.
4035			
4037	1999		Mobility Master
4038			
4040	2001	$500,000	Trapeze – PASS; AtRoad (AVL system)
4046	1999	$300,000	TRAPEZE PASS
4053			
4063	1990	$110,000	Trapeze
4074	1999	$100,000	Trans Vu
4078	2000	$125,000	Multisystem Midas PT – owned by contractor. No outright cost to us. We own the computers.
4110	1995	$235,000	Trapeze 5.0
5010	2001	$775,000	INIT
5033			
5038			
5048	2001	$80,000	Route logic – Pembroke Pines, Fl.
5094			
5112	1998	$430,000	Trapeze PT
5113	1996		Trapeze Pass
5117		$4,495,000	
5155	1994	$350,000	Trapeze in 1999 – Windows based
6008	1980	$1,000,000	Trapeze DOS (PASS)
6011	1991*	$212,300	Trapeze/PASS v.4.431.2.0
6017	1996	$500,000	

Paratransit CAD (cont.)

TRS ID	Implemented	Cost	Software
6022			
6056	1997	$2,000,000	TRAPEZE Version 431
7001			
7010		$90,000	
7015	N/A		
9002	1998	$1,000,000	Trapeze
9006			
9015			Mobility Master will be installed at our office this year
9023			
9028			
9029	1998	$250,000	Trapeze PASS V4.3
9034	1991	$100,000	Trapeze 4 and mobile data terminals
9035	2001	$94,000	Multisystems MIDAS
9036	1995	$700,000	Trapeze 4 PASS
9041			
9052	yes		Midas – PT
9061			
9062		$37,000	Teleride Transview
9078	1993*		PASS-DOS
9079	1994		Trapeze Pass 3.9 DOS version
9086	1986	$44,000	Computer Technology Inc. Software is called Scooter and Teletrac.
9087	2001	$76,000	Multisystems – "MIDAS-PT"
9089	1994	$60,000	PASS-DOS Version
9093	1997	$35,000	Schedule Pro by Easy lift Transportation
9144	1991*	$100,000	On-line PASS – DOS version
9148	1998		Easy Lift
9149			
9152	1995	$9,000,000	PASS, Trapeze (2000) + AVL system
9157	1991	$2,500,000	PASS v. 3.92h (from Trapeze) / Customized ver. of Taxi-track / Shared ride from DDS
9159	yes		PASS
9161		$6,000	
9162			
9165			
9168			
9171	1996	$6,000	Trapeze PASS DOS 3.9.214
9173			
9185	yes		trapeze 4.0

Uses of Paratransit CAD System, Part 1

TRS ID	Auto. Administration	% Requests	Auto. Reservations	% Requests	Auto. Scheduling	% Requests
0002	1997	100			1997	100
0003	1998*	100			1992	100
0024			1997	80	1997	80
1050			1999	50	1999	50
2008					1998*	100
2080	2001	100	2002	10	2001	100
3004	1999	100	1999	100	1999	100
3010	1998	100	1998	100	1998	100
3018					1998	100
3030						
3034	1997	100	1997	100	1997	100
3067					2001	12
4003						
4004					1999	50
4018			1995	100	1995	100
4029	1996	100			1996	80
4035						
4037	1999	60			1996	50
4038						
4040	2001	100			2001	99
4046	1999	100	1999	100	1999	100
4053						
4063	N/A		N/A		1994	100
4074			1999	95	1999	95
4078					1994	85
4110	N/A	0	N/A	0	1995	100
5010						
5033					1995	
5038						
5048					2001	
5094						
5112	1998	80			1998	80
5113	1996	35			1996	35
5117					1993	100
5155	1994	100	1994	100	1994	100
6008			1980	100	1985	100
6011					1991*	60
6017			1996	80	1996	80

Uses of Paratransit CAD System, Part 1 (cont.)

TRS ID	Auto. Administration	% Requests	Auto. Reservations	% Requests	Auto. Scheduling	% Requests
6022						
6056			1997	100	1997	100
7001						
7010						
7015	N/A		N/A		N/A	
9002	1998	100	1998	100	1998	
9006						
9015						
9023						
9028						
9029						
9034					1992	100
9035			2001	100	2001	100
9036	1995	95			1995	100
9041						
9052					yes	0
9061						
9062						
9078					1993*	100
9079					1994	100
9086					1986	80
9087					2001	95
9089					1994	
9093			1997	100	1997	100
9144					1991*	95
9148	1998				1998	
9149						
9152			1995	96	1995	96
9157	N/A		N/A		1991	30
9159			yes	100	yes	100
9161						
9162					1991	95
9165						
9168						
9171					1991	100
9173						
9185			1995	100	1995	98

Uses of Paratransit CAD System, Part 2

TRS ID	Auto. Routing	% Requests	Auto. Dispatching	% Requests	Auto. Reporting	% Requests
0002	1997	100	1997	100	1997	100
0003	1996*	60	1992	100	1992*	100
0024	1997	50			1997	90
1050					1999	100
2008						
2080			2001	100	2001	100
3004			1999	100	1999	100
3010						
3018						
3030						
3034	1997	100	1997	100	1997	100
3067	1999	26	2001	12		
4003						
4004					1999	100
4018			1995	100	1995	100
4029	1996	80	1996	80		
4035						
4037	1996	50			1996	75
4038						
4040	2001	99	2001	5		
4046						
4053						
4063	N/A		1994	100	1994	100
4074	1999	90	1999	95	1999	75
4078					2001	95
4110	1995	100	1995	100	1995	100
5010			2001		2001	
5033						
5038						
5048	2001		2001		yes	99
5094						
5112			1998	80	1998	80
5113			1996	35	1996	35
5117			1993	100		
5155	CMNT		1994	100	1994	100
6008						
6011	2000*		1995*	100	2001	100
6017			1996	80	1996	80

Uses of Paratransit CAD System, Part 2 (cont.)

TRS ID	Auto. Routing	% Requests	Auto. Dispatching	% Requests	Auto. Reporting	% Requests
6022						
6056	1998	100	1997	100	1997	100
7001						
7010						
7015	N/A		N/A		N/A	
9002			1998	100	1998	100
9006						
9015						
9023						
9028						
9029					1998	
9034					1992	100
9035			2001	100	2001	100
9036	1995	100	1995	100	1995	80
9041						
9052			yes	0		
9061						
9062	yes	100				
9078			1993*	100	1993*	100
9079	1994	100	1994	100	1994	100
9086			1986	80		
9087	2001	100	2001	100	2001	100
9089	1994		1994		1994	30
9093					1997	100
9144			1991*	95	1991*	
9148			1998		1998	
9149						
9152	1995	94	1995	94	1995	100
9157	N/A		1991	30	1991	100
9159	yes	100			yes	100
9161						
9162			1991	95	1991	95
9165						
9168						
9171					1991	100
9173						
9185						

Additional Information

TRS ID	Full–Time Operators	Part–Time Operators	% On–time	% not served
0002	84	30		0%
0003	98	20	85% or less	0%
0024	31	21	96% - 99%	0%
1050			91% - 95%	0%
2008	1099		86% - 90%	0%
2080	181	52	96% - 99%	0%
3004	0	35	96% - 99%	0%
3010	78	70	86% - 90%	0%
3018	60	25	85% or less	0%
3030	225	75	91% - 95%	0%
3034	150	0	91% - 95%	0%
3067	450	80	86% - 90%	0%
4003	65	0	91% - 95%	0%
4004	42	3	85% or less	1% - 2%
4018	160		91% - 95%	1% - 2%
4029	540	290	85% or less	0%
4035	103	23	85% or less	0%
4037	70	0	91% - 95%	1% - 2%
4038		5	96% - 99%	0%
4040	4	5	85% or less	0%
4046	65	5	85% or less	1% - 2%
4053	2			0%
4063	38	16	86% - 90%	0%
4074	19	1	85% or less	1% - 2%
4078	14	2	96% - 99%	
4110	35	3	91% - 95%	1% - 2%
5010			86% - 90%	0%
5033	75	0	96% - 99%	0%
5038	5	8	86% - 90%	0%
5048	35	32	91% - 95%	5% or more
5094				0%
5112	186	0	96% - 99%	0%
5113			96% - 99%	0%
5117	74	74	96% - 99%	1% - 2%
5155	270	55	96% - 99%	3% - 4%
6008	290	6	86% - 90%	0%
6011	250	25	86% - 90%	3% - 4%
6017	45	10	86% - 90%	1% - 2%

Additional Information (cont.)

TRS ID	Full–Time Operators	Part–Time Operators	% On–time	% not served
6022	9	1	96% - 99%	1% - 2%
6056	273	25	91% - 95%	0%
7001	74	0	96% - 99%	1% - 2%
7010	17	23	91% - 95%	0%
7015	24		96% - 99%	0%
9002	176	14	91% - 95%	0%
9006				0%
9015				
9023	3			0%
9028	11	5	86% - 90%	0%
9029	100	20		0%
9034	12	6	86% - 90%	0%
9035	15	10	85% or less	1% - 2%
9036	332	54	86% - 90%	0%
9041	0	6	91% - 95%	1% - 2%
9052	12	6	96% - 99%	0%
9061	30	4	96% - 99%	
9062	37	0	96% - 99%	1% - 2%
9078	58	10	91% - 95%	1% - 2%
9079	27	4	91% - 95%	3% - 4%
9086	5	25	86% - 90%	1% - 2%
9087	18	9	96% - 99%	1% - 2%
9089	10	6		
9093	14	3	91% - 95%	0%
9144	13	0	91% - 95%	0%
9148	45	0		0%
9149	1		86% - 90%	3% - 4%
9152	275	50	91% - 95%	1% - 2%
9157	1370		91% - 95%	1% - 2%
9159			91% - 95%	0%
9161	2	2	91% - 95%	0%
9162	128		91% - 95%	1% - 2%
9165	10	2	86% - 90%	0%
9168	35	10	91% - 95%	0%
9171	16	0	85% or less	1% - 2%
9173	13	7	86% - 90%	0%
9185	87		96% - 99%	0%

Most beneficial technologies and practices

TRS ID	Comment
0002	Paratransit CAD system and mobile data computers
0003	Staff training, daily performance monitoring, feedback to schedulers & dispatchers on performance
0024	
1050	
2008	Automated scheduling software improves efficiency of scheduling; however, we are currently using a DOS based system (PASS).
2080	Implementation in progress
3004	Computerized scheduling
3010	CAD/Auto scheduling
3018	N/A – don't use CAD or other listed technologies
3030	N/A
3034	PASS – Great Software
3067	The application of automated scheduling and AVL technology is in a small scale demonstration phase. Benefits are uncertain and unlikely to be in terms of greater efficiency (i.e. vehicle productivity) but rather in service quality and work force scheduling.
4003	N/A
4004	Midas PT system reports capabilities
4018	Automated scheduling, Automated dispatching
4029	CAD software, scheduling/routing made largest impact for system doing 3000 trips per day.
4035	
4037	Scheduling software
4038	
4040	Routing and Scheduling software and AVL
4046	
4053	
4063	Automated dispatch system "Trapeze"
4074	Automated scheduling
4078	
4110	Computer aided dispatch, radio communication
5010	System has not been installed long enough to determine if there is any increase in efficiency.
5033	
5038	
5048	Automated routing
5094	

Most beneficial technologies and practices (cont.)

TRS ID	Comment
5112	1998 CAD – MOT's requested for 2002 budget
5113	Computerized scheduling and dispatching
5117	Quality software
5155	Auto. Reporting & Auto. Reservations
6008	AVL, PASS Scheduling, Radio CAD
6011	Automated scheduling
6017	Trapeze system used to schedule and dispatch vehicles has worked well. Also have good working relationship with contract drivers.
6022	N/A
6056	Trazpeze version 431, Vehicle business system A.V.L. (Automated vehicle location)
7001	
7010	Computer aided reservations, dispatch, statistics, All.
7015	
9002	
9006	
9015	
9023	Independent taxi drivers and multi–purpose vehicles.
9028	
9029	
9034	Mobile data terminals, computer aided dispatching
9035	Enforcing 10/10 window allows for more shared ride opportunities that increase productivity. The right automation will allow you to increase efficiencies under increased volume. EX: we moved 30% fewer people in July 2000 at a pass/hr rate of 2.44
9036	Automated assist scheduling and routing
9041	
9052	Client trip data & history
9061	
9062	Pending implementation
9078	Nextel radios
9079	Our agency has found that having the automated dispatch and scheduling system is truly much faster than having everything done manually. Printing daily manifests is much easier than having to radio dispatch every single trip.
9086	Teletrac very helpful for adding trips for same day service.

Most beneficial technologies and practices (cont.)

TRS ID	Comment
9087	Performance data collection, Auto. Scheduling Auto. Scheduling assists with identifying most efficient route to assign for trip.
9089	In the process of changing to upgraded PASS windows version.
9093	Computer–aided dispatch has increased ***** per hour
9144	
9148	
9149	None – Still doing it manually. We were a beta site for the SMART card. We dropped the program because of computer errors or failures. (1995-96 time frame)
9152	CAD/AVL system being installed will provide significant **** to ascertain cost erre**vements and where savings should be able to be made.
9157	AVL – since it aids in dispatching, reducing fraud, and allowing complaints/incidents to be researched thoroughly. MDTs/Radios – since our system is so large, it could not be voice dispatched.
9159	Better record keeping. Follow up on no–shows reduced no–shows.
9161	N/A
9162	
9165	Smart card
9168	
9171	Automated Scheduling, Automated Reporting
9173	
9185	

Least beneficial technologies and practices

TRS ID	Comment
0002	AVL – largely due to the fact that we do not yet have a big screen monitor to display the information. Information needs to be readily available.
0003	
0024	
1050	
2008	Automated scheduling software – DOS based PASS system being upgraded to windows software Straapen Systems ADEPT in the next six months.
2080	Implementation in progress
3004	
3010	N/A
3018	N/A – see above
3030	N/A
3034	Most technologies are somewhat an improvement over previous methods.
3067	To date, introduction of automated scheduling has been highly problematic. AVL has been useful, but probably not cost–effective.
4003	N/A
4004	Midas PT scheduling functions
4018	
4029	
4035	
4037	Outdated communication system
4038	
4040	
4046	
4053	
4063	N/A
4074	Automated reporting
4078	
4110	None
5010	Same as above
5033	
5038	
5048	
5094	
5112	

Least beneficial technologies and practices (cont.)

TRS ID	Comment
5113	
5117	
5155	Automated routing
6008	N/A
6011	Automated routing
6017	
6022	N/A
6056	
7001	
7010	
7015	
9002	
9006	
9015	
9023	Dedicated drivers and single use vehicles (cutaways)
9028	
9029	
9034	
9035	Poor customer service skills on the phone undermines EVERTHING – it puts passengers in a combative mode, thereby increasing workloads for all.
9036	
9041	
9052	Reporting breakouts by category
9061	
9062	Pending implementation
9078	Automated dispatching
9079	The automated scheduling system needs to be upgraded because it sometimes doesn't provide the proper times in relation with the travel distances.
9086	N/A
9087	Input of waiting list requests
9089	
9093	Unknown
9144	
9148	
9149	

Least beneficial technologies and practices (cont.)

TRS ID	Comment
9152	New trapeze software has too many bugs and has produced r*l with man & headaches & incon**ted data than previously anticipated.
9157	Automated reporting, since the data is sometimes difficult to interpret, and needs significant auditing.
9159	Automated scheduling does not provide any efficiencies.
9161	N/A
9162	
9165	None
9168	
9171	None
9173	
9185	

Other noteworthy technologies and practices

TRS ID	Comment
0002	Can not think of any
0003	
0024	Easter Seals offers technical assistance to paratransit providers and riders specifying best practices. It's called PROJECT ACTION; and, we have used it with good results.
1050	
2008	Pilot program of AVL with mobile data terminals has proven very reliable and currently being expanded.
2080	Implementation in progress
3004	
3010	
3018	No comment – we don't seem to be very helpful here
3030	N/A
3034	
3067	We plan to demonstrate MDT technology over the coming year.
4003	N/A
4004	Transportation Demand Management (TDM) strategies are used to direct or replace trip demand (i.e. home delivered groceries). Also, user–side subsidy coupons are used for subscription trips. ZIP code coordination of medical trips to the central hospital zone has been accomplished by clinics setting patient appointments according to a ZIP code chart.
4018	
4029	
4035	
4037	None
4038	
4040	Centralized dispatching by the Brokerage
4046	
4053	
4063	We are small but plan to have AVL and Mobile Data Terminals in our buses by December. We have 52 buses doing Fixed Route and Para–transit. We plan to have windows version of the Dispatch software by December.
4074	
4078	We would love to have the funds available to provide beneficial technology.

Other noteworthy technologies and practices (cont.)

TRS ID	Comment
4110	GIS basis for computer aided dispatch must be high quality or software won't work.
5010	
5033	As you can tell, we are a little behind the times in terms of technology.
5038	Beneficial: we are a small 9–bus system; transport 220,000 passengers annually; all vehicles are lift–equipped; we handle ADA calls all day, 7–days per week. We are very personalized; operate mostly van cut–a–way buses; too expensive to use for such a small system. Very good in large. We are cost–effective and very personalized.
5048	
5094	
5112	
5113	
5117	
5155	
6008	We are in the process of procuring a data dispatching system and a new GPS system that will provide automated schedule updating with proximity validation to ensure quality data.
6011	
6017	
6022	N/A
6056	
7001	
7010	
7015	
9002	
9006	
9015	
9023	We are moving to a 100% Taxi System provider. We are moving to eliminate all dedicated drivers and large vehicles from the system.
9028	
9029	
9034	
9035	Last months our pass/hour was 3.01

Other noteworthy technologies and practices (cont.)

TRS ID	Comment
9036	Will be installing and implementing mobile data terminals within the next 18 months. This will allow for 100% real time data in the scheduling software and allow for expanded use of the existing system.
9041	
9052	
9061	
9062	Demand studies: by hour of day, day of week, ...
9078	Incentives and disincentives were time consuming; and, found that when year was finished the incentives and disincentives were almost a wash.
9079	Our agency has put in place a group trip service that allows us to transport more people with the same amount of vehicles. Offering disounted fares to groups from one common pick–up point to one drop–off location certainly provides efficiencies and boosts our ridership numbers.
9086	N/A
9087	Customer real time viewing of schedules on internet.
9089	
9093	Unknown/none
9144	
9148	
9149	
9152	
9157	N/A
9159	
9161	We have a small paratransit system. We utilize a regionwide eligibility database and dispatch vehicles via radio.
9162	
9165	
9168	
9171	
9173	
9185	