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EVALUATING THE SERVICE QUALITY OF PARATRANSIT SYSTEMS:

AN EXPLORATORY STUDY OF THE TOLEDO AREA REGIONAL TRANSIT AUTHORITY

FINAL REPORT

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DISCLAIMERS

Abstract

Paratransit systems are created to improve mobility, employment opportunities, and access to community services for individuals who are mentally or physically disadvantaged. Though essential for the community, paratransit systems are more expensive to sustain than fixed-route based mass transit systems due to their customized, on-demand service requirements. Thus, it is common that many paratransit systems in the United States experience cost overruns. To cover these cost overruns for paratransit service providers, public transit authorities often subsidize the greater portions of paratransit services. In the era of budget shortfalls, public transit authorities are faced with the dilemma of controlling paratransit costs without deteriorating paratransit services. To better cope with the dilemma, this paper identifies a host of factors such as on-time door-to-door or curb-to-curb services, flexible pickup-/drop-off windows, handling of late-cancellations and no-shows, shared rides, short-notice services, peak-hour feeder services, and overnight service that influence the overall service quality of paratransit in the metropolitan Toledo area using the survey questionnaire.

Keywords: *par-transit systems*, *service quality*, *public transportation*

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1. Introduction

The Americans with Disabilities Act (ADA) of 1990 pressured public transit authorities to reassess the way they serve aging populations and physically-handicapped individuals requiring door-to-door services with a fare scheme comparable to regular transit. Due to the rapid growth of aging baby boomers and disabled Iraq War veterans, the demand for paratransit services is expected to double over the next decade. In response to the increased demand for paratransit services, public transit authorities have attempted to incorporate paratransit services as an integral part of the mass-transit system. In general, paratransit services refer to pre-scheduled, demand-responsive public transportation services that provide curb-to-curb access for people who are unable to use fixed-route mass transit services due to their mental or physical disabilities. Transit system challenges facing those with disabilities include:

- Passengers who are unable to get on, ride, or get off an accessible public transit vehicle without others' help;
- Passengers who are unable to get an accessible public transit vehicle because it does not have a lift;
- Passengers who are unable to get around bus stops or subway stations on their own due to their physical or cognitive handicaps.

The important benefits of paratransit services are to: (1) increase travel choices; (2) improve mobility; (3) enhance community environments; (4) impose a market discipline on public transportation; (5) make poor neighborhoods more accessible; (6) help stimulate advanced transportation technologies (Cervero, 1997). In contrast with the fixed route/schedule based public transportation system, paratransit is more expensive on a per-passenger basis due to its customized service requirements for user-specified parameters of origin/destination and time. According to the American Public Transit Association (APTA), the total operating expense of paratransit services in the United States surpassed $1.2 billion with a meager $173 million collected in fares (American Public Transit Association, 2009). APTA also reported that paratransit ridership made up 2% of mass transit ridership nationwide but accounted for 13% of operating costs in 2008 (Kern, 2009).

Controlling paratransit operating costs while meeting service demand remains the greatest challenge facing public transit authorities and paratransit service providers. This includes the Toledo Area Regional Paratransit Service (TARPS) which is a subdivision of the Toledo Area Regional Transit Authority (TARTA). TARPS operates in compliance with ADA of 1990, and, in fact, goes above and beyond what the ADA requires. Its fully equipped special vehicles cover all of the Toledo metropolitan area including Maumee,

Rossford, Perrysburg, Ottawa Hills, Waterville, Spencer Township, Sylvania, and Sylvania Township. TARPS was created in 1988 to make public transportation a more viable and convenient option for Toledo residents with special needs. To cope with steady rises in operating costs, TARPS outsourced paratransit services to an external private corporation called First Transit for nearly two decades. However, in the wake of increasing concerns about service quality among the TARPS riders, TARPS started an in-house operation of paratransit services in October, 2008 with the hopes of improving its service quality. Since the aforementioned change in paratransit operations cannot warrant immediate success without measuring the paratransit service quality, there is a growing need for the development of a service improvement strategy that will allow TARPS to evaluate the service quality of current operations, find room for improvement based on the riders' feedback, and prioritize certain service elements that are considered important to high-quality paratransit services. In response to such a need, this paper aims to achieve the following study objectives:

- Develop profiles of paratransit ridership;
- Capture the paratransit service patterns;
- Identify key service attributes (or factors) essential for high-quality paratransit services;
- Evaluate the perceived service quality of current paratransit operations from the rider's perspective;
- Recommend ways to improve current paratransit services based on the rider's feedback.

2. Relevant Literature

Despite a growing interest in paratransit services among the general public, the published literature evaluating the quality of paratransit services has been nearly non-existent. However, some attempts were made to assess the effectiveness of paratransit services from financial or administrative perspectives. For instance, Jackson (1982) compared the real costs of service provided by major subsidized paratransit operations to that of for profit private-sector run operations in the New England region. He discovered that cost figures per passenger trip by non-profit and publicly-owned paratransit services were seriously underestimated and did not truly reflect the actual costs or the cost-efficiency of the paratransit services provided. From a different angle, Bower (1991) investigated the impact of an automated paratransit routing scheduling system called COMSIS on the operating cost and service quality of paratransit services. As expected, COMSIS turned out to be useful for reducing scheduling errors, reducing the cost of generating schedules, and identifying traffic patterns. Thus, Bower concluded that COMSIS improved the overall efficiency of paratransit service quality. Similarly, Chira-Chavala and Venter (1997) analyzed the impact of automated vehicle and passenger scheduling methods on the operating costs of paratransit systems. They found that such methods saved unit paratransit transportation costs by 13%. Further extending to the earlier works of Chra-Chavala and Venter, Pagano et al. (2002) assessed the impact of the computer-assisted scheduling and dispatching (CASD) systems on the service quality of paratransit services in central Illinois. They found that CASD systems allowed passengers to experience less riding time and greater on-time services at both pickups and drop-offs and subsequently enhanced their overall satisfaction with the paratransit services. On the other hand, the use of CASD to promote higher vehicle productivity resulted in slightly longer ride times. In addition, callers to the system experienced being put on hold more often. Overall, they concluded that the quality of service was positively affected by the implementation of the CASD system. More recently, Fu et al. (2007) evaluated efficiency levels of individual paratransit systems in Canada with the specific objective of identifying the most efficient paratransit systems and the sources of their efficiency using data envelopment analysis (DEA). Through identification of the most efficient systems along with the key influencing factors, they developed new paratransit service policies and operational strategies for improved resource utilization and quality of services.

As discussed above, most of these prior studies focused on the efficiency of particular paratransit systems (e.g., automated paratransit scheduling and routing) in terms of their cost saving opportunities and service deliveries. None of these prior studies, however, examined who actually used paratransit services, how much paratransit riders are either satisfied or dissatisfied with current paratransit services, and what the sources of their

satisfaction or dissatisfaction with current paratransit services are. To overcome the shortcomings of the existing paratransit studies, we first attempt to answer the following research questions:

1. What is the typical profile of a paratransit rider? Which type of paratransit services are commonly used by the rider?
2. What constitutes the service quality of paratransit systems?
3. How can we prioritize certain service attributes over the others in improving the service quality of paratransit systems?
4. Which service delivery methods are most desirable for paratransit riders?

3. Research Methodology

To address the aforementioned research questions, we conducted an exploratory study via questionnaire surveys and personal interviews primarily targeting paratransit riders in the Toledo metropolitan area. Given the paucity of paratransit studies and a couple of "what" questions raised in the prior section, an exploratory study is justified and favored over other research methodologies (e.g., Yin, 2003; Mahmoud and Jemni, 2008). A five-page questionnaire was developed in January of 2009 based on the review of the past paratransit literature and then later pre-tested and revised based on the input from TARTA administrators, TARPS officials, and representatives from Toledo area veterans associations, such as the American Region Walter Weller Post 135, whose members frequently use the TARPS paratransit services. This questionnaire was distributed to 50 randomly selected paratransit riders in the Toledo metropolitan area who are categorized as the periodic users of TARPS services by the TARPS officials. As summarized in Table 1, a typical respondent to the questionnaire is a senior citizen (over 60 years old) whose annual income level is below the federal poverty threshold ($10,830 for one-person household; $14,570 for two-person household). However, to increase variability in the data and generalizability of the survey results, the survey instrument was targeted for various groups of TARPS riders including young people under age 20. These groups included people with different gender, marital status, racial background, age and income level (see Table 1).

Table 1. Demographic Profiles

Gender		***Percentage***
	Male	60.5%
	Female	39.5
Marital status		***Percentage***
	Single	11.4%
	Married	57.1
	Divorced	11.4
	Widowed	20.0
Racial background		***Percentage***
	Caucasian	45.9%
	African-American	48.6
	Other	5.4
Age		***Percentage***
	Under 20	13.2%
	20-29	5.3
	30-39	7.9
	40-49	7.9
	50-59	23.7
	Over 60	42.1
Income level		***Percentage***
	0-$9,999	82.1%
	$10,000-$19,999	10.7
	$20,000-$29,999	3.6
	$30,000-$39,999	3.6

Of the 50 questionnaires, 38 valid responses were received producing a total response rate of 76% which far surpassed the targeted overall response rate of more than 20% for a valid assessment (Yu and Cooper, 1983). For example, Malhotra and Grover (1998) observed that a response rate over 20% was needed for a positive assessment of questionnaire-based survey results. Since a response rate below 20% for a mail survey is not uncommon in the supply chain literature (Mentzer et al., 1990; Murphy and Daley, 1994; Mentzer and Gandhi, 1995; Pedersen and Gary, 1998; Wood and Nelson, 1999; Lieb and Miller, 2002; Min and Lambert, 2002; Koh et al., 2005; Min, 2006; Singh et al., 2006), we avoided a mail survey. Instead, a group of seven graduate students rode TARPS vehicles together with their passengers and interviewed each passenger who was willing to answer the questions to increase the response rate.

The questionnaire contained various questions related to the demography of the paratransit riders, paratransit ridership patterns (e.g., frequency of TARPS usage, TARPS

fare, waiting time, boarding time, transit time, purposes of trip, types of requested mobility aids), the relative importance of service attributes to paratransit service quality, the perceived service quality of current TARPS services, and the potential impact of a managerial change from outsourcing to in-housing on TARPS service performances. The questionnaire has 11 to 15 items scored on a five point Likert scale ranging from either *extremely important* (1) to *not at all important* (5) or *agree strongly* (1) to *disagree strongly* (5). The *Statistical Packages for Social Sciences (SPSS) for Windows* (2008) was used to analyze the data collected from the sample.

More than half of the respondents were male (60.5%) and married (57.1%). Nearly half of the respondents (48.6%) were African-American due in part to the fact that TARPS current routes are heavily concentrated in the inner city area where African-American populations are predominant. Slightly less than half of the respondents (42.1%) turned out to be senior citizens over 60 years old, although 13.2% comprised school-aged, young children under 20 years old. Also, a vast majority (82.1%) of the respondents represented people well below the poverty line (annual income less than $10,000). This fact indicated that TARPS has become an important means of transportation for low-income people who cannot afford to use other more expensive means of transportation. It also implied that a stiff fare increase would likely hurt the TARPS ridership.

4. Survey Results and Discussions

4.1 Paratransit Ridership Patterns

Since paratransit routes and schedules are often affected by paratransit ridership patterns, we decided to examine the travel behaviors and tendency of TARPS riders. When asked about the frequency of TARPS rides, a majority (78.9%) of the respondents indicated that they used TARPS at least twice a week (Table 2). This result implied that TARPS service demand would not fluctuate substantially due to the riders' tendency to use TARPS services periodically. The periodic use of TARPS services also means that TARPS routes and schedules do not have to be changed frequently. Indeed, we found that 83.3% of TARPS riders were using the fixed-route TARPS services as opposed to flexible, individualized TARPS services. In an effort to improve on-time performances of TARPS services, we attempted to estimate the total amount of TARPS vehicle boarding and transit time. An overwhelming majority (89.5%) of the respondents spent less than five minutes to get on board. Also, a vast majority (81.1%) of the respondents spent no more than 45 minutes on the TARPS vehicle. This finding makes sense because TARPS services are heavily concentrated in the downtown area as opposed to the scattered Toledo suburbs such as Maumee, Sylvania, and Perrysburg.

Table 2. TARPS Ridership Patterns

Frequency of TARPS rides	***Percentage***
More than once a day	13.2%
Once a day	22.1
Once every 2 to 3 days	44.7
Once every 4 to 6 days	2.6
Once a week	7.9
Once every 2 to 4 weeks	5.3
Once a month	2.6
Less than once a month	2.6
Time to get on-board	***Percentage***
Less than one minute	18.4%
1-3 minutes	50.0
3-5 minutes	21.1
6-10 minutes	2.6
More than 10 minutes	7.9
Total traveling time	***Percentage***
Less than 15 minutes	10.8%
15-30 minutes	48.6
30-45 minutes	21.6
45-60 minutes	10.8
More than 60 minutes	8.1

Time needed to make an arrangement with TARPS	***Percentage***
One day	42.9%
2-3 days	34.3
4-5 days	5.7
5-7 days	14.3
More than 7 days	2.9
Duration of the use of TARPS	***Percentage***
Less than 6 months	5.4%
6-12 months	16.2
1-3 years	24.3
3-5 years	24.3
More than 5 years	29.7
Purpose of trip	***Percentage***
Commuting to or from work	18.4%
Shopping	23.7
Excursion	2.6
Medical treatment	34.2
Others	21.1
Mobility aids	***Percentage***
Crutch	4.3%
Wheelchair	4.3
Walker	56.5
Service animal	8.7
Others (e.g., cane)	26.1

Although paratransit services are often provided on-demand, late call-in requests at short notice may pose difficulty in scheduling the service vehicle within the desirable time windows (especially for occasional door-to-door services). With that in mind, TARPS riders were asked to estimate the time needed to make a TARPS service arrangement. Somewhat surprisingly, a majority (77.2%) of the respondents indicated that it took no more than 3 days of notice to make an arrangement with TARPS. Such a relatively quick response to rider requests may explain why a majority (71.4%) of the respondents were repeatedly using the TARPS services for a long time (i.e., a year or longer). The most common purpose of TARPS trips happened to be a visit to doctor's office or medical clinics for medical treatments. The second most popular purpose of trips was shopping. These facts revealed that TARPS trips are frequently destined to hospitals, medical clinics, shopping malls, and groceries which are mostly concentrated in the downtown Toledo or suburban shopping districts (e.g., Westfield Franklin Park Mall in Sylvania or Levis Commons in Perrysburg). Thus, the TARPS routes should be restructured in such a way that TARPS riders could have greater access to local medical facilities and/or shopping centers. Finally, when asked about the most frequently used mobility aid, more than half (56.5%) reported use of a walker. In particular, a cross-tabulation of age and mobility aid indicated that those responders in their 50's tended to use the walker more

frequently than other age groups. Considering this pattern, the TARPS vehicle should be equipped with the door that can easily accommodate riders with walkers.

4.2 Paratransit Service Attributes

In an effort to identify the most important determinants influencing the service quality of paratransit systems, we asked the respondents to indicate the paratransit service attributes that they are most appreciative of on a five-point Likert scale (1 = extremely important, 5 = not at all important). Myers (1999) suggested that importance ratings were one of the most straightforward but effective ways of measuring customer satisfaction and determining the relative importance of service attributes to service quality. As recapitulated in Table 3, the five most important service attributes that were most frequently cited by the respondents were: (1) door-to-door services; (2) driver courtesy; (3) passenger safety; (4) proximity to the passenger's residence; (5) vehicle amenity (e.g., air conditioning, heating).

Table 3. The Importance of TARPS Service Attributes

Service Attributes	Average Degree of Importance[1]	Rank
Door-to-door services	1.27 (.626)	1
Driver courtesy	1.31 (.758)	2
Passenger safety	1.32 (.768)	3
Proximity to passenger's residence	1.33 (.692)	4
Vehicle amenity (e.g., air conditioning, heating)	1.35 (.646)	5
Amount of fare	1.44 (.607)	6
Call-in services	1.44 (.705)	7
On-time performance	1.44 (.705)	7
Proximity to passenger's school or workplace	1.46 (.859)	9
Service response time (e.g., waiting time)	1.54 (.780)	10
Quality of prior services	1.61 (.761)	11
Less interrupted services	1.63 (.751)	12
Customer service follow-up	1.76 (.912)	13
Short rides (e.g., fast routes)	1.90 (1.044)	14
Service hours (e.g., 24 hour services)	2.24 (1.300)	15

[1]**Note:** Numbers in parentheses are standard deviations.
Scale: 1 = extremely important, 5 = not at all important

It is intriguing to note that although typical paratransit systems are intended to offer curb-to-curb services, TARPS riders tend to prefer door-to-door services. A vast majority (78.8%) of the respondents believed that door-to-door services are extremely important to paratransit service quality. This preference is understandable given that the current

TARPS service areas are in relatively cold climate during the winter time. For a similar reason, TARPS riders seem to value a close proximity of the TARPS bus stop to their residence. They also appreciate courteous and safe drivers who have face-to-face contact with the passengers. This finding is not surprising because the service employee (i.e., driver)'s relationship with the service recipient (i.e., passenger) often mirror service performance and thus employee courtesy is often considered to be one of the most critical service attributes that dictate service quality in any service environment (Berry et al., 1985). On the other hand, TARPS riders were not really concerned with service hours (e.g., whole day availability or overnight TARPS services), fast transit time, and service follow-up.

After identifying key determinants of service quality, we asked the respondents how much they are satisfied with current TARPS services. They seem to be generally satisfied with the way that TARPS employees, such as drivers and telephone operators, treated them, while they expressed some concern about the way TARPS officials handled customer complaints (see Table 4). In particular, the level of passenger satisfaction with the TARPS services was significantly improved after TARPS decided to offer paratransit services by their own employees rather than contracting out those services to the private sector (i.e., private company called First Transit) as shown in Table 5. To elaborate, when TARPS services were outsourced, only 73.5% of the TARPS riders were either very or somewhat satisfied with TARPS services, while 20.3% of the TARPS riders remained either somewhat or very dissatisfied with TARPS services. However, when TARPS services were handled in-house, all (100%) of the TARPS riders indicated that they were either very or somewhat satisfied with TARPS services.

Table 4. The Service Quality of Current TARPS Services

Statements	Average Extent of Agreement[1]	Rank
Drivers are driving cautiously	1.34 (.684)	1
Fare is reasonable	1.51 (.818)	2
Drivers are courteous	1.57 (.917)	3
Vehicle is well equipped	1.66 (1.056)	4
Telephone operators are courteous	1.71 (.970)	5
Service is available all day	1.94 (1.282)	6
Pickup/drop-off is timely	2.00 (1.085)	7
Service is seldom interrupted	2.00 (1.163)	8
Offer fast call-in services/short wait time	2.03 (1.000)	9
Wait is short	2.12 (.992)	10
TARPS officials handle complaints well	2.34 (1.153)	11

[1]**Note:** Numbers in parentheses are standard deviations.
Scale: 1= agree strongly, 5= disagree strongly

Table 5. The Impact of Management Changes on the TARPS Service

Outsourcing vs. In-housing	Average Degree of Satisfaction[1]	t-statistics	Level of significance
Pre-October 2008 (Use of the subcontractor)	2.09 (1.329)	t = 2.707	$\alpha = .011$
Post-October 2008 (In-housing)	1.50 (.508)		

[1]**Note:** Numbers in parentheses are standard deviations.
Scale: 1= very satisfied, 5= very dissatisfied

5. Conclusions and Managerial Implications

This study is one of the first attempts to investigate the effectiveness of paratransit services and identify key determinants influencing paratransit service quality. This exploratory study was conducted based on the data collected from the surveys of paratransit riders in the Toledo metropolitan areas. The study reveals various findings that have very important practical implications. The findings worthy of close attention are:

First, although it is safe to say that riders are generally satisfied with the overall paratransit services, there is still room for improvement. For example, although customer service follow-up is shown to be relatively unimportant to the riders, they felt that TARPS officials should handle complaints better than they do. Also, TARPS riders were concerned about untimely performance (lag time) of pick-ups and drop-offs. Especially in harsh winter weather conditions, long waits at the bus stop can be agonizing for TARPS riders and subsequently deteriorate TARPS service performances. To address these concerns, TARPS may consider exploring the development of a pass card system for frequent riders. The pass card system would allow TARPS drivers to quickly identify passengers boarding the buses. The pass cards also could be used for the purpose of processing passenger fares more quickly on TARPS if the cards were part of a technological upgrade that replaced the current money fare boxes on TARPS buses, thus eliminating the need for drivers having to wait for passengers to deposit the appropriate fare into the current lockbox on board. Another advantage of using the pass cards for rider fare processing would be the possible development of a new section on the TARPS website where people could prepay for fares that would then be credited to their passenger cards, thus eliminating the need for money to have to be removed from the TARPS buses and counted manually for TARPS records and bank deposits.
Second, the rider survey revealed that call-in services to schedule a trip on TARPS are not as efficient as riders would like them to be. For this reason, TARPS officials should consider utilizing an online reservation system via the TARPS website. The online reservation system would not only enable TARPS officials to schedule TARPS vehicles ahead of time, but also eliminate the hassles and waiting time associated with call-in services and thus ease the burden of call-center operators.

Third, in an effort to reduce operating costs many paratransit systems such as TARPS considered contracting for services with an outside service provider. As a matter of fact, the American Transit Association reported that 58% of the paratransit expenditures were payments to outside third-party contractors (Lav and Mathias, 2007). For nearly two decades, TARPS hired a company called First Transit (a subsidiary of Greyhound, Inc.) as the private contractor which managed TARPS services and succeeded in controlling

operating costs (especially driver wages). However, ever since paratransit services were outsourced, TARPS received numerous complaints from their riders about deteriorating service quality. To beget better service quality, TARPS decided to operate its paratransit services with in-house resources in October, 2008. To verify the premise that in-house operations improved paratransit services, we compared the level of passenger satisfaction during outsourcing periods to that during in-house periods and discovered that TARPS riders were more satisfied with the paratransit services rendered by TARPS than they were during pre-October 2008. This finding makes sense since TARPS is still involved in the relatively small volume of paratransit trips and thus the amount of TARPS services is manageable internally by the limited TARPS resources.

Finally, given that one fourth (25.7%) of the current TARPS riders did not need any physical assistance for boarding the TARPS vehicle and a vast majority (83.3%) of the TARPS riders used the fixed route, TARPS managers should consider either migrating those TARPS riders who do not need a wheel-chair access and physical assistance for boarding to the fixed route, regular public bus transportation system or developing a separate route and schedule with a call-a-ride van/taxi-cabs for TARPS riders who do not need daily paratransit services. This recommendation would allow TARPS managers not only to use fewer vehicles, but also to utilize smaller and more fuel-efficient vans/taxi cabs instead of buses and consequently would help reduce the operating costs of TARPS services.

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