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Since the enactment of the Americans with with Disabilities Act, in 1991, 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 67 large transit agencies. We evaluate the impact of implemented technologies and practices upon productivity and operating cost.

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INSTITUTE OF TRANSPORTATION STUDIES
UNIVERSITY OF CALIFORNIA, BERKELEY

Factors Influencing Productivity and Operating Cost of Demand Responsive Transit

Kurt Palmer, Maged Dessouky, Zhiqiang Zhou

California PATH Research Report
UCB-ITS-PRR-2008-20

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CALIFORNIA PARTNERS FOR ADVANCED TRANSIT AND HIGHWAYS

Factors Influencing Productivity and Operating Cost of Demand Responsive Transit

Final Project Report

Kurt Palmer
Maged Dessouky
Zhiqiang Zhou

Daniel J. Epstein Department of
Industrial and Systems Engineering
University of Southern California
Los Angeles, California 90089-0193

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Contents

Abstract **iv**

Executive Summary **v**

1 Introduction **1**

2 The Implementation Survey **4**
2.1 Design of the Survey 4
2.2 Summary of Survey Responses 7

3 Relationships between Operations and Performance **14**
3.1 The Performance Data 14
3.2 Operations Variables 16
3.3 Analysis Results 21

4 Conclusions **29**

5 Acknowledgement **31**

A Surveyed Agencies **33**

B Survey Form **39**

C Responding Agencies **43**

D Raw Survey Data **46**

List of Figures

1 Clusters of Surveyed Agencies 6
2 Operational Characteristics of Responding Agencies 10
3 Limits of the On–Time Window 12
4 Time in Advance that Routes are Planned 14

List of Tables

1 Responses by Segment 7
2 Operational Characteristics of Responding Agencies 8
3 Management Practices Implemented by Responding Agencies 9
4 Performance Measures Linked to Financial Clauses 11
5 Advanced Technologies Implemented by Responding Agencies 12
6 Use of Paratransit CAD systems 13
7 Operations Variables, Part 1 18
8 Operations Variables, Part 2 19
9 Operations Variables, Part 3 20
10 Passenger Miles per Vehicle Regression Results 21
11 Passenger Miles per Vehicle Regression Results 22
12 Passenger Trips per Vehicle Regression Results 25
13 Passenger Trips per Vehicle Regression Results 25
14 Average Operating Cost Regression Results 28
15 Average Operating Cost Regression Results 28

Abstract

Since the enactment of the Americans with with Disabilities Act, in 1991, 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 67 large 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 operational characteristics, management practices, and implementations of advanced technologies for 67 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 1997-2002 National Transit Database (NTD).

Our analysis indicates that use of a Paratransit CAD system to group service requests into vehicle routes provides a productivity benefit of approximately 12,000 passenger miles per vehicle, and 1,100 trips 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.

The practice of manually revising routes during the time of service produces a detrimental impact on productivity of approximately 1,800 trips per vehicle annually. Policy makers should insist on some form of computational assistance for dispatchers, so that system–wide impacts of route revisions can be evaluated correctly in real time.

No–shows are identified as having a beneficial impact on productivity of approximately 10,500 passenger miles per vehicle annually. This is a misleading result that is produced by a deficiency in the Passenger Miles per Vehicle performance measure. Agencies should not attempt to increase their no–show rates. There is a need to identify more reliable measures of productivity that can be readily estimated.

The use of financial penalties was found to have benefical impacts on productivity and operating cost. This result is in conflict with the results of our previous study. We note that there are few agencies in common between the responders to the two surveys and attribute this apparent flip–flop in results to an as yet unidentified distinction between the two survey groups.

The portion of productivity performance variability explained by surveyed variables has increased substantially from the 10% level of the previous study. However, we stand at only about 40% of the productivity variability explained. The search to identify important variables related to operating cost has been less successful. Only about 10% of operating cost variability is explained, compared to about 5% previously. There is a need for further research to identify characteristics

that determine performance. The recently announced request for proposals to the Transit Cooperative Research Program Project B-31, FY 2005, "Guidebook for Measuring, Assessing, and Improving Performance of Demand–Response Transportation", calls for research to identify both reliable metrics of performance and factors that affect performance of DRT systems.

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 81.8 million passenger trips in 2003. Over the same period, the annual operating expense for DRT has gone from less than 3% to more than 7% of the total for public transportation services nationally, becoming a $1.7 billion industry in 2003 (Federal Transit Administration 2003).

In the last fourteen years, many advanced technologies have been proposed to improve the performance of DRT systems, some have achieved substantial levels of implementation. The use of Advanced Communications systems has expanded to 45% of agencies that operate in the 78 largest metropolitan areas of the country (Volpe National Transportation Systems Center 2002). Paratransit Computer Aided Dispatching (CAD) systems are used by 34% of the agencies and Automated Vehicle Location systems are used by 28% of the agencies. (Our results show much higher percentages, see Table 5, probably due to the passage of 3 additional years.) Implementations of other Advanced Public Transportation Systems (APTS) technologies are less widespread. In addition to technological implementations, a variety of management practices such as type of service, use of financial penalties/incentives for performance, and use of ridesharing have been implemented as methods to influence productivity and operating costs.

There have been studies that investigate the impact of APTS on service productivity and cost. Computers and advanced algorithms were offered to improve the dispatching and scheduling of paratransit systems (Stone, Nalevanko, and Gilbert 1994). A study sponsored by the U. S. Department of Transportation quantified expected benefits of APTS based on future forecasts (Goeddel 1996). A survey of paratransit customers in southeastern Michigan concluded that APTS has ample potential to increase customer satisfaction when reserving a trip (Wallace 1997). A study in Santa Clara County, California, reported the productivity gains realized by of use of APTS technology (Chira–Chavala and Venter 1997). The implementation of Automatic Vehicle Location (AVL) and advanced scheduling was credited as the primary factor in increasing efficiency

by 10.3% for Houston's METROLift Service (Higgins, Laughlin, and Turnbell 2000).

The potential and actual impact of management practices on DRT productivity and operating costs have also been reported. 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, each of these studies is limited by the fact that the evidence for the effectiveness of the technologies and practices considered is based either upon projections of future performance or observations of actual performance for a small number of agencies.

Under a grant from PATH (Dessouky, Palmer, and Abdelmaguid 2003; Palmer, Dessouky, and Abdelmaguid 2004), we conducted a nationwide benchmarking study involving an analysis of data from 62 transit agencies serving large and medium sized urban areas. Our intent was to evaluate the impact of several advanced technologies and management practices upon the productivity and operating cost of DRT systems. The advanced technologies that we considered included advanced communications, automated vehicle location, automated fare payment, automated transit information, and paratransit CAD systems. The management practices that we considered included financial incentives, financial penalties, ridesharing, agency administration, contracted administration, agency service delivery, contracted service delivery, and consumer choice.

We 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 indicated that use of a Paratransit CAD system provides a productivity benefit of approximately 12000 passenger miles per vehicle annually. Agency Service Delivery was also found to have a beneficial impact on productivity of approximately 1300 passenger trips per vehicle annually. 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. The use of Financial Incentives was found to have a detrimental impact on productivity of approximately 7000 passenger miles per vehicle annually. The use of Financial Penalties was found to have a detrimental impact on operating cost of approximately $2.00 per passenger trip.

The results of our previous study regarding the use of Paratransit CAD systems, and Financial Penalty and Incentive clauses, raised questions about the details of their use. In the case of Paratransit CAD systems, there are many operational functions that agencies might support or replace with this technology. In the case of Financial Penalty and Incentive clauses, the conditions that trigger activation of the clauses are unknown. In this report, we present the results of a new survey on advanced technology and management practice implementations. We received responses from 67 transit agencies that serve large and medium sized urban areas located throughout the United States. The responses provide a more detailed description of how CAD systems and financial clauses are used than has previously been available.

Among the agencies that participated in the previous study, 24 reported at least one new technology/practice implementation during the three-year period, 16 of those in 1999. As these implementations mature, their impact upon performance will become more evident. At the inception of the current study, data from the 2000-2002 NTD had become available. We combine the implementation information from our new survey with performance data from 1997-2002 to present an updated analysis of the relationships between technologies/practices and performance.

While each of the relationships identified in our previous study is statistically significant, they collectively explain only a small fraction of the observed variation in the performance measures. The list of technologies/practices that we considered in our previous work was selected through a review of the existing literature and our own knowledge of transit systems. In order to expand the list of factors under consideration, our new survey solicited the experience and expertise of transit agency personnel to identify factors not previously considered that may be explanatory of DRT system performance. Our updated performance analysis includes these newly identified factors; and consequently, we have been able to explain a substantially greater fraction of the observed variation than previously was the case.

The remainder of the report is organized in the following way. In Section 2, we describe the survey itself and summarize the responses received. In Section 3, we present the analysis relationships between operations variables derived from the survey and the performance data from the NTD. In Section 4, we summarize our conclusions from the analysis.

2 The Implementation Survey

Data regarding the performance of DRT systems is available online from the NTD. The 2002 NTD lists 423 transit agencies that report providing a DRT service to their constituents. Of these agencies, 192 serve urban areas with a population of 200,000 or more. As in our previous study (Dessouky, Palmer, and Abdelmaguid 2003; Palmer, Dessouky, and Abdelmaguid 2004), we choose to focus on this group of 192 agencies for our survey because they provide the vast majority of DRT service. A list of the agencies surveyed appears in Appendix A.

2.1 Design of the Survey

The implementation survey had three objectives: (1) to obtain information regarding the state of implementation of advanced technologies and management practices, (2) to gather information about how CAD technology and financial clauses in service contracts are used, and (3) to gather information about other factors that might influence productivity and operating cost. We decided that closed format questions (multiple choice and fill–in the blank) would be most useful to keep the survey form short and facilitate the process of encoding responses for analysis. Even so, we wanted to access the experience of transit agency representatives in identifying factors that were not previously investigated by others or ourselves. To achieve this end, we decided to conduct interviews with a small number of agency representatives, as a means of brainstorming for questions to be included in the survey.

Interviews with representatives of Access Services, Inc. (Los Angeles, CA) and the Metropolitan Transit Authority of Harris County (Houston, TX) were conducted separately during the summer of 2004. The interview with Access Services was performed at their operations office. The interview with MTA of Harris County was performed by telephone. Attempts were made to interview a diverse group of agencies who had responded to our previous survey. We sent requests for interviews to five other agencies; but, we did not receive a response from them.

The interviews typically included a discussion of the procedures used to book a trip request, to schedule routes for the vehicles, and to service the requested trips. Follow–up questions delved into methods of handling schedule revisions and relationships with contractors. Confirmation of the current state of technology and management practice implementation was sought. Finally,

open–ended questions were asked about any operational characteristics that experience indicated would have impact on productivity and operating cost.

Copious notes of the agency representatives' comments were taken during the interview sessions. These notes were reviewed afterwards to identify common themes in methodology used by the agencies and key characteristics that might be determinative of performance. The information gleened through these reviews became the basis for development of the new survey, which appears in the Appendix B.

The initial distribution of the survey was conducted via the U. S. Postal Service. Survey forms were mailed during the third week of February 2005 and agencies were requested to reply to the survey by March 11, 2005. Follow–up contact with non–responsive agencies was conducted via electronic mail. By the end of April 2005, we had received responses from 67 agencies.

Because self–selecting respondents can produce biased survey results, we decided to segment the surveyed agencies according to industry demographic variables and focus 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. We use data from the 2002 NTD to estimate these quantities.

Figure 1 shows the results of a cluster analysis for the surveyed agencies' demographic variables. We performed a similar analysis for our previous study (Dessouky, Palmer, and Abdelmaguid 2003; Palmer, Dessouky, and Abdelmaguid 2004). In that case, the clusters were formed using the average linkage method of agglomerative hierarchical clustering (Massart and Kaufman 1983, SAS Institute 1988). For this analysis, we wanted to retain clusters with similar average characteristics to those identified before. Consequently, the list of surveyed agencies was divided into those who had been surveyed before and those who were newly listed. If an agency appeared on the list before, and its demographic characteristics remained similar to before, its cluster assignment was retained. The agencies with retained assignments were then used to calculate the average Population Density and Trips per Capita (the centroid coordinates) for each cluster. Newly listed agencies, and agencies with substantially changed characteristics, were assigned to the cluster

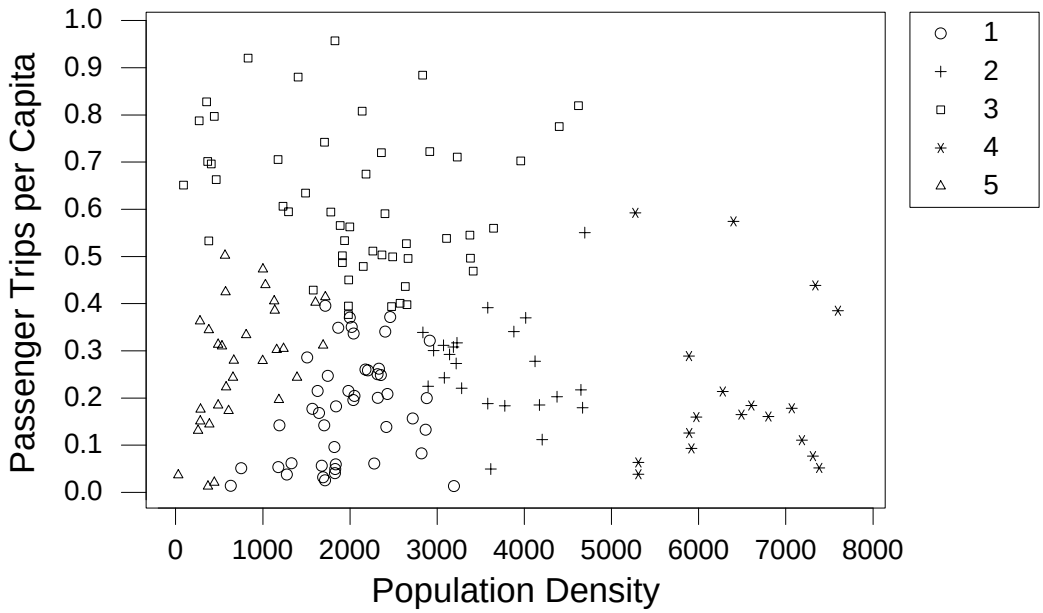

Figure 1: Clusters of Surveyed Agencies

whose centroid was closest. A Euclidian distance based upon values of the demographic variables that had been scaled by their respective standard deviation was used for the evaluation.

As in the previous study, there is a group of some 18 agencies that are considered outliers for the cluster analysis: 11 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. These 18 outliers are not represented in Figure 1, but are used throughout the rest of the current study. On the other hand, it was discovered that there is a group of 6 agencies among those surveyed that do not show reported values for the performance measures to be evaluated below, nor can they be tied via a contractual relationship to an agency that does report performance data. These 6 agencies (TRS ID: 1102, 4034, 9003, 9014, 9015, 9129) were removed from further consideration.

Table 1 shows the number of surveyed agencies in each of the demographic segments. Our goal for the survey was to achieve a 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. A list of the responding agencies appears in Appendix C.

2.2 Summary of Survey Responses

In the first portion of the survey, we asked agencies to provide information about a series of operational characteristics. Most of these questions regarded policies and procedures that are general to the DRT service. Table 2 summarizes the responses to the yes/no and multiple choice questions in this portion of the survey. It is noteworthy that among the 49 agencies that indicate they send a letter to customers who produce no–shows, 18 agencies also indicate that there is a possibility of suspension of service for customers that produce frequent no–shows. Among the 10 agencies that indicate customers are impacted in some way other than a phone call or letter, 7 agencies employ a suspension policy and 3 agencies assess fees.

Six of the questions in the operational characteristics portion of the survey requested numerical information. Histograms of the responses to these questions are shown in Figure 2. Agencies that indicate they use zones within their service area to restrict pick–up locations for providers were asked to also indicate how many zones are used, Figure 2 (a). Among the 65 agencies that accept advanced reservations, 3 agencies did not indicate the longest notice for which a reservation would be accepted. The most common answers among the 62 agencies that did respond are 7 days and 14 days, Figure 2 (b). Among the 29 agencies that accept same–day reservations, 8 did not indicate the shortest notice for which a reservation would be accepted. The most common answer among the 21 agencies that did respond was a time less than 1 hour, Figure 2 (c). The most common responses to the question regarding percentage of requests that are handled by directly operated vehicles are 'none' and 'all' (6 agencies did not respond), Figure 2 (d). For the 56 agencies that responded to the question regarding percentage of requests that are cancelled, the mean is 11% and the standard deviation is 6.8%, Figure 2 (e). Finally, for the 57 agencies that responded to the question regarding percentatge of requests that produce no–shows, the mean is 4.3% and the

Table 1: Responses by Segment

Segment	Surveyed	Responses
Cluster 1	45	20
Cluster 2	23	8
Cluster 3	51	16
Cluster 4	18	6
Cluster 5	31	12
Outliers	18	5

Table 2: Operational Characteristics of Responding Agencies

Yes/No Questions —	Yes	No	N/A
Is your service area divided into zones that limit where a particular provider may pick–up a customer?	12	54	1
Is scheduling coordinated across the zones?	10	2	55
Do you accept standing reservations?	58	8	1
Do you accept advanced reservations?	65	2	0
Do you handle same–day requests?	29	36	2
Do you accept requests for travel outside the boundaries of the local fixed–route bus service?	41	23	3
Multiple Choice Questions —			
On what basis are contractors paid?			
Service requests only	8		
Service hours only	24		
Service mileage only	4		
Requests and Hours	3		
Requests and Mileage	1		
Hours and Mileage	5		
All	1		
Other	2		
N/A	19		
Are drivers considered employees or independent contractors?			
Employees	30		
Independent Contractors	23		
Both	12		
N/A	2		
How are customers impacted when they produce no–shows?			
No impact	4		
Phone call	3		
Letter	41		
Phone call and Letter	8		
Other	10		
N/A	1		

Table 3: Management Practices Implemented by Responding Agencies

			Before	Year Implemented						After
	No	Yes	1997	1997	1998	1999	2000	2001	2002	2002
Financial Penalties	33	34	22	1	0	2	2	2	2	3
Financial Incentives	44	23	12	0	0	0	1	3	3	4
Ridesharing	27	40	38	0	0	1	0	0	0	1
Agency Administration	9	58	47	5	1	1	3	1	0	0
Contracted Administration	39	28	26	0	0	1	1	0	0	0
Consumer Choice	61	6	3	0	0	1	1	0	0	1

standard deviation is 4.3%, Figure 2 (f).

There is one question in the operational characteristics portion of the survey that asked the agency to describe how reservations for return travel are dealt with when the outbound reservation produces a no–show. Among the 54 agencies that responded to the question, 20 indicate that they cancel the return trip, 25 indicate that they keep the return trip on the schedule, 7 indicate that they contact the customer, and 2 indicate that they take some other action.

In the second portion of the survey, we asked agencies to provide information about their management practices. The initial set of questions asked about whether or not the agency uses any of six specific practices. If an agency does use one or more of the practices, we also asked them to indicate the year that each practice was first implemented. This information is summarized in Table 3. In the table, we concentrate on implementation years corresponding to the performance data that we have from the NTD. This information will be useful below, when we identify relationships between implementation and performance.

Besides the initial set of questions, we also asked a series of questions designed to delve more deeply into the use of financial penalty and incentive clauses in contracts with service providers. Two of these questions asked agencies to indicate the performance measures that are linked to penalties and incentives. Four specific measures (on–time pick–ups, productivity, customer complaints, and driver turnover) were offered to the agencies as multiple choice selections. The agencies were then asked to list any additional measures that they use. Their responses are summarized in Table 4. The table shows the number of agencies that use any of the four specific measures as their sole performance measure. The table also shows the number of agencies that use just one of the specific measures along with other measures not specifically offered. The most commonly listed

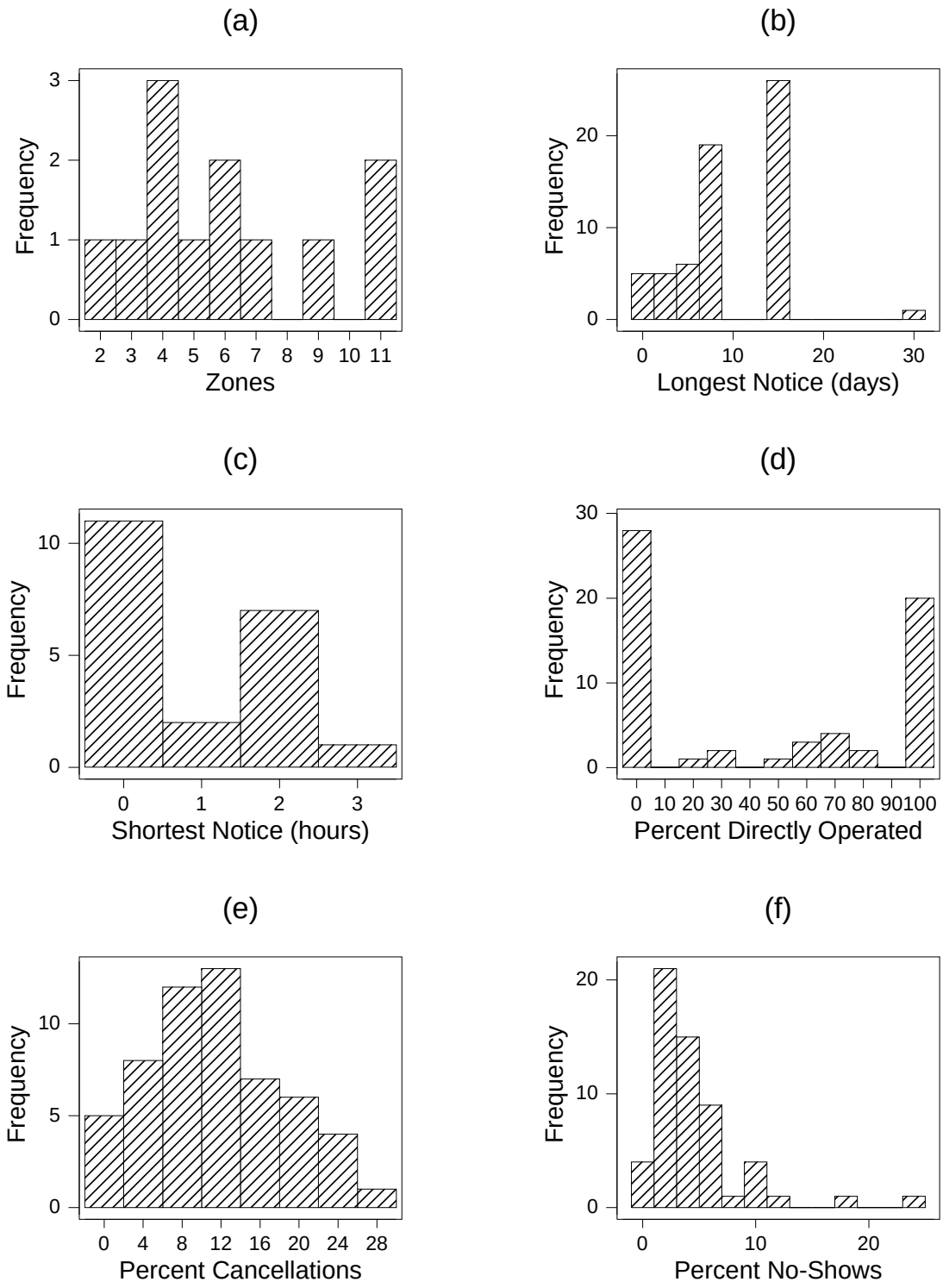

Figure 2: Operational Characteristics of Responding Agencies

Table 4: Performance Measures Linked to Financial Clauses

	Penalties		Incentives	
	w/o Other	with Other	w/o Other	with Other
1) On–time pick–ups	4	2	1	2
2) Productivity	3	0	3	0
3) Customer complaints	1	1	1	2
4) Driver turnover	1	0	0	0
(1) and (2)	3	1	1	2
(1) and (3)	5	2	0	1
(1) and (4)	1	0	0	0
(1), (2), and (3)	1	2	1	3
(1), (2), and (4)	0	1	0	1
Other only	2		2	
N/A	4		3	

other measures that agencies use include: no–show rates, vehicle maintenance history, accident history, and telephone response time. Lastly, the table shows the number of agencies that use combinations of the specific measures, either as the sole measures or in combination with other measures not specifically offered.

We also asked the agencies how often they assess penalties or award incentives. Among the 34 agencies that indicate they use financial penalties, 18 agencies assess the penalties monthly and 12 agencies did not respond. Among the 23 agencies that indicate use of financial inventives, 11 agencies award the incentives monthly and 8 agencies did not respond.

Our final question in the management practices portion of the survey asked agencies to give their definitions of the on–time window. Table 4 shows that 22 of 34 agencies use on–time pick–ups as one of the performance measures linked to financial penalties, and 12 of 23 agencies link on–time pick–ups to financial incentives. Figure 3 shows histograms of the responses for the limits of the on–time window. For the 59 agencies that indicate an earliest arrival time before the requested pick–up, half of the agencies use 15 minutes and most of the others use a shorter time, Figure 3 (a). For the 64 agencies that indicate a latest arrival time after the requested pick–up, half of the agencies use 15 minutes and most of the others use either 20 or 30 minutes, Figure 3 (b).

In the third and last portion of the survey, we asked agencies to provide information about their use of advanced technologies. The initial set of questions asked whether or not the agency uses any of five specific technologies. Here again, if the agency indicates usage of a technology,

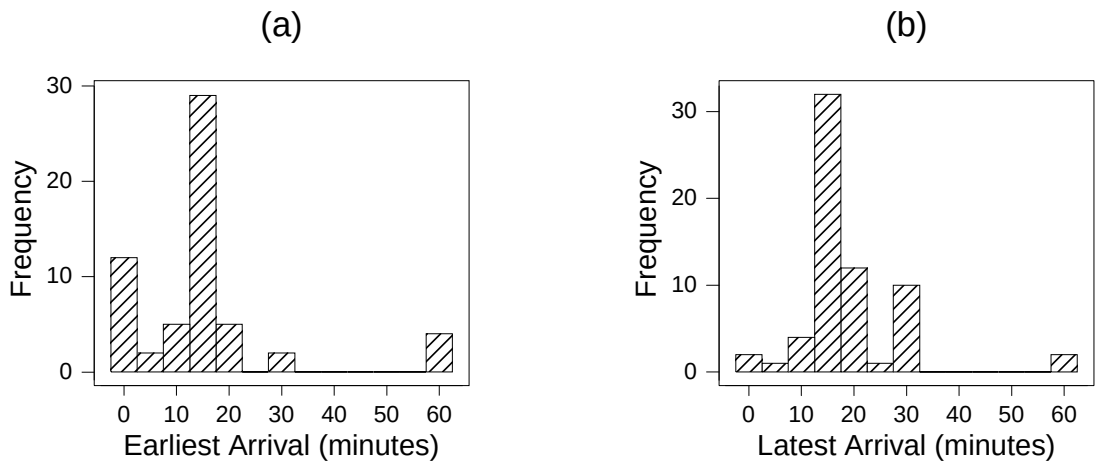

Figure 3: Limits of the On–Time Window

Table 5: Advanced Technologies Implemented by Responding Agencies

			Before	Year Implemented						After
	No	Yes	1997	1997	1998	1999	2000	2001	2002	2002
Advanced Communications	21	46	28	3	1	3	2	7	0	2
Automated Vehicle Location	37	30	5	0	0	3	3	10	1	8
Automated Fare Payment	61	6	0	0	0	0	1	3	0	2
Automated Transit Information	59	8	0	0	1	0	0	2	0	5
Paratransit CAD System	13	54	25	2	3	4	6	9	0	5

we also asked them to indicate the year of implementation. This information is summarized in Table 5.

We also asked a series of questions regarding details of the use of CAD systems. The agencies' responses are summarized in Table 6. With regard to the period of time over which a route is planned, beyond the given options of full–day or half–day, agencies plan for full shifts or build routes in real–time. With regard to the number of requests given to a driver, agencies not using full–day or half–day will give a 1-2 hours or less than 5 trips. The amount of requests communicated is sometimes limited by the display capability of a mobile data terminal.

Last of all, we asked "How long in advance are routes planned?". Figure 4 shows a histogram of the responses. Among the 45 agencies that responded, more than half plan 1 day in advance.

Table 6: Use of Paratransit CAD systems

How are service requests grouped into routes for each vehicle?	
Manually	11
Automatically, using CAD	39
Both	15
N/A	2
If routes are created automatically, does dispatch staff revise the routes manually before use?	
Yes	49
No	5
How are routes revised during the time of use?	
Manually	42
Automatically, using CAD	9
Both	10
Other	1
N/A	5
Over what period of time is a route planned to occur?	
Full-day	47
Half–day	5
Both	7
Other	4
N/A	4
What is the amount of requests given to a driver at one time?	
Full-day	49
Half–day	2
One–at–a–time	0
Other	14
N/A	2

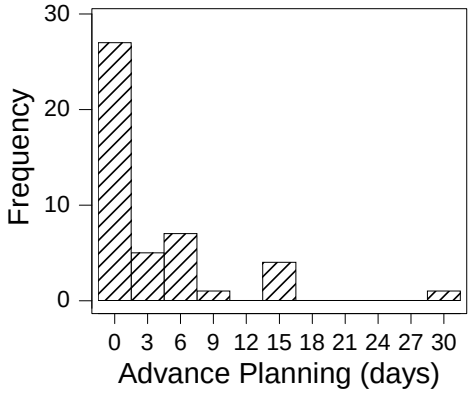

Figure 4: Time in Advance that Routes are Planned

3 Relationships between Operations and Performance

The survey responses from each agency provide a description of the operations of their DRT service. The National Transit Database (NTD) provides data that can be used to describe the performance of each agency's DRT service. We use regression models to identify relationships between the operations and the performance. The first step of the analysis is selection of the performance measures.

3.1 The Performance Data

In our previous work (Dessouky, Palmer, and Abdelmaguid 2003; Palmer, Dessouky, and Abdelmaguid 2004), we used the following performance measures

- Passenger Miles per Vehicle, $PassMil/Veh$
- Passenger Trips per Vehicle, $Trip/Veh$
- Operating Expense per Passenger Trip, $OpExp/Trip$
- Operating Expense per Passenger Mile, $OpExp/PassMil$

These performance measures are constructed from data available for each agency in the annual NTD. Passenger miles are the total of distances traveled by each passenger. Passenger trips are the total of unlinked trips made by each passenger. The number of vehicles is the number reported as the maximum actually operated to provide service on an average weekday. Operating expense is the total of contracts for purchased transportation and expenses for directly operated DRT services.

The performance measures above were selected to represent the characterisitcs of productivity and opeating cost. Productivity is defined as output per unit input. Both output and input can be measured either in monetary or non–monetary terms. Traditional measures of productivity, such as economic value of services provided per labor hour, are inconvenient to use in this case because the economic value of DRT services is neither commonly reported nor easily estimated. The National Transit Summaries and Trends (NTST) report (Federal Transit Administration 2003) uses revenue hours as a non–monetary measure of output. The NTST report also offers passenger miles and passenger trips as examples of non–monetary measures of consumption. The distinction between consumption and output is a recognition that some output is not used by the customers.

For our measures of productivity, we prefer to focus on the utilized portion of output, measured by passenger miles and passenger trips. Since we are examining operating cost as a separate perfomance characteristic, we choose to use number of vehicles as a non–monetary measure of input. For our measures of operating cost, it is appropriate to use cost per unit output so that services of varying scale may be compared. It should also be noted that, in our analysis, operating expenses have been inflation adjusted to constant 1999 dollars.

Ideally, each measure should represent an independent performance characteristic. To investigate this issue for the measures described above, a principal components analysis (Johnson and Wichern 1992) was performed separately for each year of NTD data (1997 through 2002). Data for all agencies in the survey group was used. The six analyses produced consistent results. The results reveal that these measures are most naturally arranged into two groupings. The first group, consisting of $PassMil/Veh$ and $Trip/Veh$, represents one characteristic that we interpret to be productivity. The second group, consisting of $OpExp/PassMil$ and $OpExp/Trip$, represents another characteristic that we interpret to be operating cost. However, these two characterisitcs are not independent. They have a weak negative correlation with each other. Agencies that have high

productivity also tend to have low operating cost, and visa versa.

The two measures within each grouping are positively correlated. The strongest positive correlation is that between $OpExp/PassMil$ and $OpExp/Trip$. Since we could devise no individual interpretation for these measures, nor a reason to prefer one over the other, we chose to define an Average Operating Cost (AOC) measure, see Equation 1 for an example based on the 2002 data. The AOC is formulated as the mean of the scaled performance measures. The values \$20.630 and \$10.073 are the mean and standard deviation of $OpExp/Trip$ for the 186 agencies surveyed. The values \$2.6126/mile and \$1.1854/mile are the mean and standard deviation of $OpExp/PassMil$.

$$AOC \equiv \left(\frac{OpExp/Trip - 20.630}{10.073} + \frac{OpExp/PassMil - 2.6126}{1.1854} \right) \div 2 \tag{1}$$

We interpret $PassMil/Veh$ as being related to the portion of miles traveled by the vehicle that is productive. We refer to this characteristic as mileage productivity. We interpret $Trip/Veh$ as being related to the number of passengers travelling simultaneously in the vehicle. We refer to this characteristic as people loading productivity. While the interpretation of these measures is 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 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.

Having selected the performance measures, the next step is to define the operatons variables that are derived from the survey responses.

3.2 Operations Variables

A total of 28 operations variables have been defined to represent the responses given in the survey. Most of the operations variables, 24 in all, are defined as indicator variables. For each of these, the value 1 indicates that the characteristic in question is used and the value 0 indicates that the characteristic is not in use. The four remaining operations variables are defined as continuous

values. Two of these are times expressed in days or minutes, respectively. The final two variables are percentages, actually proportions expressed as a value between 0 and 1. Tables 7, 8, and 9 show the list of operations variables.

Two of the indicator variables, Directly Operated and Purchased Transport., are used to encode the answers to the survey question regarding the percentage of service requests handled by directly operated vehicles. As Figure 2 (d) shows, 19 of the agencies have 100% directly operated (Directly Operated = 1, Purchased Transport. = 0), 28 agencies have 0% directly operated (Directly Operated = 0, Purchased Transport. = 1), and only 15 agencies have an intermediate result (5 agencies did not provide an answer). Given these results, the use of a continuous variable is unnecessary. Two indicators are used so that agencies having percentages between 0 and 100 may be represented appropriately. These indicators can also be verified by comparison to the NTD.

A concern regarding the creation of operations variables was that each of the indicators should offer a good split between the two outcomes. If an overwhelming majority of the responding agencies failed to display a particular characteristic, it would not be possible to evaluate the performance impact of the characteristic because there would be too little evidence of the performance in the presence of the characteristic. A similar problem would occur if an overwhelming majority of agencies displayed the characteristic. There would be too little evidence of the performance in the absence of the characterstic. Each of the indicators shown in Tables 7 and 8 has at least 8 agencies represented in each outcome.

Some characteristics that were investigated in the survey did not produce enough agencies that displayed the characteristic to warrant an operational variable for the characteristic. The Consumer Choice management practice had only 5 responding agencies who had implemented the practice during the 1997-2002 performance window, see Table 3. The Automated Fare Payment technology was only implemented by 4 agencies and the Automated Transit Information technology was only implemented by 3 agencies, see Table 5.

A second concern about the operations variables was that they should be nearly independent of each other. If a large portion of the responding agencies display two characteristics concurrently, then it is not possible to separate the impacts of the two on performance via the regression techniques that we use. A correlation analysis (Draper and Smith 1981) of the operations variables was performed to identify any characteristics that tend to be concurrently displayed.

Table 7: Operations Variables, Part 1

Variable	Question/Measure
Indicator Variables	
Zones	Is your service area divided into zones that limit where a particular provider may pick–up a customer?
Standing Reservation	Do you accept standing reservations?
Same Day	Do you handle same–day requests?
Outside	Do you accept requests for travel outside the boundaries of the local fixed–route bus service?
Directly Operated	What percentage of service requests does your agency handle by directly operated vehicle?
Purchased Transport.	What percentage of service requests does your agency handle by directly operated vehicle?
Service Requests	On what basis are contracted providers paid? – service requests
Service Hours	On what basis are contracted providers paid? – service hours
Service Mileage	On what basis are contracted providers paid? – service mileage
Financial Incentives	Payments to contractors, in addition to the base fee, that are contingent upon service performance results
Ridesharing	A vehicle simultaneously serves trip requests from more than one customer by use of a carpooling strategy
Agency Admin.	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 Admin.	The agency named on the survey contracts another organization(s), most likely a private operator, to perform the functions listed above

Table 8: Operations Variables, Part 2

Variable	Question/Measure
Indicator Variables (cont.)	
On–time	What performance measures does your agency link to financial penalties? – on–time pick–ups
Productivity	What performance measures does your agency link to financial penalties? – productivity
Complaints	What performance measures does your agency link to financial penalties? – customer complaints
Other	What performance measures does your agency link to financial penalties? – other
Adv. Communications	A digital radio or wireless personal communication system used to transmit voice and/or data between the vehicle and the dispatch center
Auto. 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
Auto. Grouped	How are service requests grouped into routes for each vehicle? – automatically, by using a CAD software
Manual Grouped	How are service requests grouped into routes for each vehicle? – manually
Auto. Revised	How are routes revised during the time of use? – automatically, by using a CAD software
Manual Revised	How are routes revised during the time of use? – manually
Planning Period	Over what period of time is a route planned to occur? – full–day

Table 9: Operations Variables, Part 3

Variable	Question/Measure
Continuous Variables	
Longest Notice	Longest number of days advanced notice that a customer may request a pick–up
%Cancelled	Percentage of service requests that customers cancel after routes are planned
%No–shows	Percentage of service requests that customers fail to show for the pick–up
Latest Arrival	Latest arrival time after requested pick–up that is considered on–time, in minutes

The correlation analysis revealed that Financial Incentives are concurrent with the On–time, Complaints, and Other indicators. These indicators represent performance measures that are linked to financial penalties. All agencies that implement financial incentives also implement 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. The On–time indicator is also correlated with the Productivity and Complaints indicators. See Table 4 for a detailed description of the concurrent usage of these measures.

There is a relationship between the use of Automated Vehicle Location technology and the practice of Manually Grouping service requests into routes. Agencies that have AVL technology do not use manual grouping. As a result, it is not possible for us to determine the impact of using manual grouping in the presence of AVL technology.

A final issue connected to operations variables is the timing of management practice and technology implementations. If a 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, if a practice/technology was implemented within the 1997-2002 time frame, the performance measures for the year of implementation were removed from the analysis. Tables 3 and 5 show the amount of data loss for this cause.

Table 10: Passenger Miles per Vehicle Regression Results

y: $(ScaledMiles + 3)^{0.75}$

	1997		1998		1999	
Term	Coeff. Est.	p–value	Coeff. Est.	p–value	Coeff. Est.	p–value
Auto. Grouped	0.35	0.035	0.35	0.033	0.62	0.000
%No–shows	—	—	—	—	5.37	0.013
Complaints	—	—	0.60	0.001	—	—
Productivity	—	—	0.37	0.022	—	—
Other	—	—	0.33	0.017	0.35	0.006
%Cancelled	2.11	0.019	—	—	—	—
Zones	−0.33	0.033	—	—	—	—
R–sq(adj)	28%		37%		40%	

3.3 Analysis Results

We began by analyzing relationships to the $PassMil/Veh$ productivity measure. Linear regression techniques were used to evaluate the statistical significance of the relationships between $PassMil/Veh$ and the operations variables. The first step was to scale the measure using its mean and standard deviation, see Equation 2 for the 2002 data example. A Box–Cox power transformation (Draper and Smith 1981, Myers and Montgomery 1995) was applied to the scaled measure to improve the normality of the regression residuals. 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 ($\lambda = 0.75$) 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. Tables 10 and 11 show the results of the regression analysis. The tables show all model terms found significant at the 4% level. Since the purpose of these models is to identify statistically significant relationships between $PassMil/Veh$ and the operations variables, the intercept estimates are omitted from the tables.

$$ScaledMiles = \frac{PassMil/Veh - 38455}{18834} \tag{2}$$

The most consistent relationship to $PassMil/Veh$ is with the use of Paratransit CAD technology to automatically group trip requests into routes. This relationship is observed in all years except 2001. The sense of the relationship is positive. Agencies that Auto. Grouped have a greater

Table 11: Passenger Miles per Vehicle Regression Results

y: $(ScaledMiles + 3)^{0.75}$

	2000		2001		2002	
Term	Coeff. Est.	p–value	Coeff. Est.	p–value	Coeff. Est.	p–value
Auto. Grouped	0.83	0.004	—	—	0.45	0.009
Manual Revised	—	—	−1.11	0.000	—	—
%No–shows	16.50	0.000	7.28	0.004	4.85	0.001
Productivity	—	—	0.59	0.002	—	—
Other	—	—	—	—	0.41	0.004
Service Mileage	—	—	−0.40	0.025	—	—
R–sq(adj)	39%		66%		36%	

$PassMil/Veh$ value than agencies that do not. For the 1997 data, responding agencies that Auto. Grouped had a mean $PassMil/Veh$ value of 37200 miles/vehicle, while the responding agencies that had not Auto. Grouped technology had a mean value of 27700 miles/vehicle. For 1998, the mean values are 37500 miles/vehicle for Auto. Grouped versus 27600 miles/vehicle for not Auto. Grouped. For 1999, the mean values are 40200 miles/vehicle for Auto. Grouped versus 24500 miles/vehicle for not Auto. Grouped. For 2000, the mean values are 38900 miles/vehicle for Auto. Grouped versus 23500 miles/vehicle for not Auto. Grouped. Finally, for 2002, the mean values are 38100 miles/vehicle for Auto. Grouped versus 31100 miles/vehicle for not Auto. Grouped. The results for 1998 and 1999 are consistent with our previous study. We found no significant terms in the previous study's 1997 data. These results confirm that the use of CAD systems for route creation is beneficial.

The second most consistent relationship to $PassMil/Veh$ is that of %No–shows. This relationship appears in 1999-2002. The sense of the relationship is positive. Agencies with relatively high no–show rates have a greater $PassMil/Veh$ value than agencies with relatively low no–show rates. For the 1999 data, the difference between an agency with 2% no–shows and an agency with 6% no–shows is 6700 miles/vehicle. For 2000, the difference between 2% no–shows and 6% no-shows is 18800 miles/vehicle. For 2001, the difference is 10400 miles/vehicle; and, for 2002, the difference is 5800 miles/vehicle. We interpret the seemingly beneficial impact of no–shows on this performance measure to be a result of the additional mileage that a would–be ridesharing passenger travels when the vehicle attempts to service a no–show request. It is an imperfection in

the formulation of the productivity measure that produces this regression result. Agencies should not attempt to increase their no–show rates.

In 1998, 1999, 2001, and 2002 relationships to Complaints, Productivity, and Other are observed. These variables all indicate the use of financial penalty clauses in contracts with service providers. In each case, the sense of the relationship is positive. Agencies that use the penalty clauses have a higher $PassMil/Veh$ value than those that do not. For the 1998 data, agencies that used penalties linked to Complaints had a mean $PassMil/Veh$ value of 47000 miles/vehicle, while agencies that did not use penalties linked to complaints had a mean of 34000 miles/vehicle. In the same year, agencies that used penalties linked to Productivity had a mean of 47400 miles/vehicle versus 33900 for those who did not. Also, agencies that used penalties linked to Other measures had a mean of 44100 miles/vehicle versus 34000 miles/vehicle for those who did not. For 1999 and penalties linked to Other, the means are 43500 miles/vehicle versus 32500 miles/vehicle. For 2001 and penalties linked to Productivity, the means are 50300 miles/vehicle versus 32800 miles/vehicle. Finally, for 2002 and penalties linked to Other, the means are 43900 miles/vehicle versus 33700 miles/vehicle.

The results for 1998 and 1999 that indicate a beneficial impact from the use of financial penalty clauses in contracts with service providers are in conflict with the results of our previous study. The previous study showed no significant impact of financial penalties in 1998, and showed the combination of financial penalties and incentives to be detrimental to productivity in 1999. We can offer no interpretation for this seemingly beneficial impact of financial penalties. We do note that there are only 19 agencies in common between the responders to our previous survey and this current survey. There may be an as yet uninvestigated variable that accounts for the superior productivity of the agencies in the current survey group who use financial penalties. We also note that when the 1999 data for the two survey groups are combined, the financial penalties variable becomes insignificant. This observation further supports the hypothesis of stratification between the two survey groups according to an unidentified variable.

For the 1997 data, there are two relationships that have not yet been discussed. There is a positive relationship between $PassMil/Veh$ and %Cancelled. Agencies with relatively high cancellation rates have a greater $PassMil/Veh$ value than agencies with relatively low cancellation rates. The difference between an agency with 6% cancellations and an agency with 15%

cancellations is 6500 miles/vehicle. We believe that this impact may be related to the no–shows relationship described above. There is also a negative relationship between $PassMil/Veh$ and Zones. Agencies that use zones have a mean $PassMil/Veh$ value of 30600 miles/vehicle, while agencies that do not use zones have a mean of 36300 miles/vehicle. The use of zones is unproductive because it creates situations in which vehicles travel into an area where they are not allowed to make a pick–up and must deadhead back into their assigned zone.

For the 2001 data, there are also two additional relationships to discuss. There is a negative relationship between $PassMil/Veh$ and Manual Revised. Agencies that revise routes manually on the day of use have a mean $PassMil/Veh$ value of 35300 miles/vehicle, while agencies that do not revise manually have a mean of 57400 miles/vehicle. Manual revisions to vehicle routes during the day of use are likely to be unproductive because it is difficult for humans to correctly evaluate system–wide impacts quickly without computational aids. There is a negative relationship with Service Mileage. Agencies that pay contracted service providers on a mileage basis have a mean $PassMil/Veh$ value of 36900 miles/vehicle, while agencies that do not pay contractors on a mileage basis have a mean of 37900 miles/vehicle. We interpret this impact as being the result of contractors who are paid on a mileage basis tending to drive more unloaded miles than necessary in order to increase charges to agencies.

The R–sq(adj) values for the 1998 and 1999 analyses in our previous study were 7% and 15% respectively. (No significant terms for the previous study's 1997 data corresponds to 0% R-sq(adj).) The R-sq(adj) metric indicates the percentage of the observed variance in the performance measure that is attributable to the significant variables. The analysis results for the current study show that we have been able to identify variables that account for a greater portion of the observed performance variance than previously was the case.

The next analysis was for relationships to the $Trip/Veh$ productivity measure. The scaling for the 2002 data is shown in Equation 3. The Box–Cox power transformation exponent was selected to be $\lambda = 0.5$ for all years of NTD data. Tables 12 and 13 show all of the terms that were found to be significant at the 4% level.

$$ScaledLoading = \frac{Trip/Veh - 4800.9}{2267.4} \tag{3}$$

The most consistent relationship to $Trips/Veh$ is that with Manual Revised. This relationship

Table 12: Passenger Trips per Vehicle Regression Results

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

	1997		1998		1999	
Term	Coeff. Est.	p–value	Coeff. Est.	p–value	Coeff. Est.	p–value
Manual Revised	−0.32	0.000	−0.21	0.001	—	—
Auto. Grouped	—	—	—	—	0.26	0.001
Complaints	0.16	0.025	—	—	—	—
Productivity	—	—	0.14	0.011	—	—
Ridesharing	—	—	0.09	0.035	—	—
Same Day	—	—	—	—	0.37	0.000
%No–shows	—	—	—	—	4.35	0.000
Longest Notice	—	—	—	—	−0.02	0.003
Zones	—	—	—	—	−0.23	0.006
R–sq(adj)	30%		30%		58%	

is observed in all years except 1999. The sense of the relationship is negative. Agencies that manually revise routes on the day of use have a smaller $Trips/Veh$ value than those that do not. For the 1997 data, agencies that Manual Revised had a mean $Trip/Veh$ value of 4510 trips/vehicle, while agencies that did not had a mean of 6230 trips/vehicle. For 1998, the means are 4400 trips/vehicle versus 5880 trips/vehicle. For 2000, the means are 4070 trips/vehicle versus 6320 trips/vehicle. For 2001, the means are 4350 trips/vehicle versus 6520 trips/vehicle. Finally, for 2002, the means are 4320 trips/vehicle versus 5510 trips/vehicle. As above, we interpret these results as an indication of the difficulty involved in manually evaluating the impact of route revisions.

In 1997, 1998, 2000, 2001, and 2002 relationships to Complaints, Productivity, and Other are

Table 13: Passenger Trips per Vehicle Regression Results

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

	2000		2001		2002	
Term	Coeff. Est.	p–value	Coeff. Est.	p–value	Coeff. Est.	p–value
Manual Revised	−0.28	0.000	−0.48	0.001	−0.29	0.026
Auto. Grouped	0.20	0.003	—	—	—	—
Productivity	0.21	0.000	0.28	0.014	—	—
Other	—	—	—	—	0.23	0.002
R–sq(adj)	49%		36%		20%	

observed. These are all indicators of the use of financial penalty clauses in contracts with service providers. In each case, the relationship is positive. Agencies that use the penalty clauses have a higher $Trip/Veh$ value than those that do not. For the 1997 data, agencies that used penalties linked to Complaints had a mean $Trip/Veh$ value of 5660 trips/vehicle, while agencies that did not use penalties linked to complaints had a mean of 4390 trips/vehicle. For 1998, agencies using penalties linked to Productivity had a mean of 5400 trips/vehicle and agencies that did not had a mean of 4420 trips/vehicle. For 2000 and Productivity, the means are 5800 trips/vehicle and 3770 trips/vehicle. For 2001 and Productivity, the means are 5770 trips/vehicle and 4100 trips/vehicle. For 2002 and penalties linked to Other measures, the means are 5100 trips/vehicle and 4080 trips/vehicle. Our previous study revealed no significant impact of financial penalties on $Trip/Veh$ in 1997-1999. Again, we interpret this result as an unexplained difference between the survey groups.

In 1999 and 2000 there are relationships to Auto. Grouped. This variable indicates the use of CAD software to group service requests into routes. In both years the relationship is positive. In 1999, agencies that used automatic grouping of requests had a mean of 4800 trips/vehicle and agencies that did not had a mean of 3650 trips/vehicle. In 2000, agencies that used automatic grouping of requests had a mean of 5100 trips/vehicle and agencies that did not had a mean of 4080 trips/vehicle. As above, use of CAD systems to automatically create vehicle routes is demonstrating productivity benefits.

In 1998, there is one other relationship that remains to be discussed. The Ridesharing indicator has a positive relationship to $Trips/Veh$. For agencies that use ridesharing, the mean is 4650 trips/vehicle. Agencies that do not use ridesharing have a mean of 4460 trips/vehicle. While this relationship is statistically significant, the practical importance of the impact is small.

In 1999, there are four relationships remaining to be discussed. Agencies that accept same–day requests have a mean of 5270 trips/vehicle, while agencies that do not have a mean of 4010 trips/vehicle. Same–day requests are beneficial because they allow agencies to fill gaps in routes that are created by no–shows and cancellations. Agencies that have a relatively high no–show rate have a greater $Trips/Veh$ value than agencies that have a relatively low no–show rate. The difference between agencies with 2% no–shows and 6% no–shows is 940 trips/vehicle. We hypothesize that no–shows appear beneficial here because the service request is still tallied as an unlinked

trip, and the vehicle is freed early for other pick–ups. Agencies that allow a relatively long notice for requested travel have a smaller $Trip/Veh$ value than agencies that only allow relatively short notice for advanced reservations. The difference between agencies that allow 14 days notice and those that allow only 6 days notice is 680 trips/vehicle. Allowing extended notice for advanced reservations may appear detrimental to productivity because these requests are more likely to produce a change of request. Finally, agencies that divide their service area into zones have a mean of 4420 trips/vehicle, while agencies that do not use zones have a mean of 4690 trips/vehicle. As above, the use of zones creates deadhead segments in the vehicle route and thereby reduces the number of requests serviced.

The R–sq(adj) values for the 1997-1999 analyses in our previous study were 8%, 11%, and 13% respectively. As above, the analysis results for the current study show that we have been able to identify variables that account for a greater portion of the observed performance variance than previously was the case.

Results of analyses for relationships to the AOC measure are shown in Tables 14 and 15. The AOC measure is defined in Equation 1. A Box–Cox power transformation exponent of $\lambda = -0.5$ was selected for all years of NTD data. The tables show all terms found significant at the 4% level.

For the 1998 data, there is one relationship observed between AOC and the use of Financial Incentives. The sense of the relationship is positive, i.e. agencies that use financial incentive clauses in contracts with service providers have a greater mean AOC value than agencies that do not use incentives. The mean AOC value for responding agencies that use incentives translates to a mean $OpExp/Trip$ value of \$26.50/trip, and a mean $OpExp/PassMil$ value of \$3.80/mile. The mean AOC value for agencies that do not use incentives translates to a mean $OpExp/Trip$ value of \$19.00/trip, and a mean $OpExp/PassMil$ value of \$2.65/mile. We hypothesize that the addition of financial incentive clauses to contracts that already include financial penalties produces greater costs because contractors adjust their base rates to cover any losses from penalties and then expand their revenues by earning incentives.

For the 1999 data, there are two relationships to discuss. There is a positive relationship between AOC and Service Hours. Agencies that pay contracted service providers on an hourly basis have a mean AOC value that translates to a mean $OpExp/Trip$ value of \$24.25/trip, and a

Table 14: Average Operating Cost Regression Results

y: $(AOC + 3)^{-0.5}$

	1997		1998		1999	
Term	Coeff. Est.	p–value	Coeff. Est.	p–value	Coeff. Est.	p–value
Financial Incentives	—	—	−0.07	0.005	—	—
Service Hours	—	—	—	—	−0.08	0.000
Productivity	—	—	—	—	0.06	0.022
R–sq(adj)			13%		22%	

mean $OpExp/PassMil$ value of \$3.10/mile. Agencies that do not pay contractors on an hourly basis have a mean AOC value that translates to a mean $OpExp/Trip$ value of \$16.10/trip, and a mean $OpExp/PassMil$ value of \$2.05/mile. We interpret paying contractors on an hourly basis to be detrimental because drivers are paid for idle time. There is a negative relationship between AOC and Productivity. Agencies that use financial penalty clauses linked to productivity have a lower mean AOC value than those that do not. The mean AOC for agencies that use productivity penalties translates to a mean $OpExp/Trip$ value of \$18.50/trip, and a mean $OpExp/PassMil$ value of \$2.35/mile. The mean AOC for agencies that do not use productivity penalties translates to a mean $OpExp/Trip$ value of \$20.60/trip, and a mean $OpExp/PassMil$ value of \$2.65/mile. Our previous study found the use of financial penalties to produce increased costs in the 1999 data. This contradictory result may be the complementary cost benefit to the productivity impacts noted above, and therefore remains as an unexplained difference between the survey groups.

For the 2000 data, there is a negative relationship between AOC and the practice of allowing requests for travel Outside the boundaries of the local fixed–route bus service. The mean AOC for agencies that do service such requests translates to a mean $OpExp/Trip$ value of \$17.60/trip, and a mean $OpExp/PassMil$ value of \$2.15/mile. The mean AOC for agencies that do not accept

Table 15: Average Operating Cost Regression Results

y: $(AOC + 3)^{-0.5}$

	2000		2001		2002	
Term	Coeff. Est.	p–value	Coeff. Est.	p–value	Coeff. Est.	p–value
Outside	0.04	0.031	—	—	—	—
R–sq(adj)	8%					

request for travel outside the fixed–route bus boundaries translates to a mean $OpExp/Trip$ value of \$22.75/trip, and a mean $OpExp/PassMil$ value of \$2.90/mile. Since agencies are not required to accept requests for travel outside the boundaries of the local fixed–route bus service area, we assume that agencies choose to do so in order to achieve cost recovery.

The R–sq(adj) values for the 1998 and 1999 analyses in our previous study were 7% and 4% respectively. No significant terms were found for the previous study's 1997 data. The analysis results for the current study indicate that while there has been some improvement in accounting for the observed performance variance, we have not been able to identify as many important variables related to operating costs as we have found for productivity.

The analyses above compare the average performance of several agencies that have a given characteristic against the average performance of several other agencies that do not have the characteristic. It is possible that the differences in performance from agency–to–agency obscure or enhance the observed impacts. A before vs. after analysis for individual agencies would eliminate such agency–to–agency differences.

A before vs. after (paired comparison) analysis was performed for agencies that implemented any of the management practices shown in Table 3 or advanced technologies shown in Table 5 during 1998-2001. Each of the four performance measures ($OpExp/Trip$, $OpExp/PassMil$, $PassMil/Veh$, and $Trip/Veh$) was investigated separately. As above, performance in the reported year of implementation was ignored because it could not be attributed to either the before or after condition. The difference in performance between the year following implementation and the year preceeding implementation was calculated as the impact of the technology/practice. The average of the differences was then evaluated for statistical significance. None of the averages demonstrated significance at the 5% level. This is most likely due to the large amount of variablility in year–to–year results for individual agencies caused by a variety of as yet uninvestigated factors.

4 Conclusions

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 67 agencies that responded. We have evaluated the impact of 28 operations variables on productivity and operating cost measures derived from information available in the 1997-2002 NTD.

Our analysis indicates that use of a Paratransit CAD system to group service requests into vehicle routes provides a productivity benefit of approximately 12000 passenger miles per vehicle, and 1100 trips 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.

The practice of manually revising routes during the time of service produces a detrimental impact on productivity of approximately 1800 trips per vehicle annually. Policy makers should insist on some form of computational assistance for dispatchers, so that system–wide impacts of route revisions can be evaluated correctly in real time.

No–shows are identified as having a beneficial impact on productivity of approximately 10500 passenger miles per vehicle annually. This is a misleading result that is produced by a deficiency in the $PassMil/Veh$ performance measure. Agencies should not attempt to increase their no–show rates. There is a need to identify more reliable measures of productivity that can be readily estimated.

The use of financial penalties was found to have benefical impacts on productivity and operating cost. This result is in conflict with the results of our previous study. We note that there are few agencies in common between the responders to the two surveys and attribute this apparent flip–flop in results to an as yet unidentified distinction between the two survey groups.

The portion of productivity performance variability explained by surveyed variables has increased substantially from the 10% level of the previous study. However, we stand at only about 40% of the productivity variability explained. The search to identify important variables related to operating cost has been less successful. Only about 10% of operating cost variability is explained, compared to about 5% previously. There is a need for further research to identify characteristics that determine performance. The recently announced request for proposals to the Transit Cooperative Research Program Project B-31, FY 2005, "Guidebook for Measuring, Assessing, and Improving Performance of Demand–Response Transportation", calls for research to identify both reliable metrics of performance and factors that affect performance of DRT systems.

5 Acknowledgement

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A Surveyed Agencies

Surveyed Agencies

TRS ID	Agency Name	City	State
0001	King County Department of Transportation — Metro Transit Division	Seattle	WA
0002	Spokane Transit Authority	Spokane	WA
0003	Pierce County Transportation Benefit Area Authority	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
0020	Kitsap Transit	Bremerton	WA
0024	Clark County Public Transportation Benefit Area Authority	Vancouver	WA
0025	Salem Area Mass Transit District	Salem	OR
0029	Snohomish County Transportation Benefit Area Corporation	Everett	WA
0033	Senior Services of Snohomish County	Mukilteo	WA
1001	Rhode Island Public Transit Authority	Providence	RI
1003	Massachusetts Bay Transportation Authority	Boston	MA
1004	Brockton Area Transit Authority	Brockton	MA
1005	Lowell Regional Transit Authority	Lowell	MA
1008	Pioneer Valley Transit Authority	Springfield	MA
1017	Greater Hartford Transit District	Hartford	CT
1040	Southeast Area Transit	Preston	CT
1049	The Greater New Haven Transit District	Hamden	CT
1050	Greater Bridgeport Transit Authority	Bridgeport	CT
1069	The Regional Transportation Program, Inc.	Portland	ME
1102	Connecticut Department of Transportation	Newington	CT
1105	Cape Cod Regional Transit Authority	Hyannis	MA
2002	Capital District Transportation Authority	Albany	NY
2004	Niagara Frontier Transportation Authority	Buffalo	NY
2007	Metropolitan Suburban Bus Authority, dba: MTA Long Island Bus	Garden City	NY
2008	MTA New York City Transit	Brooklyn	NY
2018	Central New York Regional Transportation Authority	Syracuse	NY
2072	Suffolk County Department of Public Works — Transportation Division	Yaphank	NY
2076	Westchester County Department of Transportation	Mount Vernon	NY
2080	New Jersey Transit Corporation	Newark	NJ
2086	Transportation Resources Intra–County for Physically Handicapped and Senior Citizens	Pomona	NY
2113	Regional Transit Services, Inc. and Lift Line, Inc.	Rochester	NY
2148	Newburgh Beacon Bus Corporation	New Windsor	NY
2159	Atlantic Paratrans, Inc.	Staten Island	NY
2173	American Transit, Inc.	Yonkers	NY
3001	Kanawha Valley Regional Transportation Authority	Charleston	WV
3006	Greater Richmond Transit Company	Richmond	VA
3010	Lehigh and Northampton Transportation Authority	Allentown	PA

Surveyed Agencies (cont.)

TRS ID	Agency Name	City	State
3014	Capital Area Transit	Harrisburg	PA
3015	Luzerne County Transportation Authority	Kingston	PA
3018	Red Rose Transit Authority	Lancaster	PA
3019	Southeastern Pennsylvania Transportation Authority	Philadelphia	PA
3022	Port Authority of Allegheny County	Pittsburgh	PA
3023	Beaver County Transit Authority	Rochester	PA
3024	Berks Area Reading Transportation Authority	Reading	PA
3025	County of Lackawanna Transit System	Scranton	PA
3030	Washington Metropolitan Area Transit Authority	Washington	DC
3034	Maryland Transit Administration	Baltimore	MD
3044	Westmoreland County Transit Authority	Greensburg	PA
3051	Ride–On Montgomery County Transit	Rockville	MD
3074	Harford County Transportation Services	Abingdon	MD
3075	Delaware Transit Corporation	Dover	DE
3083	Transportation District Commission of Hampton Roads, dba: Hampton Roads Transit	Hampton	VA
4001	Chattanooga Area Regional Transportation Authority	Chattanooga	TN
4003	Memphis Area Transit Authority	Memphis	TN
4004	Metropolitan Transit Authority	Nashville	TN
4007	Capital Area Transit	Raleigh	NC
4008	Charlotte Area Transit System	Charlotte	NC
4012	Winston–Salem Transit Authority — Trans–Aid of Forsyth County	Winston–Salem	NC
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
4023	Augusta Richmond County Transit Department	Augusta	GA
4024	Department of Transportation	Columbus	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
4034	Miami–Dade Transit	Miami	FL
4035	Central Florida Regional Transportation Authority	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

Surveyed Agencies (cont.)

TRS ID	Agency Name	City	State
4043	Metro Transit	Mobile	AL
4046	Sarasota County Area Transit	Sarasota	FL
4053	Greenville Transit Authority	Greenville	SC
4056	Pee Dee Regional Transportation Authority	Florence	SC
4063	Space Coast Area Transit	Cocoa	FL
4071	City of Huntsville, Alabama — Public Transportation Division	Huntsville	AL
4074	Pasco County Public Transportation	Port Richey	FL
4078	Cobb County Department of Transportation Authority	Marietta	GA
4086	Metropolitan Bus Authority	San Juan	PR
4097	Council on Aging of St. Lucie, Inc.	Fort Pierce	FL
4100	Santee Wateree Regional Transportation Authority	Sumter	SC
4110	Charleston Area Regional Transportation Authority	Charleston	SC
4113	Council on Aging of Martin County, Inc.	Stuart	FL
5005	Madison Metro Transit System	Madison	WI
5008	Milwaukee County Transit System	Milwaukee	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	Greater Dayton Regional Transit Authority	Dayton	OH
5022	Toledo Area Regional Transit Authority	Toledo	OH
5024	Western Reserve Transit Authority	Youngstown	OH
5032	Mass Transportation Authority	Flint	MI
5033	Interurban Transit Partnership	Grand Rapids	MI
5036	Capital Area Transportation Authority	Lansing	MI
5038	Niles Dial–A–Ride	Niles	MI
5048	LCEOC, Inc.	Hammond	IN
5050	Indianapolis & Marion County Public Transportation	Indianapolis	IN
5058	Rockford Mass Transit District	Rockford	IL
5066	Chicago Transit Authority	Chicago	IL
5094	Waukesha County Transit System	Waukesha	WI
5113	Pace — Suburban Bus Division	Arlington Heights	IL
5117	LakeTran	Grand River	OH
5119	City of Detroit Department of Transportation	Detroit	MI
5146	Madison County Transit District	Granite City	IL
5154	Metropolitan Council	St. Paul	MN
5155	Metro Mobility	St. Paul	MN
5157	Butler County Regional Transit Authority	Hamilton	OH
6006	Mass Transit Department — City of El Paso	El Paso	TX

Surveyed Agencies (cont.)

TRS ID	Agency Name	City	State
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 Transportation and 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	New Orleans Regional Transit Authority	New Orleans	LA
6041	Handitran Special Transit Division — City of Arlington	Arlington	TX
6048	Capital Metropolitan Transportation Authority	Austin	TX
6051	Corpus Christi Regional Transportation Authority	Corpus Christi	TX
6056	Dallas Area Rapid Transit	Dallas	TX
6082	The Gulf Coast Center	Galveston	TX
6087	First Transit, Inc.	Houston	TX
6088	Jefferson Parish Department of Transit Administration	Gretna	LA
6090	Lower Rio Grande Valley Development Council	McAllen	TX
6091	Hill Country Transit District	San Saba	TX
6092	ATC / Vancom	Dallas	TX
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 Springs	CO
8006	Denver Regional Transportation District	Denver	CO
8011	Transfort	Fort Collins	CO
9001	Regional Transportation Commission of Washoe County	Reno	NV
9002	City and County of Honolulu Department of Transportation Services	Honolulu	HI
9003	Bay Area Rapid Transit District	Oakland	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	Torrance Transit System	Torrance	CA
9012	San Joaquin Regional Transit District	Stockton	CA
9013	Santa Clara Valley Transportation Authority	San Jose	CA
9014	Alameda–Contra Costa Transit District	Oakland	CA

Surveyed Agencies (cont.)

TRS ID	Agency Name	City	State
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 Transit	Long Beach	CA
9027	Fresno Area Express	Fresno	CA
9028	City of Vallejo Transportation Program	Vallejo	CA
9029	Omnitrans	San Bernardino	CA
9030	North San Diego County Transit District	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
9036	Orange County Transportation Authority	Orange	CA
9041	Montebello Bus Lines	Montebello	CA
9042	City of Gardena Transportation Department	Gardena	CA
9045	Regional Transportation Commission of Southern Nevada	Las Vegas	NV
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
9090	Yolo County Transportation District	Woodland	CA
9121	Antelope Valley Transit Authority	Lancaster	CA
9129	City of Mesa	Mesa	AZ
9132	Maricopa County Special Transportation Services	Phoenix	AZ
9147	City of Los Angeles Department of Transportation	Los Angeles	CA
9157	Access Services Incorporated	Los Angeles	CA
9162	Eastern Contra Costa Transit Authority	Antioch	CA
9166	Los Angeles County Metropolitan Transportation Authority	Los Angeles	CA
9170	ATC / Vancom	Oakland	CA
9185	San Diego Metropolitan Transit Development Board	San Diego	CA
9188	County of San Diego Transit System	San Diego	CA

B Survey Form

Demand Responsive Transit Service Survey

NTD ID Number:
Agency Name:

Operational Characteristics

Is your service area divided into zones that limit where a particular provider may pick-up a customer?
_____ Yes _____ No

If yes, how many distinct zones? _____

Is scheduling coordinated across the zones? _____ Yes _____ No

Do you accept standing reservations? _____ Yes _____ No

Do you accept advanced reservations? _____ Yes _____ No

If yes, what is the longest notice for which a customer may request a pick-up? _____

Do you handle same-day requests? _____ Yes _____ No

If yes, what is the shortest notice for which a customer may request a pick-up? _____

Does you accept requests for travel outside the boundaries of the local fixed-route bus service?
_____ Yes _____ No

What percentage of service requests does your agency handle by directly operated vehicle? _____

On what basis are contracted providers paid?
_____ Service requests _____ Service hours _____ Service mileage

Are drivers considered employees or independent contractors? _____

What percentage of your service requests do customers cancel after routes are planned? _____

What percentage of your service requests do customers fail to show for the pick-up? _____

How do you deal with reservations for return travel when the outbound reservation produces a customer no-show?

How are customers impacted when they produce no-shows?
_____ No impact _____ Phone call _____ Letter
Other (please specify): _____

Management Practices

For each practice in use, please indicate the year that the practice was first implemented.
If the year is uncertain, please indicate an estimate with an asterisk, eg: 2001*

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

_____ Financial incentives – payments to contractors, in addition to 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

Implementation of Financial Penalties/Incentives

What performance measures does your agency link to financial incentives?

_____ On-time pick-ups _____ Productivity _____ Customer complaints
_____ Driver turnover Other (please specify): _____

How often are incentives awarded?

What performance measures does your agency link to financial penalties?

_____ On-time pick-ups _____ Productivity _____ Customer complaints
_____ Driver turnover Other (please specify): _____

How often are penalties assessed?

What are the limits of your on-time window?

Earliest arrival before requested pick-up: _____

Latest arrival after requested pick-up: _____

Advanced Technologies

For each technology in use, please indicate the year that the technology was first implemented. If the year is uncertain, please indicate an estimate with an asterisk, eg: 2001*

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

_____ Automated vehicle location – 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, 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 such as scheduling, routing, and dispatching.

Uses of Computer-Aided Dispatching

How are service requests grouped into routes for each vehicle?
_____ Manually _____ Automatically, by using a CAD software

If routes are created automatically, does dispatch staff revise the routes manually before use?
_____ Yes _____ No

How are routes revised during the time of use?
_____ Manually _____ Automatically, by using a CAD software
Other (please specify): _____

How long in advance are routes planned?

Over what period of time is a route planned to occur?
_____ Full-day _____ Half-day
Other (please specify): _____

What is the amount of requests given to a driver at one time?
_____ Full-day _____ Half-day _____ One-at-a-time
Other (please specify): _____

C Responding Agencies

Responding Agencies

TRS ID	Agency Name	City	State
0008	Tri–County Metropolitan Transportation District of Oregon	Portland	OR
0029	Snohomish County Transportation Benefit Area Corporation	Everett	WA
1003	Massachusetts Bay Transportation Authority	Boston	MA
1049	The Greater New Haven Transit District	Hamden	CT
2004	Niagara Frontier Transportation Authority	Buffalo	NY
2008	MTA New York City Transit	Brooklyn	NY
2080	New Jersey Transit Corporation	Newark	NJ
2086	Transportation Resources Intra–County for Physically Handicapped and Senior Citizens	Pomona	NY
3018	Red Rose Transit Authority	Lancaster	PA
3022	Port Authority of Allegheny County	Pittsburgh	PA
3025	County of Lackawanna Transit System	Scranton	PA
3030	Washington Metropolitan Area Transit Authority	Washington	DC
3034	Maryland Transit Administration	Baltimore	MD
3044	Westmoreland County Transit Authority	Greensburg	PA
4001	Chattanooga Area Regional Transportation Authority	Chattanooga	TN
4008	Charlotte Area Transit System	Charlotte	NC
4012	Winston–Salem Transit Authority — Trans–Aid of Forsyth County	Winston–Salem	NC
4019	Transit Authority of Northern Kentucky	Fort Wright	KY
4022	Metropolitan Atlanta Rapid Transit Authority	Atlanta	GA
4024	Department of Transportation	Columbus	GA
4026	Manatee County Area Transit	Bradenton	FL
4029	Broward County Mass Transit Division	Pompano Beach	FL
4035	Central Florida Regional Transportation Authority	Orlando	FL
4041	Hillsborough Area Regional Transit Authority	Tampa	FL
4053	Greenville Transit Authority	Greenville	SC
4074	Pasco County Public Transportation	Port Richey	FL
5005	Madison Metro Transit System	Madison	WI
5010	Metro Regional Transit Authority	Akron	OH
5011	Stark Area Regional Transit Authority	Canton	OH
5017	Greater Dayton Regional Transit Authority	Dayton	OH
5032	Mass Transportation Authority	Flint	MI
5050	Indianapolis & Marion County Public Transportation	Indianapolis	IN
5058	Rockford Mass Transit District	Rockford	IL
5066	Chicago Transit Authority	Chicago	IL
5117	LakeTran	Grand River	OH
5119	City of Detroit Department of Transportation	Detroit	MI
6008	Metropolitan Transit Authority of Harris County, Texas	Houston	TX
6011	VIA Metropolitan Transit	San Antonio	TX
6018	Metropolitan Tulsa Transit Authority	Tulsa	OK

Responding Agencies (cont.)

TRS ID	Agency Name	City	State
6024	Shreveport Area Transit System	Shreveport	LA
6041	Handitran Special Transit Division — City of Arlington	Arlington	TX
6056	Dallas Area Rapid Transit	Dallas	TX
6082	The Gulf Coast Center	Galveston	TX
7001	StarTran	Lincoln	NE
7006	Bi–State Development Agency	St. Louis	MO
7015	Wichita Transit	Wichita	KS
7035	Johnson County Kansas, aka: Johnson County Transit	Olathe	KS
8001	Utah Transit Authority	Salt Lake City	UT
8006	Denver Regional Transportation District	Denver	CO
8011	Transfort	Fort Collins	CO
9001	Regional Transportation Commission of Washoe County	Reno	NV
9002	City and County of Honolulu Department of Transportation Services	Honolulu	HI
9008	Santa Monica's Big Blue Bus	Santa Monica	CA
9010	Torrance Transit System	Torrance	CA
9028	City of Vallejo Transportation Program	Vallejo	CA
9029	Omnitrans	San Bernardino	CA
9030	North San Diego County Transit District	Oceanside	CA
9032	City of Phoenix Public Transit Department	Phoenix	AZ
9034	City of Glendale Transit	Glendale	AZ
9036	Orange County Transportation Authority	Orange	CA
9062	Monterey–Salinas Transit	Monterey	CA
9078	Central Contra Costa Transit Authority	Concord	CA
9089	Sonoma County Transit	Santa Rosa	CA
9090	Yolo County Transportation District	Woodland	CA
9121	Antelope Valley Transit Authority	Lancaster	CA
9157	Access Services Incorporated	Los Angeles	CA
9166	Los Angeles County Metropolitan Transportation Authority	Los Angeles	CA
9185	San Diego Metropolitan Transit Development Board	San Diego	CA

D Raw Survey Data

Operational Characteristics, Part 1

TRS ID	Zones	Number of Zones	Coordinate Zones	Standing Reserv.	Advanced Reserv.	Longest Notice
0008	No		Yes	Yes	Yes	14
0029	No			Yes	Yes	7
1003	Yes	4	Yes	Yes	Yes	14
1049	No			Yes	Yes	7
2004	Yes	4	Yes	No	Yes	14
2008	Yes	9	Yes	Yes	Yes	AAR customer 1-2; subscription can last for an indeterminable amount of days/months
2080	Yes	5	Yes	Yes	Yes	14
2086	No		Yes	Yes	Yes	30
3018	Yes	6	Yes	Yes	Yes	14
3022	Yes	11	No	Yes	Yes	Friday for Monday
3025	No	N/A	No	Yes	Yes	Ongoing appointments are allowed
3030	No		Yes	Yes	Yes	14
3034	No			Yes	Yes	14
3044	Yes	7	No	Yes	Yes	14
4001	No		Yes	Yes	Yes	14
4008	No			Yes	Yes	5
4012	No		N/A	Yes	Yes	same day if we have the capacity and time
4019	No			Yes	Yes	14
4022	No		N/A	Yes	Yes	7
4024	No		No	Yes	Yes	14
4026	No		Yes	Yes	Yes	14
4029	No		Yes	Yes	Yes	4
4035	No	N/A	Yes	Yes	Yes	7
4041	No			Yes	Yes	3
4053				Yes	Yes	14
4074	No		Yes	Yes	Yes	14
5005	No			Yes	Yes	7
5010	No				Yes	3
5011	No			Yes	Yes	7

Operational Characteristics, Part 1 (cont.)

TRS ID	Zones	Number of Zones	Coordinate Zones	Standing Reserv.	Advanced Reserv.	Longest Notice
5017	No		N/A	Yes	Yes	14
5032	Yes	11	Yes	Yes	Yes	7
5050	No	N/A		Yes	Yes	7
5058	No		Yes	Yes	Yes	14
5066	No	N/A	N/A	Yes	Yes	Next day
5117	No	N/A		No	Yes	14
5119	No		N/A	Yes	Yes	8
6008	No		Yes	No	Yes	1
6011	No		N/A	Yes	Yes	7
6018	No	N/A	N/A	Yes	Yes	7
6024	No		N/A	No	Yes	14
6041	No		N/A	Yes	Yes	6
6056	No	0	No	Yes	Yes	4
6082	No		Yes	Yes	Yes	5
7001	No			Yes	Yes	7
7006	No	6	Yes	Yes	Yes	7
7015	No	N/A		Yes	Yes	7
7035	No		Yes	No	Yes	14
8001	No			Yes	Yes	7
8006	No	N/A	Yes	Yes	Yes	3
8011	No			Yes	Yes	14
9001	No	N/A	Yes	Yes	Yes	7
9002	No	N/A	N/A	Yes	Yes	7–14
9008	No		N/A	No	Yes	6
9010	No			Yes	Yes	1
9028	Yes	3	Yes	Yes	Yes	7
9029	No	N/A		No	Yes	14
9030	No	N/A	N/A	No	Yes	14
9032	No			Yes	Yes	14
9034	No			Yes	Yes	14 ADA, 7 NON–ADA
9036	No		N/A	Yes	Yes	7
9062	Yes	2	Yes	Yes	Yes	14
9078	No			Yes	Yes	2
9089	No	N/A	N/A	Yes	Yes	7
9090	No			Yes	No	
9121	No	N/A		Yes	Yes	1
9166	Yes	6	Yes	Yes	No	
9185	Yes	4	Yes	Yes	Yes	2

Operational Characteristics, Part 2

TRS ID	Same–Day Requests	Shortest Notice	Outside Boundaries	%Directly Operated	Contract Pay Basis	Driver Status
0008	No		No	0%	hours	Indep. contract.
0029	Yes	1-2 hours	Yes	0%	hours	Indep. contract.
1003	Yes (not guaranteed)	immediate	Yes	0%	other (per completed trip route, fuel)	Indep. contract.
1049	No		Yes	100%	N/A	Employees
2004	No	1 day before	No	100%	N/A	Employees
2008			Yes	0%	hours	Indep. contract.
2080			No	0%	hours	Indep. contract.
2086	Sometimes		Yes	100%		Employees
3018	No	24 hours	Yes	0%	requests	Employees
3022	Yes	ASAP	Yes	0%	hours	Depends on the provider — lots dedicated vehicles and taxis used
3025	No	N/A	Yes	100%	hours	Employees
3030	No		Yes	65%	requests, hours requests, hours	Indep. contract.
3034	No		No	19%	hours	Direct are employees, contractors are not
3044	No	24 hours	Yes	0%	mileage	Indep. contract.
4001	Yes	5 minutes	Yes	100%	N/A	Employees
4008	No		Yes	100%	N/A	Employees
4012	Yes		Yes	100%	N/A	Union — so they fall under the management of ATC
4019	Yes	1 hour	Yes	100%	N/A	Employees
4022	No		No	100%	N/A	Employees
4024	No		No			Employees
4026	No		Yes		requests, mileage	Both

Operational Characteristics, Part 2 (cont.)

TRS ID	Same–Day Requests	Shortest Notice	Outside Boundaries	%Directly Operated	Contract Pay Basis	Driver Status
4029	No		Yes	0%	requests	Employees
4035	No	N/A	Yes	0%	requests	Indep. contract.
4041	No		No	100%	N/A	N/A
4053	No	next day		100%	N/A	Employees
4074	Yes	2 hours	Yes	80%	mileage	Both
5005	No		No	28%	requests, hours	Both
5010	Yes		Yes	67%	requests	Employees for DO and Indep. contract. for PT
5011	Yes	2 hours	Yes	100%		Employees
5017	No	N/A	No	100%	N/A	Employees
5032	Yes	1 hour	Yes	100%		Employees
5050	No		Yes	55%	hours	Employees
5058	Yes		No	100%		Employees
5066	No	N/A	No		requests	Indep. contract.
5117	No	48 hours	Yes	97%	hours	Employees
5119	No		Yes	0%	hours, mileage	Neither employees or contractor
6008	No			0%		Indep. contract.
6011	No	4:45pm on previous day	No	50%	hours	Both
6018	No	N/A	No	56%	hours	Indep. contract.
6024	Yes	15 minutes	Yes	0%	hours	Indep. contract.
6041	Yes	3 hours	No	50-60%	requests	Both
6056	No	N/A	No	0%	hours, monthly fixed cost	Indep. contract.
6082	No		N/A	100%		Employees
7001	Yes	30 minutes	No	75%	requests, hours	Employees for DO and Indep. contract. for PT
7006	Yes	ASAP	Yes	100%	N/A	Employees
7015	No	N/A	Yes	30%	requests	Employees

Operational Characteristics, Part 2 (cont.)

TRS ID	Same–Day Requests	Shortest Notice	Outside Boundaries	%Directly Operated	Contract Pay Basis	Driver Status
7035	No		Yes		hours	Indep. contract.
8001	Yes	2 hours	Yes	66%	hours	Employees
8006	Only in case of emergency	No time limit	No	0%	Revenue hours	Employees
8011	No	next day	Yes	66%	requests	Employees
9001	Yes–a few	same day	Yes	0%	hours, mileage	Both
9002	Yes	when ready	Yes	98%	mileage	Contracted service
9008	Yes	they can try for 15 min	Yes	0%	hours	Indep. contract.
9010	Yes	20 minutes	No	0%	mileage	Both
9028	Yes	2 hours	No	0%	hours, mileage plus fixed monthly expense	Employees
9029	Yes	varies	Yes	0%	Actual cost plus fixed fee	Employees
9030	Yes	whatever available	No	0%	hours, mileage	Indep. contract.
9032	Yes	2 hours	Yes		hours	Employees
9034	Yes	up to 2 hours prior to pick up wanted	Yes	100%	N/A	Employees
9036	No		Yes	0%	hours	Indep. contract.
9062	No		Yes	0%	hours	Indep. contract.
9078	Yes	if possible	Yes	0%	hours	Indep. contract.
9089	No	next day	No	100%	hours	Employees
9090	Yes	depends on the vehicle that will do the trip.	Yes	0%	hours, mileage	Indep. contract.
9121	No	N/A	Yes	0%	Vehicle hours	Indep. contract.
9166	No	next day	No	0%	requests, hours, mileage	yes
9185	Yes (if space available)	1 day	No	0%	hours	Indep. contract.

Operational Characteristics, Part 3

TRS ID	%Cancelled	%No–show	Return trip for no–show
0008			
0029	21%	2%	automatically cancel return trip unless hear from customer for the service
1003			Per FTA guideline, return trip is kept in the schedule. This inflates our no–show rides.
1049	15%	3-5%	We honor the request for all return rides
2004	0.89%	1.5%	Customer has to call us if he/she doesn't want return trip
2008	7%	3.3%	The carrier must verify that the return trip is not required prior to canceling the return trip.
2080	20%	2%	Return trips remain scheduled.
2086	10-12%	1%	
3018		2%	returned trip is generally attempted unless notification is received
3022	11%	2.5%	
3025	less than 1%	less than 1%	Using radio communication, cancellations are made.
3030	11.8%	10.8%	A vehicle is sent for the outbound reservation. If the customer is not available, then it is treated as 'no–show'.
3034			The ride is rescheduled and may be an hour delay
3044	5%	1%	Return ship is canceled
4001	2%	0.5%	We don't cancel return trip unless client cancels.
4008	15%	0.9%	Depends: if customer no–shows (cancels), we cancel return.
4012			We cancel the return trip
4019	10%	3%	Upon notification by passenger that the trip is not needed, return trip is canceled.
4022	10%	1.4%	Reservation is maintained unless we are advised differently.
4024	5%	10%	
4026	10%	10%	No
4029	3%	6%	Cancel return trip unless requested otherwise.
4035	14%	4%	ADA — return trip is provided unless customer contact verifies to cancel return. Other funding sources, return trip is automatically canceled.

Operational Characteristics, Part 3 (cont.)

TRS ID	%Cancelled	%No–show	Return trip for no–show
4041	11%	1-5%	Trip stands until customer cancels
4053			
4074	1%	2%	Call customer to inquire if they need return trip. If we do not reach customer, reservation remains on schedule.
5005	10%	2.4%	Cancel return trip automatically until customer calls to confirm. Then trip is added back in, on question asked.
5010	8%	less than 1%	Cancel it
5011	9%	2%	Cancel the trip if they don't call or we can't get a hold of them.
5017	18%	1.5%	Efforts are made to contact customer. If unsuccessful, the customer must call to retain any other trip that day.
5032	15%	5%	The return trip is provided unless the customer cancels
5050	25%	3%	Cancel return trip. It will be reinstated at customer's request.
5058	0.01%	0.03%	Call client and leave the return trip scheduled unless contact with client for a cancellation.
5066	20%	2%	Goes no customer's record. After 6 in a month, warning letter is sent
5117	6.6%	3.5%	Entire trip is canceled
5119	20%	8%	Yes
6008	9%	6%	Do not cancel (return trip scheduled separately)
6011	less than 5%	4%	Return trip canceled one hour after no–show unless customer calls to say they still want the return trip.
6018	28%	4%	We send another vehicle as we cannot strand them away from home
6024	9%	2.8%	We keep the reservation, unless we are told to cancel or we have contract with rider to verify the need.
6041	6%	2%	We cancel the return trip unless passenger notifies us otherwise.
6056	10.5%	3.3%	Return trips are carried out as scheduled.
6082	25%	25%	Return trip is canceled
7001	1%	0.5%	Cancel return.
7006	14.4%	3.7%	The return trip is canceled immediately.

Operational Characteristics, Part 3 (cont.)

TRS ID	%Cancelled	%No–show	Return trip for no–show
7015	5%	3%	We do not automatically cancel the return trip.
7035	7%	less than 1%	We automatically delete the return trip.
8001	13%	17%	Call dispatch to request possible route changes or for possible same–day pickup calls
8006	12%	6%	We keep the trip scheduled. The client would need to call and cancel.
8011			Cancel off the schedule and cancel out the trip
9001	23%	2-3%	We keep the return trip reservation (unless customer cancels it) and deal with it under the no–show policy if both trips are no–shows.
9002			Ride service as requested
9008	9%	3.5%	Phone to see if something happened to the client.
9010			
9028	11%	9%	Progressive letters of warning up to service refusal
9029	3.9%	6%	The reservation remains unchanged and is serviced.
9030	unknown	unknown	cancel
9032	10-15%	4%	We don't cancel the return request.
9034	18%	5%	ADA — not canceled unless contact with customer is made first. NON–ADA return trip is canceled.
9036	4%	3%	Customer must cancel return trip in order to avoid a no–show.
9062	24%	5%	Return trip stays unless customer is reached and confirms there is no return trip
9078			
9089	8%	2%	Attempt to contact customer throughout day to see if return ride is still needed
9090	15%	12%	return becomes cancelation
9121	17%	5%	
9166	7%	6.95%	It is the rider's responsibility to cancel the trip.
9185	6%	2-3%	Each trip is independently booked. So the reservation remains scheduled.

Operational Characteristics, Part 4

TRS ID	Impact of No–show	Comment
0008	No impact	Temporary suspension no–show policy
0029	Letter	Two warning letters and then 2 week suspension
1003	No impact	Policy under review, educational compaign will be final step.
1049	Letter	Possible suspension after 3 in a 30 day period
2004	Postcard	
2008		Each time a customer no–shows or cancels late (after 5pm on the day before the ride is scheduled), it's counted as a violation. A customer who has accumulated 7 violations in 6 months or less is subject to having his/her AAR service suspended for 2 weeks. Further suspensions of 3 or 4 weeks within a 12–month period may be assessed whether the number of violations remain excessive.
2080	Letter	2 no–shows within 30 days rolling window triggers warning letter. 3 no–shows within 30 days rolling window triggers letter advising of temporary suspension of service (generally 1 week), ability to appeal.
2086		2 week suspension for 3 no show in a 30 day period
3018	Letter	After 3 in a month, progressive discipline
3022	Phone call and letter	No show policy includes potential suspension of service
3025	Phone call	If no–shows are frequent, clients are called and told that if they do not cancel in advance, there is a chance services will be terminated.
3030	Letter	Notices detailing the violations. When the customer has reached the threshold (three no–show or six late cancellations in a 30–day period) a letter of suspension with a copy of the appeals process is sent to the customer.
3034	Phone call and letter	
3044	Letter	Two written warnings, then a one month suspension

Operational Characteristics, Part 4 (cont.)

TRS ID	Impact of No–show	Comment
4001	Letter	
4008	Letter	4 letters in 30 days — suspension for 30 days
4012	Letter	
4019	Letter	
4022	Letter	suspension
4024	Letter	
4026	Letter	
4029	Letter	
4035	Letter	suspension
4041	Letter	3 no–shows in 30 days result in suspension of service for 30 days.
4053	Letter	
4074	Phone call and letter	
5005	Letter	
5010	Letter	
5011	Phone call	
5017	Letter	
5032	Letter	
5050	Letter	Impending suspension if 4 or more No–shows within a calendar month. Appeal information is enclosed.
5058	Phone call, letters	after 3
5066	Letter	
5117	Letter	
5119	No impact	Currently, no impact. Procdure being put in place for letter & suspension.
6008	Letter	if chronic
6011		suspension if more than 4 no–shows during a calendar month
6018	Letter	Warnings are given and if they no–show 4 times in a 90 day period they risk being suspended for 30 days from the program.
6024		4 or more in one month: 1 week suspension; 2nd offense: 1 month suspension; 3rd offense: 3 month suspension; 4th offense: 6 months suspension; start over each calendar year in January.

Operational Characteristics, Part 4 (cont.)

TRS ID	Impact of No–show	Comment
6041	Letter	Can be suspended after 2nd no–shows in a 3 month period.
6056	Letter	suspension letter is sent after no–show policy is violated. 30 day suspension with 3 no–show in a rooling 30 day period. 7 day suspension with cancellation of 50% or more of scheduled trips.
6082		No–show policy which can eventually lead to suspension of service.
7001	Letter	
7006	Letter	Points system administrated by sending letters leading up to suspensions of service.
7015	Letter	
7035	Letter	Fee associated with each violation
8001	Phone call and letter	Suspension of service
8006	Letter	
8011		3 strikes/month garners 1 week suspension
9001	Letter	
9002	Letter	3 or more per month
9008	Letter	ask to pay small penalty
9010	Phone call	
9028	Phone call and letter	
9029	No impact	
9030	other	Request payment sometimes
9032	Letter	
9034	Phone call and letter	after certain number of no shows
9036	Letter	Letter after 2 in a month; suspension after 3 in a month
9062	Phone call and letter	
9078		
9089	No impact	Currently, no impact. But, implementing policy FY06 to deal with where customers will get both letters and phone calls.
9090	Letter	after 3 no–shows loss of 1 week service use
9121	Letter	
9166	Letter	
9185	Letter	

Management Practices

TRS ID	Finacial Penalties	Finacial Incentives	Ridesharing	Agency Admin.	Contracted Admin.	Consumer Choice
0008				1985*		
0029	1997*		1986	1990	1990	
1003	1980*	1980*	1977	1977		1999
1049	N/A	N/A	N/A	2001	N/A	N/A
2004	N/A	N/A		1993	N/A	N/A
2008	1996	2001	1993	1993	N/A	N/A
2080	1993	2002	1993	1993	1993	N/A
2086	N/A	N/A	1978	Yes	No	N/A
3018	1996	1996	1981	1992*		
3022	1982*	N/A	1979	N/A	1979	1980
3025			Yes	1991		
3030	2000	2000	1994	2000	1994	N/A
3034	2004	2004		1978		2004
3044			1994*	1992*		
4001	N/A	N/A	N/A	1980	N/A	N/A
4008	N/A	N/A	1981	1981	N/A	N/A
4012	N/A	N/A	N/A	1990*	N/A	N/A
4019	N/A	N/A	1978	1978	N/A	N/A
4022	N/A	N/A	N/A	1997	N/A	N/A
4024		N/A	1989	1983	N/A	
4026				1998		
4029	2001	2001		1996	1996	1996
4035	1996	2002	1992	1992	1992	N/A
4041	N/A	N/A	N/A	2000	N/A	N/A
4053	N/A	N/A	yes	yes	No	No
4074	N/A	N/A	N/A	1997	N/A	N/A
5005	1980	No	1980	1980	No	No
5010	1995			1975*		
5011	N/A	N/A	1991	1991	N/A	N/A
5017	N/A	N/A	N/A	N/A	N/A	N/A
5032	N/A	N/A	N/A	1980*	N/A	N/A
5050	2000		2005	1990	N/A	N/A
5058	N/A	N/A	N/A	Yes	No	No
5066	1996	1996			1996	1996

Management Practices (cont.)

TRS ID	Finacial Penalties	Finacial Incentives	Ridesharing	Agency Admin.	Contracted Admin.	Consumer Choice
5117	1985	N/A	1992	1984	N/A	N/A
5119	2005	2005	N/A	1997	N/A	N/A
6008	1985*	1990*	1979	1979	1979	
6011			1988	1980		
6018	1999*			1999*	1999*	N/A
6024	N/A	N/A	N/A	1981	1981	N/A
6041	2002		1981	1981		
6056	1994	1994	1990*	1995	1994	N/A
6082	N/A	N/A	1983	1983	N/A	N/A
7001	N/A	N/A	1972	1972	1985*	N/A
7006	1987	N/A				
7015	N/A	N/A	1986*	1990*	1990*	N/A
7035	1990		1990		1980	
8001	1996	2003	1999	1996	1996	
8006	2002	2002	1996	1996	1996	N/A
8011				1997		
9001	1995*	1995*	1988	1988	1988	N/A
9002				yes		
9008	not yet		always	no	no	no
9010	2004	2003	1990*	2000	2000*	2000
9028	1996	1996	N/A	1996	1980	none
9029	1988*	1988*	1976*	1976	1976*	
9030				1995	1992	
9032	2001	2001		1975		
9034			1975	1975	N/A	N/A
9036	1976*	1976*	1976*	1995	1976*	N/A
9062	1999*	N/A	1991*	1991*	1991	N/A
9078						
9089			1994*	1990	1990	
9090					1996*	
9121	1992	1992	1992	1996	1992	N/A
9166	1994	1994	1994	N/A	1994	N/A
9185	1995	1995	1995	1997	1995	N/A

Implementation of Financial Penalties/Incentives, Part 1

TRS ID	Measures for Incentives	Other measures	Incentives Awarded
0008	Other	Availability of operators to perform route	
0029			
1003	On–time pick–ups, Customer complaints, Other	accidents, communication failures, uniform	Monthly
1049	N/A		N/A
2004	N/A		N/A
2008	On–time pick–ups, Other	no–show rates	
2080	On–time pick–ups, Productivity, Other	customer service, safety, and operator excellence	weekly for on–time pickup, monthly, annually, depending on the individual incentive
2086	N/A		
3018			
3022	On–time pick–ups, Productivity, Customer complaints	Compliance with other requirement, cost/productivity	
3025	No incentives		N/A
3030	On–time pick–ups, Other	FTA drug, alcohol compliance, Telephone response time	Monthly
3034	On–time pick–ups, Productivity, Driver turnover, Other	On–time pullouts	Monthly
3044			
4001			
4008			
4012			
4019	N/A		N/A
4022			
4024	On–time pick–ups		Yearly
4026	N/A		Never
4029	Customer complaints		Monthly

Implementation of Financial Penalties/Incentives, Part 1 (cont.)

TRS ID	Measures for Incentives	Other measures	Incentives Awarded
4035	Customer complaints, Other	Call hold time	Quarterly
4041			
4053	None		N/A
4074	None		N/A
5005	No		
5010			
5011	No		No
5017			
5032			
5050			
5058	N/A	N/A	N/A
5066	On–time pick–ups, Productivity		Monthly
5117			
5119	On–time pick–ups, Productivity, Customer complaints, Other	Missed trips, long trips, vehicle maintenance, uniform, qualifications, accident reports, use of vehicles	Monthly
6008	Customer complaints, Other	accidents	
6011	None		N/A
6018			
6024			
6041	N/A		N/A
6056	N/A		N/A
6082			
7001			
7006			
7015			
7035			
8001	Productivity		Annually
8006	On–time pick–ups, Productivity, Customer complaints		Monthly

Implementation of Financial Penalties/Incentives, Part 1 (cont.)

TRS ID	Measures for Incentives	Other measures	Incentives Awarded
8011			
9001	On–time pick–ups, Productivity, Customer complaints, Other	no–shows, phone hold time, road calls, preventable accidents	Quarterly
9002			
9008	None		
9010	Other	for disabled patrons	$1.00 for every disabled patron trip is billed on invoices
9028			
9029	Other	Telephone performance, manitenance performance	Monthly
9030			
9032	On–time pick–ups, Productivity, Customer complaints, Other	Safety, accident per 100,000 miles	Monthly and quarterly
9034			
9036	Productivity		None to date
9062			
9078	On–time pick–ups, Productivity, Customer complaints		Monthly
9089			
9090	Customer complaints, Driver turnover		Every 6 months
9121	Productivity		Monthly
9166	On–time pick–ups		Monthly
9185	On–time pick–ups Productivity, Other	Vehicle cleanliness, no–shows, late cancellations, failure to pass CHP inspection, abandon call ratio, failure to provide obligation in the scope of work.	Based on verification, either paid or deducted from invoices

Implementation of Financial Penalties/Incentives, Part 2

TRS ID	Measures for Penalties	Other measures	Penalties Assessed
0008	Other	Availability of operators to perform route	
0029	Other	Not reporting accidents	one or twice a year
1003	On–time pick–ups, Customer complaints, Other	accidents, communication failures, uniform	Monthly
1049	N/A		
2004			
2008			
2080	On–time pick–ups, Customer complaints		As warranted per contract — periodically and upon upon instances of non–compliance
2086			
3018	On–time pick–ups, Customer complaints		Monthly
3022	Productivity		Quarterly
3025	No penalties		N/A
3030	On–time pick–ups, Other	FTA drug, alcohol compliance, Telephone response time	Monthly if necessary
3034	On–time pick–ups, Productivity, Driver turnover, Other	Driver out of uniform, incomplete manifest, missing manifest, vehicle maintenance PM	Monthly
3044			
4001			
4008			
4012			
4019	N/A		N/A
4022			
4024	On–time pick–ups		
4026	N/A		Never
4029	On–time pick–ups Customer complaints		Monthly
4035	On–time pick–ups, Customer complaints, Other	Call hold time	Quarterly

Implementation of Financial Penalties/Incentives, Part 2 (cont.)

TRS ID	Measures for Penalties	Other measures	Penalties Assessed
4041			
4053	N/A		N/A
4074	N/A		N/A
5005	On–time pick–ups		Monthly
5010	On–time pick–ups		Monthly
5011	No		
5017			
5032			
5050	On–time pick–ups, Customer complaints		Monthly
5058			
5066	On–time pick–ups, Productivity		Monthly
5117			
5119	On–time pick–ups, Productivity, Customer complaints, Other	Missed trips, long trips, vehicle maintenance, uniform, qualifications, accident reports, use of vehicles	Monthly
6008	Driver turnover		
6011	Other	Failure to perform scheduled runs; abandonment of 'at risk' customers	very seldom
6018	On–time pick–ups		
6024			
6041	On–time pick–ups, Other	Late paperwork	As they occur, very few each month
6056	On–time pick–ups, Driver turnover		Monthly
6082			
7001			
7006			
7015			
7035	On–time pick–ups, Productivity	We have not had to penalize the contractor at this time. However, we have initiated several warning letters.	

Implementation of Financial Penalties/Incentives, Part 2 (cont.)

TRS ID	Measures for Penalties	Other measures	Penalties Assessed
8001	Productivity		Annually
8006	On–time pick–ups, Productivity, Customer complaints		Monthly
8011			
9001	On–time pick–ups, Productivity, Customer complaints, Other	no–shows, phone hold time, road calls, preventable accidents	Quarterly
9002			
9008	Other	missing service	not yet
9010	Customer complaints		Monthly
9028			
9029	Other	Telephone performance, manitenance performance	Monthly
9030			
9032	On–time pick–ups, Customer complaints		Monthly
9034			
9036	Customer complaints, Other	Maintenance, missed service	
9062	On–time pick–ups, Productivity		rarely
9078	On–time pick–ups, Productivity, Customer complaints		Monthly
9089			
9090			
9121	Productivity		Monthly
9166	On–time pick–ups		Monthly
9185	On–time pick–ups, Productivity, Other	Vehicle cleanliness, no–shows, late cancellations, failure to pass CHP inspection, abandon call ratio, failure to provide obligation in the scope of work.	Monthly if needed

Implementation of Financial Penalties/Incentives, Part 3

	On–time Window	
TRS ID	Earliest Arrival	Latest Arrival
0008	0	30
0029	15	15
1003		0
1049	15	15
2004	15	15
2008	0	30
2080	20	20
2086	60	15
3018	15	15
3022	10	20
3025	15	15
3030	15	15
3034	0	30
3044	15	15
4001	15	15
4008		
4012	20	20
4019	10	10
4022		30
4024	15	15
4026	15	15
4029	15	15
4035	15	15
4041		
4053	30	30
4074	60	0
5005	0	20
5010	20	20
5011	60	60
5017	10	20
5032		
5050	15	15
5058	15	15
5066		5

Implementation of Financial Penalties/Incentives, Part 3 (cont.)

	On–time Window	
TRS ID	Earliest Arrival	Latest Arrival
5117	20	20
5119	10	10
6008	15	15
6011	0	20
6018	15	15
6024	15	15
6041	15	15
6056	0	20
6082	15	15
7001	15	15
7006	15	15
7015	60	60
7035	15	15
8001	20	20
8006	15	15
8011	15	15
9001	15	15
9002	0	30
9008	0	15
9010		25
9028	15	15
9029	10	30
9030	3	10
9032	0	30
9034	15	15
9036	5	15
9062	15	15
9078	30	30
9089		30
9090	15	15
9121	0	20
9166	0	20
9185	5	10

Advanced Technologies

TRS ID	Advanced Communications	Advanced Vehicle Location	Auto. Fare Payment	Auto. Transit Information	Paratransit CAD
0008		1996*			1993*
0029	1997*	N/A	N/A	N/A	1994
1003	1999	2004(12)	middle from 1998-2004	2005(1)	2004(12)
1049	2001	N/A	N/A	N/A	2001
2004	1995	1996	N/A	2001	1995
2008	N/A	N/A	N/A	N/A	1996*
2080	1993	2002			2001*
2086	2004	2005		2005	2005
3018	1992				
3022	N/A	N/A	N/A	N/A	2001*
3025					Yes
3030	1994	2000	N/A	N/A	2000
3034	2001	2001	2001	2005	2001
3044					
4001	1980	N/A	N/A	N/A	1991
4008	N/A	1999	N/A	N/A	1993
4012	1995*	1995*		2004	1995*
4019	1978	2001	N/A	N/A	2001
4022	1997	Soon	Soon	N/A	2000*
4024					
4026			2005		2000
4029					1996
4035	1992	N/A	N/A	N/A	1992
4041					
4053	1997				2003
4074	N/A	N/A	N/A	N/A	1999
5005	1975(simple radio) 2004(MDT's)	2004	No	No	1992*
5010	1975*	2001	2001		2001
5011	1989	N/A	N/A	N/A	2003
5017	1999	1999	2004	2003	1999
5032	1980*	2006*	2007*	2006*	2004
5050	2001	N/A	N/A	N/A	1996

Advanced Technologies (cont.)

TRS ID	Advanced Communications	Advanced Vehicle Location	Auto. Fare Payment	Auto. Transit Information	Paratransit CAD
5058	prior to 1991	N/A	N/A	N/A	N/A
5066					2005 pending
5117	2001	1999	N/A	1998	1994
5119	N/A	2000*	N/A	N/A	1997
6008	1979	1993			1980
6011	1981	2001			1991*
6018	1998				1998
6024	1981	N/A	N/A	N/A	1996
6041					2000*
6056	1994	2001	N/A	N/A	1997
6082	1983	2001	N/A	N/A	1999*
7001	1972				1999*
7006	1995				1993
7015	1990*	N/A	N/A	N/A	N/A
7035	1980	2001			2001
8001	2001	2003			
8006	N/A	N/A	N/A	N/A	1996
8011	2001*	2001*			2001*
9001	2003	2003	N/A	N/A	1992
9002	yes	2000			1998
9008	2000				
9010	2001	2001	2001	2001	2001
9028	N/A	N/A	N/A	N/A	N/A
9029					1998
9030	N/A	N/A	N/A	N/A	N/A
9032	1975	2001			2000
9034	2000	2003	N/A	N/A	1991
9036	1976*	FY06	N/A	FY06	1995
9062	1991*	2005	N/A	N/A	1991
9078					
9089		2005			1994
9090	1999*				2000*
9121	N/A	N/A	N/A	N/A	N/A
9166	1994	1996	N/A	N/A	1994
9185	1995	N/A	N/A	N/A	yes

Uses of Computer–Aided Dispatching, Part 1

TRS ID	Routes Grouped	Manual Revise Before Use	Revised During Use	Comment	How long planned in advance
0008	Automatically	Yes	Automatically		
0029	Both	Yes	Manually	used to be manually, just migrated to TRAPEZE4	7 days
1003	Manually (10%), Automatically (90%)	Yes	Automatically		
1049	Automatically	Yes	Manually		14 days for subscription; 2 days for demand
2004	Automatically	Yes	Manually		The day before
2008	Automatically	Yes	Both		A basic route matrix is adjusted daily
2080	Automatically	Yes	Both		On–going and continuously revised
2086					
3018	Manually		Manually		
3022	Both, depends on the providers	Yes	Manually		day in advance
3025	Manually		Manually		The day before
3030	Manually	Yes	Manually		
3034	Automatically	Yes	Both		
3044	Manually		Manually		
4001	Automatically	Yes	Both		24 hours
4008	Automatically	Yes	Both		5 days
4012	Automatically	Yes	Manually		1 day
4019	Automatically	Yes	Automatically		24 hours
4022	Automatically	Yes	Both		7 days
4024	Both	Yes	Manually		

Uses of Computer–Aided Dispatching, Part 1 (cont.)

TRS ID	Routes Grouped	Manual Revise Before Use	Revised During Use	Comment	How long planned in advance
4026	Both	Yes	Manually		2 weeks to 2 days
4029	Automatically	Yes	Manually		night before
4035	Automatically	No	Both		Evening prior to service
4041	Automatically	Yes	Manually		
4053	Automatically	Yes	Manually		12 hours
4074	Automatically	Yes	Manually		day before service
5005	Automatically	Yes	Both		day before service
5010	Automatically	No	Manually		Less than 24 hours
5011	Both	Yes	Both		7 days
5017	Automatically	Yes	Automatically		finalized day before
5032	Automatically	No	Automatically		
5050	Automatically	Yes	Manually		day before service
5058	Both	Yes	Manually		1 day
5066					
5117	Automatically	Yes	Other	use radio with driver	
5119	Automatically	Yes	Manually		at least 30 days
6008	Automatically	Yes			
6011	Manually (subscriptions, 35% of trips) Automatically (non–subscript.)	Yes	Manually	Scheduler revise the routes before use	7 days subscription, 1 day non–subscription
6018	Both	Yes	Manually		The night before the route is scheduled
6024	Manually	Yes	Manually		Up to two weeks
6041	Manually	Yes	Manually		6 days
6056	Automatically	Yes	Manually		Up to 4 days in advance
6082	Automatically	Yes	Manually		2 days

Uses of Computer–Aided Dispatching, Part 1 (cont.)

TRS ID	Routes Grouped	Manual Revise Before Use	Revised During Use	Comment	How long planned in advance
7001	Automatically	Yes	Manually		24 hours
7006	Automatically	Yes	Automatically		Routes are perfected the day before service
7015	Automatically	Yes	Automatically		24 hours
7035	Automatically	Yes	Manually		24 hours
8001	Manually	Yes	Manually		daily–weekly–biweekly
8006	Automatically	Yes	Automatically		
8011	Automatically	No			The night before the route is scheduled
9001	Both	Yes	Manually		1-8 days
9002	Automatically	Yes	Manually		Evening prior to service
9008	Manually		Manually		
9010	Automatically	No	Automatically		
9028	Manually		Manually		up to 7 days
9029	Automatically	Yes	Manually		14 days
9030	Automatically	Yes	Manually		days before
9032	Automatically	Yes	Manually		
9034	Both	Yes	Manually		up to 2 weeks in advance for presheduled, but route is built as day progresses using same day requests
9036	Automatically	Yes	Manually		
9062	Both	Yes	Manually		night before
9078	Automatically	Yes	Manually		14 days
9089	Both	Yes	Manually		
9090	Manually				
9121	Both	Yes	Both		afternoon before
9166	Both	Yes	Manually		
9185	Both	Yes	Manually		between one and two days

Uses of Computer–Aided Dispatching, Part 2

TRS ID	What Period	Other Period	Amount of requests	Other Amount
0008	Full–day, Half–day		Full–day	
0029	Full–day		Full–day	
1003	Other	schedules are created after 4pm the day before operations	Other	several routes at a time in sequences
1049	Full–day		Full–day	
2004	Full–day		Full–day	
2008	Full–day		Full–day	
2080	Other	various — shifts are generally 4 to 9 hours in length	Other	Full route
2086				
3018	Full–day		Full–day, One–at–a–time	
3022	Other	Depends on the provider	Other	Depends on the provider
3025	Full–day		Full–day	
3030	Full–day		Full–day	
3034	Full–day		Full–day	
3044	Half–day		Full–day	
4001	Full–day		Full–day	
4008	Other	various routes from 5:30 am, ends at 2:30 am	Other	
4012	Full–day		Other	5 lines on the MDT
4019	Full–day		Other	1 hour
4022	Full–day		Full–day	
4024	Full–day		Full–day	
4026	Full–day		Full–day	
4029	Full–day		Full–day	
4035	Full–day		Full–day	
4041	Full–day		Full–day	
4053	Full–day		Full–day	
4074	Full–day		Full–day	

Uses of Computer–Aided Dispatching, Part 2 (cont.)

TRS ID	What Period	Other Period	Amount of requests	Other Amount
5005	Full–day		Full–day	
5010	Full–day	return trips are added as they occur	Full–day	return trips are added as they occur
5011	Full–day		Full–day	
5017	Full–day, Half–day		Full–day	
5032	Full–day		Full–day	
5050	Full–day		Full–day	
5058	Full–day		Full–day	
5066				
5117	Half–day		Full–day	
5119	Full–day		Full–day	
6008				2-3 requests at a time
6011	Half–day		Full–day	Full day on printed log; 2 hours on MDT
6018	Full–day	We have 4, 6 & 8–hour routes.	Full–day	We give a paper manifest for the entire route whether it is a full or partial day.
6024	Full–day		Full–day	
6041	Full–day		Full–day	
6056	Full–day		Full–day	with changes throughout the day
6082	Full–day, Half–day		Full–day	
7001	Full–day		Full–day	
7006	Full–day	6, 8, 10–hour shifts	Full–day	On a printed passenger manifest and six stops at–a–time on Mobile data terminal.
7015	Full–day		Full–day	
7035	Full–day		Half day	
8001	Full–day		Half day	
8006	Full–day		Full–day	
8011	Full–day		Full–day	

Uses of Computer–Aided Dispatching, Part 2 (cont.)

TRS ID	What Period	Other Period	Amount of requests	Other Amount
9001	Full–day, Half–day		Full–day, Half–day, One–at–a–time	one–at–a–time (additions, cancels, etc.)
9002	Half–day		Other	8-hour shift
9008	Full–day		Full–day	
9010	Full–day		Other	requests up to 100-150 miles at one time
9028	Full–day		Full–day	
9029	Full–day		Full–day	
9030	Full–day		Full–day	
9032	Half–day		Full–day, Other	one–at–a–time for same–day requests
9034	Other	Service is primarily same–day. Route is planned as requests come in.	Other	approx. 1 hour route of trips is sent via MDT
9036	Full–day		Full–day	currently full–day, beginning in FY06, with implementation of MDT units, will give driver next three to five stops
9062	Full–day		Full–day	
9078	Full–day		Full–day	
9089	Full dau		Full–day	
9090	Full–day		Full–day	
9121	Full–day, Half–day		Full–day, Half–day	
9166	Full–day, Half–day		Full–day, Half–day, One–at–a–time	
9185	Full–day, Half–day		Full–day, Half–day, One–at–a–time	eg: Road calls for passenger's incidents/illnesses.