MEDICAL TRANSPORTATION PROGRAM IMPACT

ON RURAL TRANSIT IN TEXAS

RESOURCE-BASED COST ALLOCATION METHODOLOGY

A Thesis

by

ANDREA SUZANNE EDRINGTON

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER IN URBAN PLANNING

December 2010

Major Subject: Urban and Regional Planning

MEDICAL TRANSPORTATION PROGRAM IMPACT

ON RURAL TRANSIT IN TEXAS

RESOURCE-BASED COST ALLOCATION METHODOLOGY

A Thesis

by

ANDREA SUZANNE EDRINGTON

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER IN URBAN PLANNING

Approved by:

Chair of Committee,	Eric Dumbaugh
Committee Members,	Timothy Lomax
	Luca Quadrifoglio
Head of Department,	Forster Ndubisi

December 2010

Major Subject: Urban Planning and Regional Planning

ABSTRACT

Medical Transportation Program Impact on Rural Transit in Texas
Resource-Based Cost Allocation Methodology. (December 2010)
Andrea Suzanne Edrington, B.A., The University of Texas at Austin
Chair of Advisory Committee: Dr. Eric Dumbaugh

Coordination of health and human service transportation programs in rural communities provides a source of sustainable funding for public transit. Significant funding is available for non-emergency medical transportation (NEMT) for Medicaid-eligible clients. In 2009, 21 of the 39 rural transit districts in Texas received NEMT funds under the Texas Medical Transportation Program (MTP). The benefits of MTP funds to rural transit districts are an additional funding source, a consistent cash flow through regular reimbursement for MTP services, and the opportunity to maximize resources (vehicles, miles, hours) by combining MTP passenger trips with general public transit. However, MTP may also increase resources required (miles, hours) to deliver transportation due to program service requirements, resulting in a higher cost per passenger trip and reduced productivity due to longer trip lengths and time. The purpose of this research is to develop a resource-based cost allocation methodology to accurately reflect cost and resources by MTP and general public passenger trip and apply the methodology to five case studies to analyze the impact of MTP trips on general public transit service.

Results of the case study analysis reveal that in four of the five case studies, MTP is more resource intensive than general public transportation. MTP passenger trips have longer trip lengths than general public trips ranging from additional mileage per passenger trip of 13 to 40 miles. Using a resource-based cost allocation methodology, in four of the five case studies, MTP trips have higher operating cost per boarding as compared to general public service ranging from a difference of $12 to as much as a $32

per passenger trip. Four of the five case study rural transit districts do not cover the full cost of providing MTP service with MTP revenues with a shortfall ranging from approximately $6.00 per passenger trip to $19.00 per passenger trip. The cumulative impact of MTP on the Texas Performance Funding Formula was found to be positive resulting from the significant positive impact on the local investment indicator. However, the additional funding generated by MTP in the funding formula is still not sufficient to compensate fully for the deficits found.

DEDICATION

This thesis is dedicated to my husband, Rick Edrington. Thank you for the last three and a half years of shopping and cooking dinner nearly every night – your love and support is appreciated. I dedicate this thesis to Jeff Arndt. Thank you for allowing me to discuss homework assignments over lunch, generously offering experienced insight, making me laugh and for believing in me. I dedicate this thesis to Linda Cherrington. Thank you for pushing me to be better, demanding quality, generously providing thought provoking feedback, and allowing me the flexibility to balance work, family and education. Lastly, I dedicate this thesis to Dr. Katie Turnbull who was the first to ask, "Have you considered a master in urban planning?" Our words can have profound impact on others. Thank you for your encouragement and support throughout this journey.

ACKNOWLEDGEMENTS

I would like to thank my committee chair, Dr. Eric Dumbaugh, who motivates his students to produce high quality work and for motivating me to expand my outlook and approach to transportation research. I would like to thank my committee members, Dr. Tim Lomax and Dr. Luca Quadrifoglio, for their guidance and support in this research. I would like to thank the quality professors at Texas A&M University who guide and challenge their students to be critical thinkers and to positively contribute to our communities.

I would like to thank Dr. Judy Perkins, Professor, and Dr. Yonggao Yang, Assistant Professor, Prairie View A&M University, for participation in design of methodology to determine medical transportation program case studies. I would also like to thank representatives of the agencies that provide public transportation in Texas who provided information and responded to fact-finding questions.

This research was funded as a special study in RMC 0-6205, *Benchmarking and Improving Texas Rural Public Transportation Systems,* by the Texas Department of Transportation (TxDOT), Federal Transit Administration (FTA), and the Federal Highway Administration (FHWA).

TABLE OF CONTENTS

Page

LIST OF FIGURES

Page

LIST OF TABLES

Page

INTRODUCTION

Providing coordinated transportation in rural communities can maximize the use of resources to provide cost effective transportation. Rural communities receive transportation funding from a variety of sources including Federal, state, local governments, health and human service agencies and other public and private entities. Texas rural transit districts serve as coordinators of service pooling resources and funding to provide transportation across a variety of programs. Coordinating transportation can lower administrative costs, avoid duplication of services, increase productivity, improve cost effectiveness, and enhance mobility in rural communities. Without coordination of service, transit service can be disjoint resulting in a "proliferation of small organizations that provide transportation … each owning a few vehicles that can be used only for their agency's own designated clients and purposes (Burkhardt, Nelson, Murray, & Koffman, 2004)." In Texas, rural transit districts have gained from coordinating general public transportation with other transportation programs including Area Agency on Aging, Head Start, Elderly Persons and Persons with Disabilities, Job Access Reverse Commute, New Freedom and welfare-to-work programs. Rural transit districts recognize the need for funding from many sources to remain sustainable. Medicaid is often the largest funder of transportation in regions with Medicaid non-emergency medical transportation (NEMT) expenditures representing almost 20 percent of the entire federal transit budget (Rosenbaum, Lopez, Morris, & Simon, 2009, p. 1). In rural areas, NEMT funds are often greater than public transit funds (Hosen & Fetting, 2006, p. 1). In Texas, 21 of the 39 rural transit districts in 2009 provided non-emergency medical transportation under the Texas Medical Transportation Program (MTP).

Texas rural transit districts have gained by coordination recognizing MTP provides an additional funding source, a consistent cash flow through regular

---

This thesis follows the style of the *Journal of the American Planning Association.*

reimbursement for MTP services, and the opportunity to maximize community resources. However, one-on-one discussions with Texas transit districts revealed that rural transit districts are concerned about the impacts that operating MTP service may have on operations and funding. For a coordinated rural demand response transit system, MTP may enhance system operating performance if the additional MTP patrons are scheduled to share rides with general public patrons, increasing the trips per unit of service provided. However, MTP may also reduce performance in rural areas where MTP trips have longer trip lengths to provide transportation from rural areas into urban areas (outside of the general public service area) where specialized medical facilities are located.

The difficulty in understanding the MTP impact stems from the fact that most transit agency' vehicles serve customers with a variety of trip purposes. The co-mingling of MTP passengers with general public passengers complicates determining the cost of MTP services. To provide a methodology that accounts for the differences in resources used by trip type, a resource-based cost allocation methodology was developed. This resource-based cost allocation method allocates costs based on the percentage of passenger miles, passenger hours and administrative labor by trip type to take into account the average trip lengths and average trip times that may differ across trip types served. For example, if the average trip is five miles in length for trip type A and the average trip length for trip type B is 25 miles in length, the costs would differ significantly between the two trip types.

The resource-based cost allocation methodology is used in this study to analyze the impact of MTP trips on general public transit service by rural transit districts in Texas. The purpose of this research is to apply the resource-based cost allocation methodology to five case studies of rural transit districts that provide MTP service in order to provide information in determining:

- the resources required to provide MTP services and general public transit service by rural transit districts;
- the results of a resource-based cost allocation methodology to determine the cost per boarding for MTP and general public transit service;
- the comparison of MTP cost per boarding using a resource-based cost allocation or a traditional boardings-based cost allocation methodology;
- the analysis of cost for MTP service and revenues earned through contracts to provide the service;
- the estimated impact, if any, of providing MTP service on general public transit service; and,
- estimate the impact of MTP on the performance indicators for the Texas Transit Funding Formula.

This research report is organized as follows:

- research context – literature review, MTP federal requirements and the State of Texas MTP Program;
- methodology for case study selection and resource-based cost allocation;
- resource-based cost allocation research results;
- performance indicator impact for the Texas Transit Funding Formula for the five rural transit district case studies; and,
- summary of research findings.

RESEARCH CONTEXT: LITERATURE REVIEW, FEDERAL REQUIREMENTS AND STATE OF TEXAS MTP PROGRAM

The purpose of this section is to provide general information for the context of the research. This section outlines the literature review, federal and state MTP requirements, MTP administrative and operating structure and provides the number of MTP passenger trips provided by rural transit districts in Texas.

LITERATURE REVIEW

To develop a better understanding of rural public transit operation of NEMT, a literature review was conducted. This review examined reports, guidebooks, studies and research in:

- rules, regulations and history of NEMT (Rosenbaum, Lopez, Morris, & Simon, 2009) (Health Consumer Alliance, 2006) (42 U.S.C.) (TAC 380.201);
- coordinated transportation services including public transit and NEMT coordination efforts (Hosen & Fetting, 2006) (Burkhardt, Nelson, Murray, & Koffman, 2004) (Burkhardt, Koffman, & Murray, 2003);
- NEMT service delivery, cost benefit, cost effectiveness (Hanley, Sikka, Ferguson, Kober, & Sun, 2008) (Bradley, et al., 1998) (Borders, 2006) (The Hilltop Institute, 2008) (American Public Human Services Association, 2003) (Hughes-Cromwick, Mull, Bologna, Kangas, Lee, & Khasnabis, 2005);
- rural public transportation (Burkhardt, Hedrick, & McGavock, 1998);
- public transportation cost allocation (Minnesota Department of Transportation, 2005) (RLS & Associates, Inc., 2006); and,
- public transportation performance measures (Ellis & McCollom, 2009) (Ryus, et al., 2010).

A better understanding of issues relating to factors in providing sustainable coordinated transportation can be derived from the literature. TCRP Report 101 authors state that transportation coordination strategies typically help address cost effectiveness

by pooling vehicles and combining administrative operations (Burkhardt, Nelson, Murray, & Koffman, 2004, p. 6)." These authors point to cost allocation as a coordination obstacle and can be resolved by working through cost sharing arrangements; also recognizing that driver hours and miles cannot be separated and tracked easily (Burkhardt, Nelson, Murray, & Koffman, 2004, p. 39). TCRP Synthesis 65 (Hosen & Fetting, 2006) examines tasks necessary for successful public transit and NEMT partnerships. On success factor of coordination highlighted is that providing NEMT should "make business sense" – ensure adequate funding for NEMT rather than the transit agency subsidizing NEMT.

A better understanding of industry estimation of NEMT cost and resources needed to provide NEMT can be derived from the literature. The University of Iowa study (Hanley, Sikka, Ferguson, Kober, & Sun, 2008) provides cost estimates of NEMT recognizing location (urban and rural) and mode (ambulatory, fixed route, taxi, bus, etc.) differences in cost per unit and delivery of service (brokerage) impacts on costs. Authors derive average costs based on NEMT contract agreements comparing to National Transit Database (NTD) data for reasonableness. Authors based costs of NEMT services on overall averages by mode and area (urban or rural) but note that discretion should be used in using these average estimates as "marginal costs can play a significant role" (for example when trip distances are large). The TCRP 29 Report authors (Hughes-Cromwick, Mull, Bologna, Kangas, Lee, & Khasnabis, 2005) also compare NEMT costs by using NTD and Request for Proposal average costs by mode separating by urban and rural transit providers – also recognizing the difficulty in distinguishing the cost of a NEMT trip from other transit trips in a shared ride service.

Stephen Borders research provides insight to the reasons that rural NEMT service are more resource intensive. Borders research examined the distance and travel time of Medicaid recipients (age 0 to 20) in urban and rural areas of Texas (Borders, 2006). Borders conducted a survey and found that a substantial number reported traveling very

long distances averaging 30.8 miles for MTP users. Border states that more and more practicing physicians are opting out of the Medicaid program leading to longer MTP travel especially in rural areas – "some respondents indicated traveling up to 700 miles and several hours one way for their medical care (Borders, 2006, p. 86)."

Minnesota Department of Transportation, *Coordination Action Plan,* provides best practices for implementing a fully allocated cost methodology by program. Four transit agencies (Kansas Department of Social and Rehabilitation Services, Maryland Transit Administration, Alabama Department of Transportation and Tri-Cap Transit Connection) are highlighted using a method of allocating costs based on hours and miles of service by program rather than the average cost across all services.

While the aforementioned studies point to cost allocation as a factor providing sustainable coordinated transportation (particularly in rural areas), cost allocation methodology is lacking for shared ride services. This research provides a resource-based cost allocation methodology for demand- response transit systems.

MEDICAL TRANSPORTATION PROGRAM SERVICE FEDERAL REQUIREMENTS

Federal requirements codified as Title XIX of the Social Security Act and accompanying regulations state that Medicaid programs provide coverage of medical care and services, and "fulfill administrative requirements necessary to operate the Medicaid program efficiently (Health Consumer Alliance, 2006)." Among these administrative requirements is the mandate that a State plan "specify that the Medicaid agency will ensure necessary transportation for recipients to and from providers and describe methods that the agency will use to meet this requirement. The mandate to assure necessary transportation stems from provisions of the Social Security Act and regulations requiring that medical assistance are:

- available in all political subdivisions of the State (U.S. Code Title 42) (1);
- provided with reasonable promptness to all eligible individuals (2);
- furnished in the same amount, duration, and scope to all individuals in a group (3);
- provided in a manner consistent with the best interests of the recipient (4);
- available to eligible recipients from qualified providers of their choice (5) and,
- provided in accordance with methods of administration found necessary by the Secretary for proper and efficient operation of the state plan (6).

State Medicaid expenses are matched by the federal government at varying rates.

MEDICAL TRANSPORTATION PROGRAM IN TEXAS

In Texas, MTP rules are found under Texas Administrative Code (TAC) Title 1, Part 15, Chapter 380. Eligible MTP recipients are "to receive reasonable transportation to health care services if medical necessity exists, no other means of transportation are available, the mode of transportation is the most cost-effective mode available that does not endanger the recipient's health and the facility is reasonably close to the prior authorized health care service that meets the recipient's health care needs (TAC 380.201).

In Texas, medical transportation is operated through public/private transportation companies and administered by the state Health and Human Services Commission. Texas operates MTP on a statewide basis through a network of Transportation Service Area Providers (TSAPs) that coordinate services in each of the 24 service areas

---

[1] 42 U.S.C. § 1396a(a)(1).
[2] 42 U.S.C. § 1396a(a)(8).
[3] 42 U.S.C. § 1396a(a)(10)(B)(ii); 42 C.F.R. § 440.240(a).
[4] 42 U.S.C. § 1396a(a)(19).
[5] 42 U.S.C. § 1396a(a)(23).
[6] 42 U.S.C. § 1396a(a)(4)(A).

corresponding to the areas of the Texas Association of Regional Councils. TSAPs are directed to enter into subcontract agreements with public and private transportation service providers to ensure transportation availability to all eligible recipients. The scope of services requires that TSAPs ensure demand response transportation services are provided for all recipients in a timely, satisfactory and acceptable manner to meet the needs of recipients.

The two categories of eligible MTP trips include the following:

- Reasonable Trips: Transportation within a recipient's local community, county of residence, or county adjacent to a recipient's county of residence where the recipient wishes to maintain an ongoing relationship and establish a relationship with a health care provider of their choice.
- Special Trips: Transportation to and from a recipient's county of residence and beyond the adjacent county, where additional health care requirements can be met when the appropriate health care service(s) are not available locally.

Service delivery requirements are Monday through Saturday for appointments scheduled as early as 5:30 a.m. and as late as 7:00 p.m. Other scheduling requirements include:

- recipients are not delivered to program eligible service appointments prior to the time that the facility is open for business,
- recipients arrive at program eligible service appointments on-time, but no more than one hour prior to the scheduled appointment time, and
- recipients depart program eligible service appointments no more than one hour from receipt of recipient request for return trip.

TSAP contracts are priced on a cost per one-way trip for each of the two trip category types - reasonable and special. MTP does not reimburse the costs for no-show trips (where a patron misses the scheduled trip).

Although MTP service can be provided by volunteers, gas vouchers, and bus tokens, a demand response transportation service provides the majority of MTP service. Demand response transportation services use a reservation system. Qualified passengers request a reservation in advance for a pick-up and drop-off at the origin and destination. Pick-ups and drop-offs may occur anywhere within the demand response service area or the designated MTP provider location.

MTP Requirements with Potential Impact to Rural Transit Service Delivery

Several of these MTP service requirements as described may affect general public service delivery as the requirements may result in extended operation in terms of time, service area and driver/vehicle resources. These MTP requirements include:

- operation of MTP service 6 days per week – where many rural transit districts operate general public service weekdays only,
- MTP *appointments* may be scheduled from 5:30 a.m. to 7:00 p.m. (which may require a bus pull-out of 4:30 a.m. and bus pull-in of 8:00 p.m.) – where many rural transit districts schedule bus-pull-out from the garage to begin about 6:00 a.m. and bus pull-in about 7:00 p.m. to meet peak commute times,
- MTP arrival and departure time thresholds of no more than one hour and MTP option to travel outside of the general public service area (which may result in vehicles laying over in remote areas for long periods of time) – where rural general public transportation are not constrained by arrival and departure time thresholds and typically do not travel outside of designated general public service boundaries.

In Texas in 2009, 21of the 39 rural transit districts (54 percent) operated some MTP service, either directly as a TSAP or as a sub-contractor to a TSAP (Table 1). As a point of reference, this research compiles performance data using fiscal year 2009 state reported data (PTN-128). In fiscal 2009, Texas had 39 rural transit districts. In fiscal 2010, Caprock Community Action Association merged with South Plains Community Action Association bringing the total number of rural transit districts to 38. For those

rural transit districts that operate MTP service in fiscal year 2009, an average 16 percent of passenger boardings are MTP passenger boardings (with a median of 17 percent); and the range of MTP passenger boardings 2 percent to 37 percent of total passenger boardings.

Table 1. Fiscal Year 2009 Rural Transit District MTP Passenger Boardings.

Rural Transit District (Headquarters)	TSAP or Sub-Contractor **	Total RTD Passenger Boardings	Total MTP Passenger Boardings	% MTP Passenger Boardings
Alamo Area Council of Governments (San Antonio)	Sub	95,370	34,398	36.1%
Aspermont Small Business Development Ctr. (Aspermont)	Sub	16,035	5,951	37.1%
Brazos Transit - The District (Bryan)	TSAP	704,078	11,176	1.6%
Capital Area Rural Transportation System (Austin)	TSAP	362,733	97,265	26.8%
Caprock Community Action Assoc.* (Crosbyton)	Sub	44,192	15,270	34.6%
Community Council of Southwest Texas (Uvalde)	TSAP	146,648	47,153	32.2%
Concho Valley Council of Governments (San Angelo)	TSAP	82,088	3,224	3.9%
Community Services, Inc. (Corsicana)	Sub	117,648	19,916	16.9%
Central Texas Rural Transit District (Coleman)	TSAP	184,603	27,106	14.7%
Del Rio, City of (Del Rio)	Sub	75,101	15,573	20.7%
Golden Crescent Regional Planning Commission (Victoria)	TSAP	136,619	21,848	16.0%
Senior Center Resources and Public Transit Inc. (Greenville)	Sub	48,063	5,775	12.0%
Hill Country Transit District (San Saba)	TSAP	152,719	19,516	12.8%
Kaufman Area Rural Transportation (Kaufman)	Sub	100,561	12,203	12.1%
Public Transit Services (Mineral Wells)	Sub	77,491	9,585	12.4%
Rolling Plains Management Corp. (Crowell)	Sub	96,433	15,672	16.3%
Services Program for Aging Needs (Denton)	Sub	53,874	14,706	27.3%
South Plains Community Action Assoc.* (Levelland)	Sub	77,585	14,142	18.2%
Texoma Area Paratransit System (Sherman)	Sub	99,745	12,600	12.6%
Transit System Inc., The (Glen Rose)	Sub	27,296	5,218	19.1%
West Texas Opportunities, Inc. (Lamesa)	TSAP	147,339	54,615	37.1%

*In 2010, Caprock Community Action Association merged with South Plains Community Action Association to become one rural transit district.

**TSAP is the Transportation Service Area Provider responsible for providing MTP service to the designated area whether directly or through a sub-contractor. "Sub" means a transit district that is a sub-contractor to a TSAP.

CASE STUDY SELECTION METHODOLOGY

Service level and service area characteristic data for rural transit districts that operated MTP services were first collected. The source of data was the TxDOT Public Transportation Division (PTN) web based system for reporting uniform public transit data to the state (PTN-128). All federal and state funded transit providers are required to submit financial and operating data to TxDOT using the PTN-128 web based system. Data collected for this research include:

- total passengers (boardings);
- MTP passengers (boardings);
- revenue miles;
- operational expense;
- local investment funds;
- service area population and square miles; and
- counties served by the rural transit district.

A two-tier process was used to select case studies. The first tiering was designed to separate rural transit districts providing MTP service into groups of similar magnitude. Tier-1 benchmarks each rural transit district data element (i.e. passengers, miles, expenses, etc.) relative to the transit district with the highest (maximum) value for the data element. Appendix A provides the formula for calculating the Tier-1 score grouping results. Five peer-groups were identified in the Tier-1 scoring. The Tier-2 score provides a factor for assessing the magnitude of MTP service in terms of passengers and revenues within each of the Tier-1 score groupings. Appendix B provides the formula for calculating the Tier-2 score and Tier-2 score results.

First selected were the rural transit districts with the median Tier-2 scores from each of five Tier-1 peer groupings for case study. This ensured that the sample reflected the full range of sizes of service area, operations and of similar MTP magnitude. Subsequently one of the originally selected rural transit districts was replaced from Peer-

group 2 because that transit district's driver manifests did not capture adequate information needed to allocate service and costs between public and MTP service. A transit district from the same grouping was used as a replacement. A second transit district from Pier-group 5 was replaced from another Tier-1 grouping to permit study of a system with the greatest amount of MTP service in a low-density service area. Five agencies were selected and identified as Case Study 1 through 5 throughout the remainder of this report.

RESOURCE-BASED COST ALLOCATION METHODOLOGY

In most transit agencies, vehicles serve customers with a variety of trip purposes. The co-mingling of MTP passengers with general public passengers complicates determining the cost of MTP services. Traditionally, cost-allocation methodologies have been based on a boardings-based allocation – allocating costs by number of boardings by trip type. This methodology does not take into account the average trip lengths and average trip times that may differ across trip types served. For example, if the average trip is five miles in length for trip type A and the average trip length is 25 miles for trip type B, the costs per trip will differ significantly between the two trip types. Where transit agencies serve large service areas (rural transit providers), these cost differences may be amplified as trip lengths often vary significantly.

To provide a methodology that accounts for the differences in resources used by trip type, a resource-based cost allocation methodology was developed. This resource-based cost allocation methodology allocates costs based on resources used to provide each service. Resources are passenger miles, passenger hours and administrative labor by trip type. This resource-based cost allocation methodology was applied to five rural transit district case studies representing five of the 21 rural transit districts that provide MTP service.

The description below provides an example of the steps to allocate costs using a resource-based cost allocation methodology. The methodology uses a sample of driver manifests and allocates resources by service type. The resource allocation is then used to allocate costs based on resources used for each service type.

From the sample manifests provided, each client's trip information from the sample manifests into a spreadsheet template was first entered as displayed in the Table 2 example.

Table 2. Trip Information Template Input Example.

Date	Trip Type*	Passengers	Pick-up Odometer	Pick-up Time	Drop-off Odometer	Drop-off Time
5/12/2009	O	1	76,037	12:40	76,044	12:58
5/12/2009	O	1	76,037	12:40	76,051	13:12
5/12/2009	G	3	76,054	13:22	76,058	13:32
5/12/2009	M	2	76,060	13:55	76,064	14:06

*G = General Public, M = Medical Transportation Program, O = Other

Once all manifest data was entered, a summary by trip type of total passenger boardings, passenger miles, passenger hours and the average passenger miles per boarding and average passenger hours per boarding was calculated. Revenue miles and revenue hours differ from passenger miles and passenger hours. Revenue miles and revenue hours are miles and hours the vehicle is operated. Passenger miles and passenger hours are the cumulative distances and time ridden by individual passengers. The template generates the trip speed as a quality assurance check and calculates the passenger miles and passenger hours (Table 3).

Table 3. Trip Speed Check, Passenger Miles and Hours Calculation Example.

Date	Trip Type*	No of Passengers	Trip Revenue Miles	Trip Revenue Hours	Speed Check	Passenger Miles	Passenger Hours
5/12/2009	O	1	7.00	0:18	23.33	7.00	0:18
5/12/2009	O	1	14.00	0:32	26.25	14.00	0:32
5/12/2009	G	3	4.00	0:10	24.00	12.00	0:30
5/12/2009	M	2	4.00	0:11	21.82	8.00	0:22

*G = General Public, M = Medical Transportation Program, O = Other

For example in Table 3, there is one general public trip (notated with a "G" in the "Trip Type" column). This trip involved carrying three passengers a distance of four miles in ten minutes. The speed for the trip is calculated as 24 miles per hour (4 miles/ 10 minute* 60 minutes/hour). The passenger miles associated with the trip is 12 (3

passengers * 4 miles) and the passenger hours associated with the trip is 30 minutes (3 passengers * 10 minutes).

Table 4 illustrates an example summary of manifest data by service type for a one-week period. General public and other non-MTP services were combined for this analysis.

Table 4. Summary of Sample Week by Trip Type Example.

Service Type	Passenger Boardings	Passenger Miles	Passenger Hours	Passenger Miles per Boarding	Passenger Hours per Boarding
General Public & Other	899	8,208	393	9.14	0.44
MTP	662	16,142	498	24.40	0.75

The sample week summary is then applied to the state -reported annual data as reflected on the PTN-128 form. Fiscal year annual passenger miles and passenger hours for each service type were calculated by multiplying the PTN-128 reported number of annual boardings by the calculated passenger miles per boarding and passenger hours per boarding from the sample (see Table 5). This step links service allocation to annual ridership.

Table 5. Annual Passenger Miles and Passenger Hours Calculation.

Service Type	Passenger Boardings	Passenger Miles per Boarding	Passenger Hours per Boarding	Passenger Miles	Passenger Hours
General Public & Other	54,422	9.14	0.44	479,941	22,991
MTP	34,398	24.40	0.75	839,371	25,890
Total	88,820	14.85	0.55	1,319,313	48,881

The percentage of passenger miles and passenger hours, by service type, are the basis for the allocation of cost among the service types. Table 6 displays these percentages by service type for the example. This calculation provides information regarding the amount of resources MTP service requires as compared to the amount of resources public and other service requires. For example, MTP represents 39 percent of boardings in Table 4, 64 percent of passenger miles and 53 percent of passenger hours. In this case, MTP trips are more resource intensive per passenger than a general public transit trip.

Table 6. Percent Boarding, Passenger Miles/Hours by Service Type Example.

Service Type	Passenger Boardings	Passenger Miles	Passenger Hours
General Public & Other	61%	36%	47%
MTP	39%	64%	53%
Total	100%	100%	100%

To allocate costs across services, the state reported PTN-128 operational fiscal year costs were used. Total expenses were sub-divided into mileage-based expenses, hours-based expenses and administrative expenses. Mileage-based expenses are defined as maintenance and fuel/lubricant expenditures (which may be reported as part of operating costs) because these types of expenditures are closely associated with the number of miles operated by transit vehicles. Hours-based expenses are defined as operating expenditures excluding fuel/lubricants, as these types of expenditures are closely associated with hours of labor. Administrative expenses include administration and planning expenditures that are allocated based upon the provider's estimated percentage of time spent on each program.

Once expenses were subdivided between mileage-based, hours-based, and administrative expenses, expenses were then allocated to each program based upon each

program's percentage of passenger miles or passenger hours (see Table 7). Administrative expenses were allocated based upon each agency's estimate of the relative amount of administrative time required by each program. Based upon this resource-based analysis, MTP service costs were $1,533,638 of the total annual costs of $2,780,657, or 55 percent of costs (compared to 39 percent of passenger boardings).

Table 7. Resource-Based Cost Allocation by Service Type Example.

Fiscal Year 09	Mileage-Based Expenses*	Hours-Based Expenses	Administrative Expenses (Administrative & Planning)	Total Operating Cost
Total Rural Transit District Operational Expenditures	$488,257	$1,859,134	$433,265	$2,780,657
Service Type	Passenger Miles	Passenger Hours	Administration (Transit District Estimate)	
General Public and Other	36%	47%	45%	
MTP	64%	53%	55%	
Annual Allocation	Mileage Based Expenses	Hours Based Expenses	Administrative Expense	Resource-Based Cost Allocation
General Public and Other	$177,619	$874,431	$194,969	$1,247,019
MTP	$310,639	$984,703	$238,296	$1,533,638
Total	$488,257	$1,859,134	$433,265	$2,780,657

*Mileage-based expenses include maintenance and fuel/lubricants.

Then cost per passenger boarding was calculated based on the resource-based cost allocation methodology. Table 8 provides the example cost per passenger boarding calculation for each service type. This calculation provides information regarding the unit cost of service-by-service type for the sample week.

Table 8. Estimated Cost per Passenger Boarding by Service Type Example.

Service Type	Annualized Boardings	Resource-Based Cost Allocation	Cost per Passenger Boarding
General Public & Other	54,422	$1,247,019	$22.91
MTP	34,398	$1,533,638	$44.59

RESOURCE-BASED COST ALLOCATION RESEARCH RESULTS

This section provides the results for each of the five case study rural transit districts researched. A resource-based cost allocation methodology was developed and a comparison was provided of this methodology to a traditional boardings-based cost allocation methodology. This section provides case study results as follows:

- resource allocation,
- resource-based cost allocation,
- comparison of resource-based or boardings-cased cost allocation, and
- comparison of MTP revenues and expenditures.

CASE STUDY RESOURCE ALLOCATION

For each of the five case studies, a manifest study was completed as previously described to allocate total passenger miles, passenger hours and passenger boardings by trip type (see Appendix C). A sample of demand response manifests was collected representative of a typical service week for each case study transit district. One of the case study transit districts provided a two-week sample of manifests and the full dataset available was used. For Case Study 1, the transit district also operated special event circulator service during the year representing approximately 7 percent of total boardings. For Case Study 1, the manifest study excludes special event service. For Case Study 3 and Case Study 5, both rural transit districts directly operate service and sub-contract a portion of service. Directly operated service is service that the transit district operates with its own drivers rather than sub-contracting to another agency such as a taxicab company or a health and human services agency in the area. For Case Study 3 and Case Study 5, the manifest study was completed for the directly operated portion of service only.

To compare resources used across trip types, the average passenger miles per boarding and average passenger hours per boarding by service type was calculated (see Table 9). In all but Case Study 2, the case study MTP trips are longer in distance

(ranging from 13 to 40 mile difference) and in time (ranging from 0.2 hours or 12 minutes to 1 hour difference) than the general public transit trips. MTP trip lengths were found to be longer because typically passengers travel from rural areas into urban areas to specialized medical facilities.

Table 9. Case Study – Average Passenger Miles and Passenger Hours per Boarding by Trip Type.

Case Study Rural Transit District	Average Passenger Miles per Boarding			Average Passenger Hours per Boarding		
	General Public/Other	MTP	Difference	General Public/Other	MTP	Difference
Case Study 1*	8.8	24.4	15.6	0.4	0.7	0.3
Case Study 2	46.2	43.4	(2.8)	1.2	1.2	0
Case Study 3**	22.7	62.7	40.0	0.7	1.7	1
Case Study 4	8.6	22.0	13.4	0.4	0.6	0.2
Case Study 5**	15.0	37.8	22.8	0.5	0.9	0.4

*This rural transit district operated both demand response and special event circulator service. The special event circulator service is excluded from this analysis.
**These rural transit districts both directly operated and sub-contracted service. Only the directly operated portion of the agency service is included in this analysis (no sub-contractor data).

Table 10 provides the percent of case study passenger boardings, passenger miles and passenger hours that are MTP. Note that in Case Study 1, the percent MTP passenger boardings is 39 percent - greater than the percents listed in Table 1. This analysis excludes special event circulator service from total boardings as these are one time events and not demand response service; therefore, the MTP percent of total boardings is increased. With the exception of Case Study 2, MTP trips are more resource intensive than general public or other passenger trips. For example, for Case Study 5, MTP represents 19 percent of the passenger boardings but represents 37 percent of passenger miles, 32 percent of passenger hours and administration. This is reflective of the MTP service in the study areas where a few passengers ride in one vehicle to distant locations to reach medical services.

Table 10. Case Study Percent of Passenger Boardings, Passenger Miles, Passenger Hours, and Administration that Are MTP (Cost Allocation Elements).

Rural Transit District Case Study	% of Passenger Boardings	% of Passenger Miles	% of Passenger Hours	% of Administration
Case Study 1*	39%	64%	53%	55%
Case Study 2	37%	37%	40%	37%
Case Study 3**	16%	34%	33%	34%
Case Study 4	19%	38%	25%	25%
Case Study 5**	19%	37%	32%	32%

*This rural transit district operated both demand response and special event circulator service. The special event circulator service is excluded from total boardings; therefore MTP % passenger boardings increases.
**These rural transit districts both directly operated and sub-contracted service. Only the directly operated portion of the agency service is included in this analysis (no sub-contractor data).

CASE STUDY RESOURCE-BASED COST ALLOCATION

Operating expenses were allocated across service types based on the resulting resource allocation percent of passenger miles, passenger hours and estimated administration percent (see Appendix C). Mileage-based costs (maintenance and fuel) are allocated based on percent of passenger miles, hours-based costs (operating expense excluding fuel) are allocated based on percent of passenger hours and administrative costs are allocated based on percent of estimated administration. The results of this resource-based cost allocation methodology reflect the resources used by trip type for each case study. Table 11 provides the case study resource-based cost allocation and resulting operating cost per boarding.

Using this resource-based cost allocation methodology, in four of the five case studies, MTP operating costs are a higher percent of total cost as compared to the percentage of passenger boardings. For example, in Case Study 1, the MTP costs are 55 percent of operating costs as compared to 39 percent of passenger boardings (see Table 11). Case Study 2 is the exception with MTP service costs at 38 percent of operating costs, which parallels the 37 percent of passenger boardings. Recall that Case Study 2 average trip lengths and times were similar across trip types resulting in similar cost per

trip of $53.21 for general public and other trips and $55.99 for MTP. For the remaining four case studies, the cost per boarding difference between general public and other passengers trips and MTP passenger trips ranges from a $20 to $39 per boarding.

Table 11. Case Study Resource-Based Cost Allocation.

Case Study Transit District	Passenger Boardings		Operating Expenditures		Cost per Boarding (Average)
Case Study 1*					
General Public/Other	54,422	61%	$1,188,097	45%	$21.83
MTP	34,398	39%	$1,461,007	55%	$42.47
Total	88,820	100%	$2,649,104	100%	$29.83
Case Study 2					
General Public/Other	10,084	63%	$536,528	62%	$53.21
MTP	5,951	37%	$333,224	38%	$55.99
Total	16,035	100%	$869,752	100%	$54.24
Case Study 3**					
General Public/Other	15,027	84%	$347,073	66%	$23.10
MTP	2,819	16%	$175,370	34%	$62.21
Total	17,846	100%	$522,443	100%	$29.28
Case Study 4					
General Public/Other	22,078	81%	$666,180	72%	$30.17
MTP	5,218	19%	$259,751	28%	$49.78
Total	27,296	100%	$925,931	100%	$33.92
Case Study 5**					
General Public/Other	61,005	81%	$1,770,704	67%	$29.03
MTP	14,422	19%	$874,677	33%	$60.65
Total	75,427	100%	$2,645,382	100%	$35.07

*This rural transit district operated both demand response and special event circulator service. The special event circulator service is excluded from this analysis.
**These rural transit districts both directly operated and sub-contracted service. Only the directly operated portion of the agency service is included in this analysis (no sub-contractor data).

ANALYSIS OF MTP REVENUES COMPARED TO EXPENDITURES

After completing the resource-based cost allocation for each rural transit district case study, a comparison of the amount of MTP service annual revenues to MTP service expenditures as calculated through the resource-based cost allocation model was

conducted. This cost recovery analysis provides insight to the possible impacts that MTP service has on general public transit services. A final step included assigning fleet replacement costs to the analysis based upon an average capital cost per mile and comparing the full cost of MTP service –operating and capital – to the revenues received for providing the service.

How much of the MTP costs were recovered through MTP revenues were calculated. Because MTP revenues for each rural transit district include both directly operated and sub-contracted service, MTP revenues were compared to total MTP costs including both directly operated (as calculated above) and sub-contracted expenses. Table 12 provides a summary of the total MTP operating expense including directly operating and sub-contracted expenses.

Table 12. Medical Transportation Program Operating Expenses (Resource-Based Cost Allocation).

Case Study Transit District	Directly Operated Cost	Sub-Contractor Cost	Total Operating Cost
Case Study 1	$1,461,007	$0	$1,461,007
Case Study 2	$333,224	$0	$333,224
Case Study 3	$175,370	$519,121	$694,491
Case Study 4	$259,751	$0	$259,751
Case Study 5	$874,677	$1,245,204	$2,119,881

MTP services also generate a need for capital expenditures, particularly replacement vehicles. An average annual vehicle replacement cost of $0.38 per mile was used based upon the assumption that an average vehicle cost is $75,000 with a 200,000-mile service life. The calculated MTP annual vehicle miles were multiplied by the $0.38 capital cost per mile to estimate the annual capital cost for each transit district. Table 13 provides the estimated annual capital cost for vehicle replacement results for each transit district studied. The fleet estimates does includes in-service vehicle

requirements without spare vehicles. Typically, operation of service includes spare vehicle costs.

Table 13. Estimated Vehicle and Annual Capital Cost for MTP Service.

Rural Transit District	Estimated Total Annual Miles	Annual Capital Cost – Fleet without Spares ($0.38/mile)
Case Study 1	816,715	$310,352
Case Study 2	168,345	$63,971
Case Study 3*	410,370	$155,941
Case Study 4	113,648	$43,186
Case Study 5**	365,671	$138,955

*Case Study 3 includes both directly operated and sub-contracted vehicle miles. This agency provides vehicles to its sub-contractors; therefore, assume the sub-contractor rate does not include capital cost.
** Case Study 5 includes directly operated MTP miles only. This agency sub-contracts to a taxicab company; therefore, analysis assumes that the sub-contractor rate includes capital cost.

The combined estimated capital costs and operating costs were compared to the MTP revenues. Table 14 provides a summary of the balance between total costs and revenues. One of the five case study transit districts, Case Study 3, fully covers the MTP operating with MTP revenues and also receives sufficient revenue to provide for fleet replacement (including a spare) as well.

This resource-based allocation indicates expenses exceed revenue for MTP service in four of the five case studies. Funding from public and other funds are applied to fund the MTP deficit, reducing the funding availability of service to the general public. The average annual MTP deficit among the four case study sites that do not cover the full cost of MTP service is about $230,000. This amount can be translated into capacity for an additional 8,200 general public/other trips ($230,000 divided by $28.00 per trip average cost of general public transit trips).

Table 14. MTP Revenues Compared to Estimated Operating and Capital Cost. (Resource-Based Cost Allocation)

Case Study Transit District	Operating Cost	Estimated Capital Cost (Fleet without Spares)	Total Annual Cost	Revenues	Estimated Annual Funding Balance (Operating Cost Only)	Estimated Annual Funding Balance (Total Cost)
Case Study 1	$1,461,007	$310,352	$1,771,359	$1,366,302	($94,705)	($405,057)
Case Study 2	$333,224	$63,971	$397,195	$282,472	($50,752)	($114,723)
Case Study 3	$694,491	$155,941	$850,432	$956,556	$262,065	$106,124
Case Study 4	$259,751	$43,186	$302,937	$234,512	($25,239)	($68,425)
Case Study 5	$2,119,881	$136,948	$2,256,830	$1,920,242	($199,639)	($336,588)

Also, the average MTP revenues collected per boarding were compared to the total cost (including capital) per boarding. Table 15 provides the results of this MTP rates. None but Case Study 3 has set MTP rates to cover the operating and capital cost of operating MTP service.

Table 15. MTP Estimated Rate Differential (Fiscal Year 2009).

Case Study Transit District	MTP Passenger Boardings	MTP Revenues	Average Revenues per Boarding	Total MTP Cost per Boarding (with Capital)	Rate Difference
Case Study 1	34,398	$1,366,302	$39.72	$51.50	($11.78)
Case Study 2	5,951	$282,472	$47.47	$66.74	($19.28)
Case Study 3	21,848	$956,556	$43.78	$38.92	$4.86
Case Study 4	5,218	$234,512	$44.94	$58.06	($13.11)
Case Study 5	54,615	$1,920,242	$35.16	$41.32	($6.16)

All calculations are based upon a one-week or two-week data sample that has been annualized and therefore the results are representative only of that sample. Weeks were sampled that each case agency defined as a good representation of the year (good weather, full service, no special events).

COST ALLOCATION METHODOLOGY COMPARISON – RESOURCE-BASED AND BOARDINGS-BASED

A comparison of the resource-based cost allocation methodology to a traditional boardings-based cost allocation methodology was conducted for each of the five case studies. The boardings-based cost allocation was based on percent of passenger boardings by service type. Then a comparison of the difference in costs to the MTP annual revenues using the two cost allocation methodologies was calculated.

Table 16 provides a comparison of the cost per boarding based on the two different cost allocation methodologies. In four of the five case studies, the cost per boarding for MTP is significantly different - ranging from a difference of $13 in Case Study 1 ($43 as compared to $30) to a difference of $33 in Case Study 3 ($62 as compared to $29).

Table 16. Cost Allocation Methodology Comparison.

	Resource-Based Allocation			Boardings-Based Allocation		
Case Study Transit District	Cost Allocation		Cost per Boarding	Cost Allocation		Cost per Boarding
Case Study 1*						
Total	$2,649,104		$29.83	$2,649,501		$29.83
General Public/Other	$1,188,097	45%	$21.83	$1,623,408	61%	$29.83
MTP	$1,461,007	55%	$42.47	$1,026,092	39%	$29.83
Case Study 2						
Total	$869,752		$54.24	$869,738		$54.24
General Public/Other	$536,528	62%	$53.21	$546,956	63%	$54.34
MTP	$333,224	38%	$55.99	$322,782	37%	$54.34
Case Study 3**						
Total	$522,443		$29.28	$522,531		$29.28
General Public/Other	$347,073	66%	$23.10	$439,991	84%	$29.28
MTP	$175,370	34%	$62.21	$82,540	16%	$29.28
Case Study 4						
Total	$925,931		$33.92	$925,880		$33.92
General Public/Other	$666,180	72%	$30.17	$748,886	81%	$33.92
MTP	$259,751	28%	$49.78	$176,995	19%	$33.92

Table 16. Continued

Case Study Transit District	Resource-Based Allocation			Boardings-Based Allocation		
	Cost Allocation		Cost per Boarding	Cost Allocation		Cost per Boarding
Case Study 5**						
Total	$2,645,382		$35.07	$2,645,225		$35.07
General Public/Other	$1,770,704	67%	$29.03	$2,139,445	81%	$35.07
MTP	$874,677	33%	$60.65	$505,780	19%	$35.07

*This rural transit district operated both demand response and special event circulator service. The special event circulator service is excluded from this analysis.
**These rural transit districts both directly operated and sub-contracted service. Only the directly operated portion of the agency service is included in this analysis (no sub-contractor data).

Table 17 provides a comparison of MTP revenues received and the estimated MTP operating and capital cost using a boardings-based cost allocation methodology. Note that in four of the five case studies, MTP revenues cover MTP costs using a boardings-based cost allocation methodology.

Table 17. MTP Revenues Compared to Estimated Operating and Capital Cost. (Boardings-Based Cost Allocation)

	MTP Operating Expenditures	Sub-Contractor Cost	Estimated Capital Cost (Fleet without Spares)	Total Annual Cost	MTP Revenues	Estimated Annual MTP Funding Balance
Case Study 1	$1,026,092	$0	$310,352	$1,336,444	$1,366,302	$29,858
Case Study 2	$322,782	$0	$63,971	$386,753	$282,472	($104,281)
Case Study 3	$82,540	$519,121	$155,941	$757,602	$956,556	$198,954
Case Study 4	$176,995	$0	$43,186	$220,181	$234,512	$14,331
Case Study 5	$505,780	$1,245,204	$136,948	$1,887,932	$1,920,242	$32,310

IMPACT OF MTP ON RURAL TRANSIT DISTRICT PERFORMANCE-BASED FUNDING FORMULA

The purpose of this analysis is to provide insight on the impact of MTP on rural transit district performance-based funding formula based on the five case study rural transit district performance.

RURAL TRANSIT DISTRICT FUNDING AND ALLOCATION

Federal funding for transit comes primarily through the United States Department of Transportation (U.S. DOT). Funding for the U.S. DOT is authorized by the Safe, Accountable, Flexible, Efficient, Transportation Equity Act – a Legacy for Users (SAFETEA-LU), approved by Congress in 2005 to fund federal surface transportation programs over five years, through fiscal year 2009. FTA provides Section 5311 non-urbanized area (rural) formula funds to states. FTA apportions the first 20 percent of funds available to the states based on relative land area in non-urbanized areas with no state receiving more than five percent of the amount apportioned. FTA apportions the remaining 80 percent based on non-urbanized population of each state relative to the national non-urbanized population.

The Texas Legislature makes biennial appropriations of state funding in support of the eligible urban and rural transit districts in Texas. The Texas Transportation Commission, appointed by the Governor, is charged with developing the methodology for distribution of state funds (and federal rural funds) among transit districts. In June 2004, the Commission established a formula to allocate both the federal and state funds for rural transit districts based on needs and performance. The formula was modified in 2006. TxDOT uses the Commission's formula to calculate each transit district's funding allocation annually.

Texas Rural Transit District Funding Formula

The TxDOT funding formula allocates funds to each rural transit district according to needs and performance (see Figure 1). Rural transit districts receive the needs allocation based upon their relative population (weighted 75 percent) and land area (weighted 25 percent). The funding formula distributes performance funding based on an equally weighted average of three performance indicators. The funds are allocated to each transit district based on its performance compared to the other rural transit districts. The indicators are as follows:

- local investment per operational expense,
- passenger boardings per revenue mile, and
- revenue miles per operational expense.

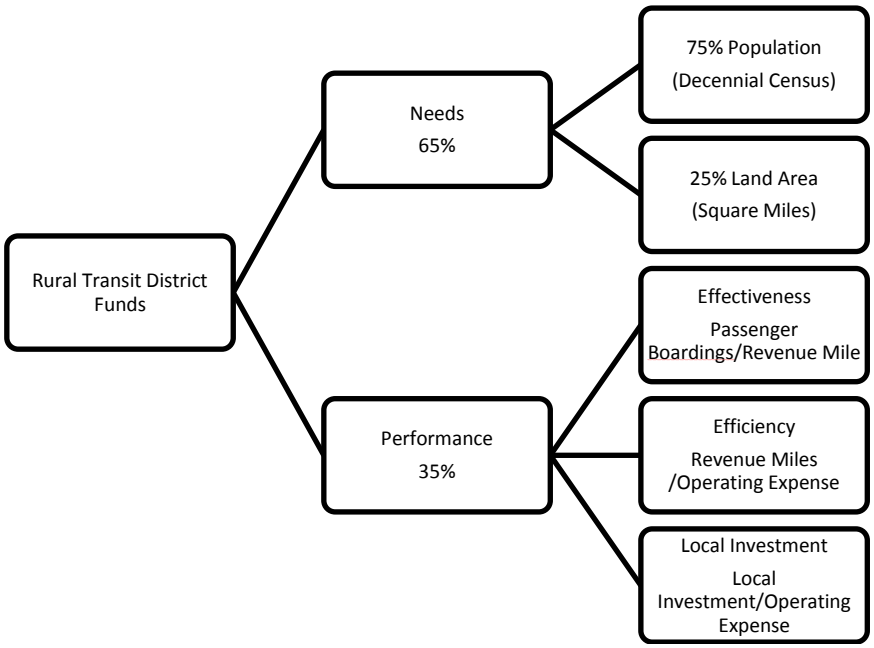

Figure 1. Rural Transit District Funding Allocation.

"Local investment per operational expense" encourages cooperation and coordination. It is calculated as the total local investment divided by total operational expenses.

Local investment is the sum total of all revenues received outside of federal and state Section 5311 funds (for rural transit districts) and federal Section 5309 funds. Local investment funds include passenger fares, local contributions (county, city), contributed services (non-cash), auxiliary transit revenues (advertising), other transit revenues (charters), non-transit revenues (lease of buildings, etc.), and contract revenues (including government funded competed programs such as Job Access Reverse Commute, Section 5310 service for persons who are elderly and/or disabled, and the medical transportation program).

Operational expenses are those expenses associated with the day-to-day operation of the transit agency. The operational expense categories include driver and dispatch labor, supervision, fuel, training, maintenance, administration, planning, and purchased transportation expenses.

"Passenger boardings per revenue mile" is the total unlinked passenger trips divided by actual revenue miles and is a measure of service effectiveness.

Unlinked passenger trips or boardings are the number of passengers who board transportation vehicles. Passengers are counted each time they board vehicles no matter how many vehicles they use to travel from their origin to their destination.

Revenue miles includes all miles the vehicle is available to carry passengers from the point of the first passenger pick-up or bus stop to the last passenger drop-off or bus stop. Notice the definition of revenue service states "is available to carry passengers;" therefore the vehicle is still considered in revenue service even when not carrying passengers on its route.

"Revenue miles per operational expense" is the total revenue miles divided by the total operational expense. It is a measure of service efficiency.

ANALYSIS OF MTP SERVICE IMPACT ON THE STATE ESTABLISHED RURAL FUNDING FORMULA INDICATORS METHODOLOGY

For rural transit districts, 35 percent of their state and federal funding is allocated based upon three performance factors. The value of these factors (and therefore the amount of funding allocated to a transit district) is influenced by the provision of MTP services. In order to estimate the impact that MTP has on agency funding, the three rural transit district funding performance indicators were calculated with MTP service and without MTP service. The incremental amount of performance funding generated by providing MTP service was calculated and compared to the revenues generated to the net MTP service costs.

MTP Service Impact on the State Established Rural Funding Formula Performance Indicators and Performance Funding

The rural funding formula performance indicators are estimated with MTP service data included and without MTP service data included. Expense data are based on the resource-based cost allocation methodology for the portion of service that is directly operated and contract costs for the portion of service (if any) that is sub-contracted. Note that Case Study 3 and Case Study 5 have a portion of service that is sub-contracted. For each of the three performance indicators, the performance factor and estimate of the resultant performance funding was calculated. Table 18 provides the funding formula indicator and performance factor estimates for each of the case study rural transit districts with MTP service and without MTP service. Table 18 also provides the Federal and State performance funding and difference with and without MTP service.

Generally for these case studies, providing MTP has the impact of slightly decreasing the effectiveness indicator (passengers per revenue miles) while the impact on the efficiency of the service (revenue miles per operating expense) varies. Recall that Case Study 2 has similar mileage and hours across service types resulting in little difference in effectiveness and efficiency indicators when MTP is excluded. Also, note that Case Study 3 and Case Study 5 have a significant proportion of MTP service that is sub-contracted. Only 2 percent of Case Study 3 passenger boardings are directly operated MTP and 14 percent are sub-contractor MTP. Because the sub-contractor MTP costs are significantly less (approximately $30.00 per passenger boarding as compared to $62.00) and represent a higher proportion of the total service, the exclusion of MTP does not have a significant overall impact in the efficiency indicator. Similar results occur in Case Study 5 where 10 percent of total passenger boardings are directly operated MTP service and 27 percent of total passenger boardings are sub-contractor MTP service (at lower costs similar to general public service).

The most significant performance indicator impact is the local investment indicator (local investment per operating expense) as MTP revenues are considered local investment revenue. Operating MTP significantly increases the local investment indicator. Combined, operating MTP service has the impact of increasing each transit district's share of the performance funding, driven largely by the local investment indicator. The last column of Table 18 provides an estimate of the incremental additional annual MTP-generated performance funding for each transit district.

Table 18. Impact of MTP on the Rural Funding Formula Performance Indicators.

Service Type	Passengers per Revenue Mile	Revenue Miles per Operating Expense	Local Investment per Operating Expense	Performance Factor	Federal and State Performance Funding	Federal and State MTP-Generated Performance Funding
Case Study 1						
Service with MTP	0.09	0.41	0.58	2.35%	$318,879	
Without MTP	0.15	0.33	0.15	1.64%	$221,953	$96,926
Case Study 2						
Service with MTP	0.04	0.45	0.41	1.92%	$260,778	
Without MTP	0.04	0.46	0.14	1.43%	$193,988	$66,790
Case Study 3*						
Service with MTP	0.13	0.52	0.65	2.93%	$397,208	
Without MTP	0.17	0.53	0.26	2.35%	$318,879	$78,328
Case Study 4						
Service with MTP	0.11	0.28	0.49	1.98%	$268,516	
Without MTP	0.14	0.24	0.34	1.73%	$234,307	$34,209
Case Study 5**						
Service with MTP	0.08	0.39	0.64	2.40%	$325,531	
Without MTP	0.09	0.42	0.41	2.06%	$278,969	$46,563

*Includes sub-contractor MTP - 14% of total Case Study 3 boardings are sub-contractor MTP at approximately half the cost of directly operated MTP. Only 2% of total Case Study 3 boardings are directly-operated MTP.

**Includes sub-contractor MTP - 27% of total Case Study 5 boardings are sub-contractor MTP at similar costs as general public service. Only 10% of total Case Study 5 boardings are directly-operated MTP.

Table 19 displays the full estimated financial impact of MTP considering all elements of costs and revenues using the resource-based allocation. Although MTP generates additional performance formula funding, MTP-generated performance funding revenues do not offset the deficits.

Table 19. MTP-Generated Performance Funding Offset.

	Resource-Based Allocation		
Case Study Transit District	**Estimated Annual MTP Funding Balance**	**MTP-Generated Performance Funding**	**New Annual MTP Funding Balance**
Case Study 1	($405,057)	$96,926	($308,130)
Case Study 2	($114,723)	$66,790	($47,934)
Case Study 3	$106,124	$78,328	$184,452
Case Study 4	($68,425)	$34,209	($34,216)
Case Study 5	($338,594)	$46,563	($292,032)

SUMMARY OF FINDINGS

This case study research relies on the developed resource-based cost allocation methodology for allocating cost across general public and MTP passenger trips. The resource-based cost allocation identifies resources used - percent of passenger miles, passenger hours, administrative labor by trip type. Passenger miles and passenger hours were calculated for each case study transit agency based on a 2009 sample of manifests. The transit agency's annual 2009 operating expenditures were split into mileage-based expenditures (maintenance and fuel), hours-based expenditures (operating expenditures less fuel) and administrative expenditures. These operating expenditure categories are then allocated by trip type based on percent of resources used (miles, hours and administration). Vehicles are another resource considered in cost allocation. A capital cost per vehicle mile was also calculated and capital costs were allocated by trip type based on vehicle miles traveled.

For MTP service, both the operating cost and vehicle capital cost were then compared to actual MTP revenues received in 2009 for each case study to determine if deficits exist. MTP revenues per boarding were calculated (to reflect MTP contract rates) and compared to MTP cost per boarding. This comparison determined if MTP contract per boarding rates cover MTP expenditures per boarding.

As many transit agencies use a boardings-based cost allocation methodology (allocating the system cost per boarding to number of boardings by trip type), a comparison of the resource-based cost allocation methodology to a boardings-based cost allocation methodology was completed. This provided insight on the magnitude of difference found between the two cost-allocation methodologies.

Finally, the three performance indicators included in the Texas Transit Performance-Based Funding Formula were calculated to compare performance with MTP and without MTP for each case study transit agency. The funding for performance

was then calculated with MTP and without MTP based on these performance factors. This comparison provided information regarding the impact MTP has on the performance-based funding allocation.

Research findings for this analysis are as follows:

- In four of the five case studies, MTP passenger trips have longer trip lengths than general public/other trips. Of the four case studies with longer average MTP trip lengths, the range of additional mileage per MTP passenger trip was 13.4 to 40.0 miles (see Table 9)
- In four of the five case studies, percent of services resources (miles and hours) to provide MTP are higher than percent of MTP boardings (see Table 10).
- In four of the five case studies, MTP trips have higher operating cost per boarding as compared to general public service using a resource-based cost allocation methodology, ranging from a difference of $12 to as much as a $32 difference per passenger trip (see Table 11).
- A resource-based allocation indicates a deficit exists in funding MTP service for four of the five case studies averaging $230,000 deficit (see Table 14). This amount equals the capacity for an additional 8,200 general public ($230,000 divided by $28.00 per trip average cost of general public trips).
- Using a resource-based cost allocation methodology, four of the five case study transit districts do not cover the full cost of providing MTP service with MTP revenues. MTP rates for these four have a shortfall ranging from approximately $6.00 per passenger trip to $19.00 per passenger trip (see Table 15).
- Using a *boardings-based* cost allocation methodology, four of the five case rural transit districts indicate covering the full cost of providing MTP service with MTP revenues (see Table 17).
- For the five case studies, impacts on the funding related performance indicators was as follows (see Table 18):
    - MTP decreased or maintained passengers per revenue mile

  - MTP has mixed impacts on revenue miles per operating expense
  - MTP increased the local investment per operating expense
- The cumulative impact of MTP on these performance indicators was positive resulting from the significant positive impact on the local investment indicator. Each agency received more funding as a result of operating MTP than they would have received had they not operated MTP (see Table 18).
- The additional funding generated by MTP in the funding formula is still not sufficient to compensate fully for the deficit (see Table 19).

LIMITATIONS

Case studies may be used to determine if multiple cases report similar findings. Five of the 21 rural transit districts that provide MTP service were tested. Case study research does not mean the same or similar results would be found across the remaining 16 rural transit districts. Without geo-coding trips as in-county and out-of-county, comparison of the in-county/out-of-county contract rates to in-county/out-of-county expenditures could not be made.

FUTURE RESEARCH

Conducting resource-based cost allocation for the remaining 16 rural transit districts would be beneficial in providing useful information about cost by service type. A second opportunity is to code trips by in-county/adjacent county and beyond adjacent county trips to better determine the two contract rates. A third opportunity for future study is to analyze the benefits that MTP provides to a steady cash-flow and the benefits of the ability to use MTP revenues to match state and federal general public transit grant requirements. Studies on the reverse affect on those transit districts that lost MTP contracts may also provide beneficial information. Lastly, applying the resource-based cost allocation to the 30 state-funded urban transit districts to determine MTP impact may also provide valuable information to performance based funding decisions.

REFERENCES

American Public Human Services Association. (2003). *Medicaid Non-Emergency Transportation: Three Case Studies.* Retrieved June 7, 2010, from http://www.ctaa.org/webmodules/webarticles/articlefiles/BusPassandBrokerageCaseStudyReport-APHSA.pdf

Borders, S. (2006). *Transportation Barriers to Health Care: Assessing the Texas Medicaid Program.* Dissertation. College Station: Texas A&M University.

Bradley, D., Darnell, P., Johnson, D., Larsen, J., McCoy, J., Neale, K., et al. (1998). *Designing and Operating Cost-Effective Medicaid Non-Emergency Transportation Programs.* Washington, D.C.: American Public Welfare Association.

Burkhardt, J., Hedrick, J., & McGavock, a. A. (1998). *Assessment of the Economic Impacts of Rural Pubic Transportation.* Washington, D.C.: Transportation Research Board.

Burkhardt, J., Koffman, D., & Murray, G. (2003). *Economic Benefits of Coordinating Human Service Transportation and Transit Services.* Washington, D.C.: Transportation Research Board.

Burkhardt, J., Nelson, C., Murray, G., & Koffman, D. (2004). *Toolkit for Rural Community Coordinated Transportation Services.* Washington, D.C.: Transportation Research Board.

Ellis, E., & McCollom, B. (2009). *Guidebook for Rural Demand-Response Transportation: Measuring, Assessing and Improving Performance.* Washington, D.C.: Transportation Research Board.

Hanley, P., Sikka, N., Ferguson, G., Kober, B., & Sun, J. (2008). *Iowa Medicaid Non-Emergency Medical Transportation System Review and Options for Improvements.* University of Iowa. Iowa City: Public Policy Center.

Health Consumer Alliance. (2006, April). *Medicaid Transportation Services.* Retrieved June 7, 2010. http://healthconsumer.org/cs026MedicaidTransport.pdf

Hosen, K., & Fetting, E. (2006). *Transit Agency Participation in Medicaid Transportation Programs.* Washington, D.C.: Transportation Research Board.

Hughes-Cromwick, P., Mull, H., Bologna, J., Kangas, C., Lee, J., & Khasnabis, S. (2005). *Cost Benefit Analysis of Providing Non-Emergency Medical Transportation.* Washington, D.C.: Transportation Research Board.

Minnesota Department of Transportation Office of Transit. (2005). Retrieved June 7, 2010, from Coordinate MN Transit: http://www.coordinatemntransit.org/reports/toolkit/documents/00-FullToolKit.pdf

RLS & Associates, Inc. (2006). *Minnesota Coordination Action Plan.* Minneapolis: Minnesota Department of Transportation.

Rosenbaum, S., Lopez, N., Morris, M., & Simon, M. (2009). *Medicaid's Medical Transportation Assurance: Origins, Evolution, Current Trends, and Implications for Health Reform.* Community Transportation Association of American and George Washington University. Washington, D.C.: School of Public Health and Health Services.

Ryus, P., Coffel, K., Parks, J., Perk, V., Cherrington, L., Arndt, J., et al. (2010). *A Methodology for Performance Measurement and Peer Comparison in the Public Transportation Industry.* Washington, D.C.: Transportation Research Board.

Texas Administrative Code. In *Title 1, Part 15, Texas Health and Human Services, Chapter 380, Subchapter B, Rule Section 380.201(a).*

The Hilltop Institute. (2008). *Non-Emergency Medical Transportation (NEMT) Study Report.* University of Maryland. Baltimore: The Hilltop Institute.

U.S. Code Title 42. United States Code Title 42 Public Health and Welfare, Chapter 7, Subchapter XIX. Grants to States for Medical Assistance Program, Section 1396a State plans for medical assistance. In *US Code Collection.*

APPENDIX A

TIER-1 SCORE

The formula for calculating the Tier-1 Score is as follows:

General Public Passengers/Max General Public Passenger Level + Revenue Miles/Max Revenue Mile Level + Operational Expenditure/Max Operational Expenditure Level + Square Mileage/Max Square Mileage Level + Counties/Max County Level + Population/Max Population Level

For example, the City of Del Rio's Tier-1 Score is calculated as follows: 28,386/557,245 + 143,523/1,890,346 + $751,420/$7,010,274 + 3,170/44,056 + 1/22 + 44,856/798,164 = 0.41.

These Tier-1 Scores are then used to group rural transit districts based on relative service levels and service area size and populations. There are five Tier-1 level groupings as shown below.

Tier-1 Scores - Service and Service Area Characteristic (Fiscal Year 2007 Data)

Rural Transit District	General Public Passgrs. Served	MTP Passgrs. Served	Total Revenue Miles Served	Total Operating Expense	Service Area Square Miles	Counties in Service Area	Service Area Population (2000 Census)	Tier-1 Score
Group 1:								
Del Rio, City of	28,386	12,185	143,523	$751,420	3,170	1	44,856	0.41
Senior Center Resources and Public Transit Inc.	50,664	8,000	372,953	$894,333	841	1	76,596	0.58
Transit System Inc., The	36,122	4,015	300,585	$1,087,478	1,695	2	80,910	0.61
Services Program for Aging Needs	75,879	208	402,369	$1,074,071	748	1	62,453	0.64
Kaufman Area Rural Transportation	37,434	9,677	555,916	$1,055,649	896	1	82,737	0.68
Group 2								
Aspermont Small Business Development Ctr.	10,113	4,209	331,444	$487,769	6,317	7	39,877	0.77
Public Transit Services	70,036	6,405	502,905	$901,840	2,765	2	117,544	0.82
Community Services, Inc.	78,666	17,989	490,483	$924,746	1,924	2	135,414	0.84

Rural Transit District	General Public Passgrs. Served	MTP Passgrs. Served	Total Revenue Miles Served	Total Operating Expense	Service Area Square Miles	Counties in Service Area	Service Area Population (2000 Census)	Tier-1 Score
South East Texas Regional Planning Comm.	63,286	2,260	512,561	$1,442,861	2,027	3	131,130	0.94
Rolling Plains Management Corp.	72,027	15,372	467,852	$1,102,307	6,553	8	86,084	1.15
Group 3								
Golden Crescent Regional Planning Commission	107,057	19,992	869,810	$1,630,703	7,088	8	160,333	1.61
Concho Valley Council of Governments	84,351	14,456	544,575	$1,565,781	15,309	12	56,505	1.63
South Plains Community Action Assoc.	75,133	14,944	724,165	$1,754,869	9,640	11	145,716	1.67
Community Council of Southwest Texas	104,061	52,554	679,475	$2,720,391	11,138	8	109,525	1.69
Hill Country Transit District	138,101	16,110	809,495	$1,774,555	8,321	9	155,387	1.72
Group 4								
Texoma Area Paratransit System	225,878	10,363	1,242,999	$2,077,821	5,601	6	200,664	2.01
Central Texas Rural Transit District	89,612	20,658	1,145,249	$3,065,133	9,607	11	151,924	2.11
Alamo Area Council of Governments	94,649	27,998	1,154,450	$2,235,192	10,130	11	392,995	2.32
Group 5								
Capital Area Rural Transportation System	290,275	65,116	1,890,344	$4,512,054	7,192	9	427,869	3.27
West Texas Opportunities, Inc.	111,574	54,691	1,119,304	$3,175,480	44,056	22	190,752	3.48
Brazos Transit - The District	557,245	9,465	1,782,372	$7,010,274	16,910	21	798,164	5.28

APPENDIX B

TIER-2 SCORE

Tier-2 Score provides a factor for assessing the magnitude of MTP service in terms of passengers and revenues. Tier-2 Scores are calculated as follows:

MTP percent of total passengers/Max MTP percent total passengers + MTP revenues per MTP passengers/Max MTP revenues per MTP passenger.

For example, the City of Del Rio's Tier-2 Score is calculated as follows: 30.03%/33.56% + $16.92/$108.29 = 1.05.

The table below provides Tier-2 Scores for each rural transit district that operates MTP service and the median score for each of the five groupings.

Tier-2 Scores - Magnitude of MTP Passengers and Revenues (Fiscal Year 2007 Data)

Rural Transit District	MTP % of Total Passengers	MTP Revenue / MTP Passengers	Tier-2 Score
Group 1 (Median Score = 0.70)			
Del Rio, City of	30.0%	$16.92	1.05
Senior Center Resources and Public Transit Inc.	13.6%	$24.73	0.63
Transit System Inc., The	10.0%	$43.31	0.70
Services Program for Aging Needs	0.3%	$19.36	0.19
Kaufman Area Rural Transportation	20.5%	$25.25	0.85
Group 2 (Median Score = 0.77)			
Aspermont Small Business Development Ctr.	29.4%	$40.51	1.25
Public Transit Services	8.4%	$36.27	0.58
Community Services, Inc.	18.6%	$23.23	0.77
South East Texas Regional Planning Comm.	3.5%	$16.93	0.26
Rolling Plains Management Corp.	17.6%	$28.63	0.79
Group 3 (Median Score = 0.79)			
Golden Crescent Regional Planning Commission	15.7%	$35.25	0.79
Concho Valley Council of Governments	14.6%	$21.67	0.64
South Plains Community Action Assoc.	16.6%	$46.01	0.92
Community Council of Southwest Texas	33.6%	$19.97	1.18
Hill Country Transit District	10.5%	$46.70	0.74

Rural Transit District	MTP % of Total Passengers	MTP Revenue / MTP Passengers	Tier-2 Score
Group 4 (Median Score = 1.11)			
Texoma Area Paratransit System	4.4%	$9.14	0.22
Central Texas Rural Transit District	18.7%	$108.29	1.56
Alamo Area Council of Governments	22.8%	$46.92	1.11
Group 5 (Median Score = 1.02)			
Capital Area Rural Transportation System	18.3%	$51.17	1.02
West Texas Opportunities, Inc.	32.9%	$28.10	1.24
Brazos Transit - The District	1.7%	$50.03	0.51

APPENDIX C

CASE STUDY SERVICE AND COST ALLOCATION

(Operating Costs)

Case Study 1 (Excludes Special Event Circulator Service)

Service Allocation	Boardings	Passenger Miles	Passenger Hours	Administrative*
General Public	61%	36%	47%	45%
MTP	39%	64%	53%	55%

*Administrative percent distribution based on staff estimation

Cost Allocation

Annual Allocation - FY09	Boardings	Mileage Based Expenses*	Hours Based Expenses**	Administrative Expenses	Total Cost	Cost per Boarding
Total Service:	88,820	$456,625	$1,738,686	$453,793	$2,649,104	$29.83
General Public	54,422	$166,111	$817,779	$204,207	$1,188,097	$21.83
MTP	34,398	$290,513	$920,907	$249,586	$1,461,007	$42.47

*Mileage-based expenditures includes maintenance and fuel - estimated fuel at 10% of total directly operated operational expenditure

**Hours-based expenditure includes operating expenditure less fuel (estimated fuel cost 10% of total operational expenditure)

Case Study 2

Service Allocation	Boardings	Passenger Miles	Passenger Hours	Administrative*
General Public	63%	63%	60%	63%
MTP	37%	37%	40%	37%

*Administrative percent distribution estimated based on passenger hours

Cost Allocation

Annual Allocation - FY09	Boardings	Mileage Based Expenses*	Hours Based Expenses**	Administrative Expenses	Total Cost	Cost per Boarding
Total Service:	16,035	$276,503	$386,216	$207,033	$869,752	$54.24
General Public	10,084	$174,484	$231,846	$130,198	$536,528	$53.21
MTP	5,951	$102,019	$154,370	$76,835	$333,224	$55.99

*Mileage-based expenditures includes maintenance and fuel - estimated fuel at 13% of total directly operated operational expenditure

**Hours-based expenditure includes operating expenditure less fuel (estimated fuel cost 13% of total operational expenditure)

Case Study 3 (Directly Operated Service)

Service Allocation	Boardings	Passenger Miles	Passenger Hours	Administrative*
General Public	84%	66%	67%	66%
MTP	16%	34%	33%	34%

*Administrative percent distribution based on staff estimation

Cost Allocation

Annual Allocation - FY09	Boardings	Mileage Based Expenses*	Hours Based Expenses**	Administrative Expenses	Total Cost	Cost per Boarding
Total Service:	17,846	$115,313	$341,000	$66,131	$522,443	$29.28
General Public	15,027	$75,950	$227,477	$43,646	$347,073	$23.10
MTP	2,819	$39,363	$113,522	$22,485	$175,370	$62.21

*Mileage-based expenditures includes maintenance and fuel - actual fuel expenditure

**Hours-based expenditure includes operating expenditure less fuel

Case Study 4

Service Allocation	Boardings	Passenger Miles	Passenger Hours	Administrative*
General Public/Other	81%	62%	75%	75%
Medical Transportation (MTP)	19%	38%	25%	25%

*Administrative percent distribution based on staff estimation

Cost Allocation

Annual Allocation - FY09	Boardings	Mileage Based Expenses*	Hours Based Expenses**	Administrative Expenses	Total Cost	Cost per Boarding
Total Service:	27,296	$209,832	$488,303	$227,794	$925,931	$33.92
General Public	22,078	$130,942	$364,392	$170,846	$666,180	$30.17
MTP	5,218	$78,890	$123,912	$56,949	$259,751	$49.78

*Mileage-based expenditures includes maintenance and fuel - estimated fuel at 10% of total operating expenditure

**Hours-based expenditures include operational expenditures less fuel

Case Study 5 (Directly Operated)

Service Allocation	Boardings	Passenger Miles	Passenger Hours	Administrative*
General Public	81%	63%	68%	68%
MTP	19%	37%	32%	32%

*Administrative percent distribution estimated based on passenger hours

Cost Allocation

Annual Allocation - FY09	Boardings	Mileage Based Expenses*	Hours Based Expenses**	Administrative Expenses	Total Cost	Cost per Boarding
Total Service:	75,427	$611,109	$1,637,267	$396,543	$2,645,382	$35.07
General Public	61,005	$382,969	$1,117,161	$270,574	$1,770,704	$29.03
MTP	14,422	$228,602	$520,106	$125,969	$874,677	$60.65

*Mileage-based expenditures includes maintenance and fuel - estimated fuel at 13% of total directly operated operational expenditure

**Hours-based expenditure includes operating expenditure less fuel (estimated fuel cost 13% of total operational expenditure)

VITA

Name: Andrea Suzanne Edrington

Address: Texas Transportation Institute, 701 North Post Oak Drive,
Houston, Texas 77024

Email Address: s-edrington@tamu.edu

Education: Bachelor of Arts, Economics, The University of Texas at Austin, 1989
Master in Urban and Regional Planning, Texas A&M University, 2010