AN ANALYSIS OF THE EFFICIENCY AND EFFECTIVENESS OF SELECTED RURAL TRANSIT SYSTEMS IN THE STATE OF NORTH DAKOTA

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EXECUTIVE SUMMARY

This report evaluates the efficiency and effectiveness of eight of the 23 Section 18 funded transit systems operating in North Dakota.

Need For And Purpose of Evaluation

Several factors indicate an increasing need for efficient and effective transit service in North Dakota. First, with the current climate of fiscal constraint at the federal level, it appears that resources available for mass transit will become increasingly limited. Because mass transit is a low priority item for the federal government, it receives only limited federal funding. Second, with the likelihood of continued increases in gasoline prices, more transit services will be demanded. Finally, because of North Dakota's diffused population and increasing elderly population, these services will be increasingly difficult to provide and more in demand. Thus, efficiency and effectiveness will be important elements in the future for Section 18 funded projects in North Dakota.

The purpose of this study is to evaluate the efficiency and effectiveness of eight of the 23 existing Section 18 funded projects in North Dakota. Since the provision of services to the transportation disadvantaged is a major goal of mass transit projects, a major focus of the study is on the effectiveness of services to the elderly and handicapped.

Section 18 Summaries

Eight Section 18 funded projects are evaluated in this study. The eight projects are 1) James River Senior Citizens Center (Jamestown, ND), 2) South Central Senior Services Council (Valley City, ND), 3) Southwest Senior Services (Bowman, ND), 4) Kidder County Council on Aging (Steele, ND), 5) West River Transportation Council (Bismarck, ND), 6) Minot Commission on Aging (Minot, ND), 7) Nelson County Council on Aging (McVille, ND), and 8) Helping Hands Taxi and Delivery Service (Grafton, ND).

The eight systems range in size and scope from a small taxi operation to a small urban system operating several buses over fixed routes. However, there are more similarities between these systems than differences, particularly when compared to urban mass transit systems. The systems serve several purposes, and are all targeted at the elderly and handicapped population.

Review of Literature

As part of the study all state DOT's throughout the country were surveyed to determine whether they had recently completed rural transit evaluations. Most states responded and sent recently completed evaluations.

These reports were evaluated in-depth, in terms of methodology and applicability to North Dakota. A recent study commissioned by the Commonwealth of Kentucky was found to be exemplary in terms of its methodology and its approach. This methodology was found to be highly relevant and applicable to the state of North Dakota. Thus, much of the methodology used in the Kentucky study has been adapted for use in the North Dakota evaluations. However, relevant portions of the research design have been formulated separately or abstracted from other studies.

Selection of Performance Measures

Several quantitative performance measures were revealed in past rural transit studies. Quantitative performance measures are easily obtainable and provide a useful

means for comparison between transit systems. These performance measures can be separated into 10 categories. The categories are: (1) social effectiveness, (2) service effectiveness, (3) cost effectiveness, (4) labor efficiency, (5) administrative efficiency, (6) vehicle efficiency, (7) cost efficiency, (8) revenue efficiency, (9) operation efficiency, and (10) maintenance efficiency.

Four factors are considered in this study when deciding which performance measures to use. These factors are: (1) the completeness and reliability of the data, (2) the controllability of the performance indicator by management, (3) the applicability of the performance measures to rural transit systems which serve the elderly and handicapped, and (4) the explanatory ability of the performance measures.

The performance measures used are listed on pages 12 through 14 of the report. Performance measures are calculated for each of the eight projects in Table 1.

Comparison of Sample Performance Measures to Those of Other States

Table 2 of the report compares the mean performance measures of the sample North Dakota projects to the mean performance measures for several other states, including Kentucky, Michigan, and Florida.

In most social or service effectiveness measures the North Dakota values are comparable to those of Kentucky. However, both the North Dakota and Kentucky values for these measures are much smaller than those for Michigan. This is not surprising, as population and geographic factors affecting rural transit services in North Dakota and Kentucky are very similar, while those for Michigan are much different. Michigan is much more densely populated than Kentucky or North Dakota.

The cost of providing rural transit services is higher in North Dakota than for any other state evaluated. This underscores the effects of population density and geography on unit costs.

Analysis of Outliers

The comparison of each system's values to the means for the group is one method of evaluating the performance of rural transit systems. If the performance level of a given transit system falls below the group mean, it can generally be concluded that the enterprise is not achieving its potential in terms of effectiveness or efficiency.

In order to determine which performance indicators are significantly different from the mean of the group, t-statistics are calculated. The t-statistic applies statistical significance to the deviations of performance indicators from the group mean. T-statistics are presented in Table 3 of the report, with an asterisk next to significant outliers. In addition to the t-statistics shown, a verbal analysis of outliers is presented in Table 4, with three basic categories: "average", "strong", and "needs improvement".

The James River Senior Citizens Center was strong in several categories, but showed a need for improvement in vehicle efficiency and in cost efficiency (mainly in operations).

South Central Senior Services was also strong in several performance categories. However, a significantly lower percentage of its rides were provided to the elderly and handicapped population than the group average.

Southwest Senior Services was shown to be very strong in the social effectiveness category, but also showed a need for improvement in administrative efficiency, particularly with respect to administrative salaries and fringe benefits.

The Kidder County Council on Aging was shown to be very strong in several

performance categories. However, it was shown to need improvements in vehicle efficiency and maintenance efficiency.

The West River Transportation Council was also strong in several categories. However, improvements were shown to be needed in administrative efficiency, particularly with respect to administrative salaries and fringe benefits.

While the Minot Commission on Aging was shown to have several strong performance measures, it was shown to need improvements in maintenance efficiency, revenue efficiency, and operation efficiency (especially operating salaries and fringe benefits).

The Helping Hands Taxi and Delivery Service and the Nelson County Council on Aging had many strong performance measures, but both showed a need for improvement in service effectiveness. Other outliers within these two systems were the direct result of poor service effectiveness.

Ridership Surveys

A one-page rider survey was developed for each of the eight transit systems studied. The sample size for these surveys varied greatly. Many systems had less than 10 riders on the trips which were evaluated. Furthermore, it was difficult to survey riders of irregular route, taxi, and small van services. However, some riders were surveyed for each system. The results of these surveys are shown in Table 5 of the report.

Suggestions For Improvement

In this section of the report, the outliers are looked at in conjunction with the qualitative attributes of each system in order to suggest improvements. Several possible improvements are suggested for each of the eight systems, which aim at improving the areas shown to need improvement in Table 4. These improvements are shown on pages 43-48.

Examples of suggested improvements include the following: 1) to improve high operating costs, increase the use of volunteer or part-time labor, 2) to improve maintenance efficiency, implement a preventative maintenance program, and 3) to improve poor service and social effectiveness measures, increase marketing activities.

Recommendations For Future Research

Several things became apparent from the study beyond the evaluation of eight systems. First, many of the enterprises surveyed did not develop performance measures as a routine matter of accounting and record keeping. In addition, they did not collect much of the underlying data (such as vehicle hours and miles) which are needed to compute measures of effectiveness and efficiency. Furthermore, several of the projects do not report their full transportation budgets to the DOT. They only report section 18 expenses and revenue. In order for accurate performance measures to be calculated, the projects' entire transportation expenses and revenues should be made available. A standardized data collection schedule would perhaps prove useful to both transit managers and to the state DOT. A guidebook could be developed containing basic formulas which will allow managers to convert service schedules, distances, and average vehicle speeds to approximate measures of annual vehicle hours and miles. Second, more evaluations of North Dakota transit systems are needed to fully understand how performance and cost factors vary across systems and why. Third, rural transit operations need to be evaluated periodically, as the competitive and financial environment is rapidly changing.

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I. INTRODUCTION

Section 18 of the Urban Mass Transportation Assistance Act of 1978 established federal funding and assistance for transit systems operating in rural and small urban areas. There are currently 23 Section 18 funded transit systems operating in North Dakota. The systems range in size and scope from small taxi or van operations to small urban systems operating several buses over fixed routes. However, the systems have many similarities, and collectively are much different than the mass transit systems operating in urban areas.

The level of federal funding and the commitment of the federal government to mass transit are subject to considerable uncertainty. Proposed Department of Transportation (DOT) budgets perennially call for deep cuts in mass transit funding and the elimination of Amtrak services. In the current climate of fiscal constraint, it is unlikely that funding for mass transit services will be expanded. To the contrary, it appears that the resources available for mass transit will become increasingly constrained by broader budgetary problems. Unfortunately, the resource constraints may coincide with a period of increased demand due to higher gasoline prices and a steady rise in the number of senior citizens.

In this era of resource constraints and increasing demand, more emphasis is being placed on improved transit management and efficient utilization of existing resources. Because federal funding for mass transit is currently a low-priority item, North Dakota has only a minimal amount of funds to support the state's public transportation needs. Because of the light population density and geography of the state, the ridership base tends to be more diffused than in other states, thereby increasing the degree of difficulty associated with the provision of service. Thus, efficiency and effectiveness will be important elements for the future of Section 18 projects in North Dakota.

The purpose of this study is to evaluate eight of the 23 existing Section 18 projects in North Dakota.[1] Each of the eight systems will be evaluated in terms of their effectiveness and efficiency. Two of the objectives of the evaluation are to identify areas where efficiency or effectiveness could be improved, and to suggest methods of implementing needed improvements. The provision of services to the transportation disadvantaged is a major goal of mass transit projects. Thus, a major focus of the evaluation will be on the effectiveness of services to the handicapped and elderly.

The material in this report is organized as follows. First, a brief overview of each of the eight transit projects is presented. Second, a review of literature and previous studies is presented. The literature review describes many of the performance measures and procedures utilized in this study. Third, the evaluations of the North Dakota systems are summarized. In this section, the performance measures which were used are described and comparisons are presented which characterize the performance of the North Dakota systems relative to those of other states. Fourth, the outliers of the analysis are evaluated. Fifth, the results of the ridership surveys are summarized. And, sixth (in conclusion), recommendations for improvements in effectiveness and/or efficiency are presented.

[1] One of the original nine rural transit projects was dropped from the study because of insufficient data.

II. SECTION 18 PROJECT SUMMARIES

This section of the report gives a brief overview of each of the eight section 18 funded transit projects evaluated. This overview is presented in the following pages.

1) JAMES RIVER SENIOR CITIZENS CENTER, INC. (JAMESTOWN, ND)

The James River Senior Citizens Center, Inc. provides transportation throughout Stutsman County as well as in the neighboring cities of Wimbledon and Gackle. Over 38,000 rides are provided annually by this service. Rides are provided for employment, recreational, shopping, nutritional, and medical purposes. Ninety-five percent of all rides are provided to the elderly or handicapped. This project provides intercity/fixed route service, dial-a-ride service, and contracted service.

There are four other transportation providers in the James River Senior Citizens Center's service area. However, two of these services transport their own clients exclusively, and two of them don't provide the same type of service. These services are J.B. Shortway Charter Service (a commercial motorcoach service), Hi Acres Manor Nursing Home, Central Dakota Nursing Home, and Jamestown Taxi Service. The James River Senior Citizens Center provides transportation for several agencies which don't have transportation services. However, it does not coordinate routes with the other transit services. James River operates six vehicles, one of which is handicapped-accessible. The James River Senior Citizens Center does not place any restrictions on who can use their service, but gives priority to the elderly and handicapped.

2) SOUTH CENTRAL SENIOR SERVICES COUNCIL, INC. (VALLEY CITY, ND)

South Central Senior Services Council of Valley City provides transportation in Barnes, Griggs, and LaMoure Counties. This transit project provides over 21,000 rides annually. Rides are provided for shopping, educational, medical, employment, and recreational purposes. Seventy percent of this project's rides are provided to the elderly and handicapped. South Central Senior Services Council provides intercity/fixed route, unscheduled fixed route, dial-a-ride, and contracted services. South Central Senior Services and the Greyhound Bus Line are the only transportation providers in the area. The project operates four vehicles and keeps all of them active. One of these four vehicles is handicapped-accessible. There are no restrictions on who can use this service, but priority is given to the elderly and handicapped.

3) SOUTHWEST SENIOR SERVICES (BOWMAN, ND)

Southwest Senior Services of Bowman provides transportation to people in Adams, Hettinger, and Bowman counties. Over 12,000 rides per year are provided by this transit system. The primary purposes of the trips are for shopping, medical, recreational, educational, and employment purposes. Southwest Senior Services provides intercity/fixed route service as well as dial-a-ride service. Southwest Senior Services is the only transportation provider in its area.

Like most of the rural transit projects in North Dakota, the Southwest Senior Services ridership base consists primarily of elderly and handicapped clients. Eighty-two percent of Southwest Senior Services' riders are either elderly or handicapped.

Southwest Senior Services has two 16-passenger buses, which are both handicapped-accessible. Nearly all of this system's handicapped riders are also senior citizens. Southwest Senior Services does not place restrictions on who can use its service, but gives priority to the

elderly and handicapped.

4) KIDDER COUNTY COUNCIL ON AGING (STEELE, ND)

The Kidder County Council Aging located in Steele, provides transportation for Kidder County. This project provides over 4,000 rides annually. Rides are provided for medical, shopping, and general purposes. Ninety-nine percent of this project's rides are provided to elderly and handicapped clients. This project provides intercity/fixed route service and unscheduled fixed route service. Kidder County Council on Aging and the Greyhound Bus Line along I-94 are the only transportation providers in the area.

The Kidder County Council on Aging operates one bus. This bus is not handicapped-accessible. There are no restrictions placed on who can use this service. However, riders under the age of 60 pay a higher fee.

5) WEST RIVER TRANSPORTATION COUNCIL (BISMARCK, ND)

The West River Transportation Council is headquartered in Bismarck. It provides transportation to people in rural Burleigh, Grant, McLean, Mercer, Morton, and Oliver Counties. This transit project provides over 36,000 rides annually. Rides are provided for medical, shopping, and recreational purposes. The West River Transportation Council provides intercity/fixed route service and unscheduled fixed route service.

This project is the primary transportation provider in the area. The Greyhound bus line on I-94 is the only other transportation service in the area. The West River Transportation Council serves as a feeder to the Greyhound line.

West River's service is provided nearly exclusively to the elderly and handicapped. Ninety-nine percent of West River's riders are either elderly or handicapped.

The project operates 10 vehicles, and uses seven of them on a regular basis. Six of

these vehicles are handicapped-accessible. There are no restrictions on who can use West River's transportation services, however priority is given to the elderly and handicapped.

6) MINOT COMMISSION ON AGING (MINOT, ND)

The Minot Commission on Aging is located in Minot, and provides transportation services for the entire city of Minot. Over 30,000 rides per year are provided by the Minot Commission on Aging. Rides are provided for medical, nutritional, shopping, recreational, employment and educational purposes. This project exclusively provides dial-a-ride service.

Other transportation providers in the Minot Commission on Aging's service area include Minot-Ace Checker Cab, Minot City Bus, Minot Vocational Workshop, North Central Human Service Center, and Trinity Nursing Home. However, the Minot Vocational Workshop, North Central Human Service Center, and the Trinity Nursing Home only transport their own clients. The Minot Commission on Aging complements the services of the city bus system by carrying passengers who can't use the city bus. Efforts to coordinate service with other transportation providers have also been made.

The services are targeted at the elderly and handicapped. Ninety percent of the trips provided by this service are made by elderly and handicapped persons.

The Minot Commission on Aging operates four vehicles for transit services. All of these vehicles are handicapped-accessible. There are no restrictions on who can use the Minot Commission on Aging's service, but the elderly and handicapped are given priority.

7) NELSON COUNTY COUNCIL ON AGING (McVILLE, ND)

The Nelson County Council on Aging of McVille, provides transportation in Nelson County, part of Eddy County, and part of Grand Forks County. This project provides 2,500 rides per year. Most trips are made for shopping, medical, recreational, nutritional, and

educational purposes. Ninety-five percent of this project's rides are provided to the elderly and handicapped. This project provides intercity/fixed route service and unscheduled fixed route service.

There are several other transportation providers in this project's service area. These are the Star Bus Line, the Friendship Manor Nursing Home, the Good Samaritan Nursing Home, the Aneta Nursing Home, and the Michigan Nursing Home. However, these nursing homes only provide rides to their own residents. The Nelson County Council on Aging has informed other agencies of its services, but has not tried to coordinate routes or service with other agencies.

The Nelson County Council on Aging owns two twelve passenger vans. One van is active and one is used as a back up. Neither van is handicapped-accessible.

There are no restrictions on who can use this service, but priority is given to the elderly and handicapped.

8) HELPING HANDS TAXI AND DELIVERY (GRAFTON, ND)

The Helping Hands Taxi and Delivery service of Grafton, provides transportation within a four mile radius of the city of Grafton. The project transports over 1,500 people per year. Rides are provided for shopping, medical, religious, employment, and educational purposes. Eighty-five percent of this project's rides are provided to the elderly and handicapped. This project provides dial-a-ride service and some fixed route service.

There are two other providers in the Helping Hands Taxi and Delivery Service's area. These providers are the Walsh County Transportation Service and the Grafton Lutheran Sunset Home. The Walsh County Transportation Service provides rides to Grand Forks on a monthly basis, while the Grafton Lutheran Sunset Home provides wheelchair rides to its residents. Coordination with these agencies is limited by the size and lack of handicapped

accessibility of this service's vehicle.

Helping Hands Taxi and Delivery operates one vehicle (taxicab), which is not handicapped-accessible. There are no restrictions on who can use the service, but priority is given to the elderly and handicapped.

III. REVIEW OF LITERATURE

As part of this study, all state DOT's throughout the country were surveyed to determine whether they had recently completed rural transit evaluations. If a given DOT had recently performed or commissioned a rural transit review, they were asked to provide copies of the reports.

The response was excellent, with most states responding and sending copies of recent evaluations. The various studies were evaluated and several were identified as exceptional studies. These reports were evaluated in-depth, both in terms of methodology and applicability to North Dakota. A recent study commissioned by the Commonwealth of Kentucky was found to be exemplary in terms of its methodology and its approach. Furthermore, the types and scopes of the systems evaluated in the Kentucky study make it both relevant and applicable to North Dakota.

Much of the methodology used in the Kentucky study has been adapted for use in the North Dakota evaluations. However, relevant portions of the research design have been formulated separately or abstracted from other studies.

Rural transit studies performed in other states have identified several quantitative efficiency and effectiveness measures which can be used in the North Dakota study. These measures are particularly convenient because they generally consist of information that is easily obtainable. They also provide a useful means of comparison between transit systems.

In addition to the quantitative analysis, some qualitative analysis must occur in order

to suggest ways to improve the efficiency and effectiveness of transit systems (Ernst and Whinney). This is the case because most of the performance indicators can only show the problems, but cannot identify causes. Qualitative analysis should be geared towards evaluating management practices which can't be measured, but which may affect something measurable. However, management practices should not be criticized on their own merit, but should be evaluated by the way in which they affect performance.

Quantitative performance measures are used in this study to evaluate efficiency and effectiveness. Qualitative measures are employed in areas where quantitative measures are below standards. Quantitative measures are also related to management practices in order to determine what types of management practices contribute to a successful rural transit system in North Dakota.

Quantitative performance measures are generally divided into two basic categories: efficiency and effectiveness. Efficiency measures are aimed at two basic goals: (1) to minimize costs for a given level of output produced, and (2) to maximize output for a given level of input (Ernst and Whinney). These two goals are actually the same, but the starting point for measurement is different.

Effectiveness measures are aimed at three different goals: (1) to maximize the quality of the service provided, (2) to minimize costs per passenger, and (3) to maximize the utilization of the service (Ernst and Whinney).

The Kentucky Section 18 Transit Evaluation Study produced an extensive list of performance measures and categorized them as follows:

1. **Social Effectiveness** - this measures the amount of service supplied to or consumed by a specific population.

2. **Service Effectiveness** - this measures the amount of utilization of the transit system and the quality of service.

3. **Cost Effectiveness** - this measures the transit system's ability to transport passengers while minimizing costs.

4. **Labor Efficiency** - this measures the productivity of labor or the level of output per worker.

5. **Administrative Efficiency**- this measures the ability of the transit system to minimize administrative costs while providing transportation service.

6. **Vehicle Efficiency** - this measures the suitability of a fleet size and the shape of the system's fleet. A system which has vehicles that are in good shape and which has an adequate number of vehicles will have lower maintenance costs because of elevated vehicle efficiency.

7. **Cost Efficiency** - this measures the transit system's ability to minimize costs while providing adequate service in terms of vehicle miles and vehicle hours.

8. **Revenue Efficiency** - this measures the revenue generated by the transit system in comparison to the amount of service provided.

9. **Operations Efficiency** - this measures the ability of the transit system to minimize operating expenses for the amount of service provided. Operating expenses are those attributable to dispatching, scheduling, and driving vehicles.

10. **Maintenance Efficiency** - this measures the efficiency of the transit system's vehicle maintenance resources.

Using the same categories as the Kentucky study, several quantitative performance measures can be identified. These performance measures are categorized below:

1.Social Effectiveness

Passengers Per Capita
Vehicle Miles Per Capita
Vehicle Hours Per Capita
Vehicles Per Capita
Percentage Of Trips By The Elderly or Handicapped
Percent Of Elderly/Handicapped Population Served
Vehicle Miles Per Elderly/Handicapped Population In Service Area
Vehicle Hours Per Elderly/Handicapped Population In Service Area

2. Service Effectiveness

Passengers Per Vehicle Mile
Passengers Per Vehicle Hour
Passengers Per Active Vehicle
Passengers Per Peak Vehicle
Average Passengers Per Scheduled Trip
Complaints Per 1,000 Passengers
Vehicle Miles/Accidents
Passengers By Route/Vehicle Miles By Route
Passengers By Route/Vehicle Hours By Route

3. Cost Effectiveness

Total Expense Per Passenger
Operating Expense Per Passenger
Administrative Expense Per Passenger
Subsidy Per Passenger

4. Labor Efficiency

Vehicle Hours Per Employee
Vehicle Miles Per Employee
Active Vehicles Per Administrative Employee
Active Vehicles Per Operating Employee
Active Vehicles Per Employee
Labor Expense/Total Expense

5. Administrative Efficiency

Administrative And Support Expense/Total Expense
Administrative Expense Per Active Vehicle
Administrative Expense Per Vehicle Mile

6. Vehicle Efficiency

Vehicle Hours/Available Vehicle Hours
Number Of Vehicles Used At Peak/Total Vehicles
Revenue Vehicle Miles/Vehicle Miles
Vehicle Miles Per Active Vehicle
Vehicle Hours Per Active Vehicle
Vehicle Miles Per Peak Vehicle
Vehicle Hours Per Peak Vehicle
Maintenance Expense Per Active Vehicle
Fuel Expense/Total Expense
Vehicle Miles/Roadcalls

7. Cost Efficiency

Total Expense Per Vehicle Mile
Total Expense Per Vehicle Hour
Operating Expense Per Vehicle Mile
Operating Expense Per Vehicle Hour
Total Salary And Fringe Expenses Per Vehicle Mile
Total Salary And Fringe Expenses Per Vehicle Hour
Administrative Salary And Fringe Expenses Per Vehicle Mile
Administrative Salary And Fringe Expenses Per Vehicle Hour
Operations Salary And Fringe Expenses Per Vehicle Mile
Operations Salary And Fringe Expenses Per Vehicle Hour

8. Revenue Efficiency

Passenger Revenue Per Vehicle Mile
Passenger Revenue Per Vehicle Hour
Passenger Revenue/Total Expenses
Passenger Revenue/Operating Expenses
Operating Revenue/Total Expenses
Operating Revenue/Operating Expenses
Passenger Revenue Per Active Vehicle
Passenger Revenue Per Passenger
Operating Revenue Per Vehicle Mile
Operating Revenue Per Vehicle Hour
Operating Revenue Per Active Vehicle
Operating Revenue Per Passenger
Passenger Revenue By Route Per Vehicle Mile By Route
Passenger Revenue By Route Per Vehicle Hour By Route

9. Operations Efficiency

Operations Expense Per Active Vehicle
Operations Expense Per Vehicle Mile
Operations Expense/Total Expense
Operations Expense Per Vehicle Hour

10. Maintenance Efficiency

Maintenance Expense Per Active Vehicle
Maintenance Expense Per Vehicle Mile
Maintenance Expense/Total Expense
Maintenance Expense Per Vehicle Hour

Not all of the performance measures listed above are relevant to North Dakota or practical to use. In the next section of the report, the process used to select performance measures for the North Dakota study is highlighted.

IV. SELECTION AND CALCULATION OF PERFORMANCE MEASURES

Four factors are considered in deciding which performance measures to use. These factors are: 1) the completeness and reliability of the data, 2) the controllability of the performance indicator by management, 3) the applicability of the performance measures to rural transit systems which serve the handicapped and elderly, and 4) the explanatory ability of the performance measures.

The completeness and reliability of the data are vital to the effective use of performance indicators for evaluation. Because of incomplete data in some cases, several performance measures were dropped from the study.

When the efficiency of a transit system is being evaluated it is important that only those things that can be controlled by the transit manager be considered. Things such as the system environment are not under the control of the transit manager, and therefore cannot be improved upon by the transit manager. In this study, controllability is considered in choosing performance measures.

The performance measures' applicability to the transit systems analyzed in this study is also a factor in the selection process. Measures such as crimes reported per vehicle hour or percent of urban population served are not considered because of the transit systems' rural

nature. Conversely, measures such as the percentage of trips by the elderly or handicapped are emphasized in the study.

The explanatory ability of performance measures is also particularly important. It is desirable to explain as much as possible about the transit systems without prohibitively high costs. Fielding and Anderson used factor analysis to select a few performance indicators which represent important performance concepts. Their study is taken into account when choosing performance measures. However, since many performance measures can be obtained at a low cost, the majority of the measures mentioned are used in the final analysis.

The performance measures used and their definitions are as follows:

%RIDES TO ELD/H -	percent of rides that are provided to the elderly and handicapped.
PASS/CAP -	passengers per capita.[2]
VEHICLE MILES/CAP -	vehicle miles per capita.
VEHICLE HOURS/CAP -	vehicle hours per capita.
VEHICLES/CAP -	vehicles per capita.
EHPASS/EPOP -	elderly and handicapped passengers per elderly population in the service area.[3]
VEHICLE MILES/EPOP -	vehicle miles per elderly population in the service area.
PASS/VEHICLE MILE -	passengers per vehicle mile.
PASS/VEHICLE HOUR -	passengers per vehicle hour.

[2]Passengers for a project are defined as the number of one way passenger trips provided by the service.

[3]Data were not available on the amount of handicapped population in each service area. Elderly population was used, since most of the handicapped riders on these systems are elderly.

PASS/ACT VEHICLE -	passengers per active vehicle
PASS/PK VEHICLE -	passengers divided by the number of vehicles used at peak times.
TOTEXP/PASS -	total expense per passenger.
OPEXP/PASS -	operating expense per passenger.[4]
ADMINEXP/PASS -	administrative expense per passenger.
VEHICLE HOURS/EMP -	vehicle hours per employee.
VEHICLE MILES/EMP -	vehicle miles per employee.
ACT VHCLS/ADMEMP -	Active vehicles per administrative employee.
ACT VHCLS/OPEMP -	Active vehicles per operating employee.
LABEXP/TOTEXP -	labor expense per total expense.
ADMEXP/TOTEXP -	administrative expense per total expense.
ADMEXP/ACT VHCL -	administrative expense per active vehicle.
ADMEXP/VHCL MILE -	administrative expense per vehicle mile.
VHCL MLS/ACT VHCL -	vehicle miles per active vehicle.
VHCL HRS/ACT VHCL -	vehicle hours per active vehicle.
MAINTEXP/ACT VHCL -	maintenance expense per active vehicle.
FUELEXP/TOTEXP -	fuel expense per total expense.
TOTEXP/VHCL MILE -	total expense per vehicle mile.
TOTEXP/VHCL HOUR -	total expense per vehicle hour.
OPEXP/VHCL MILE -	operating expense per vehicle mile.
OPEXP/VHCL HOUR -	operating expense per vehicle hour.
TSAL&FB/VHCL MILE -	total salary and fringe benefits per vehicle mile.

[4]Operating expenses are those attributable to vehicle operations and maintenance.

TSAL&FB/VHCL HOUR - total salary and fringe benefits per vehicle hour.

ADMSAL&FB/VHCL ML - administrative salary and fringe benefits per vehicle mile.

ADMSAL&FB/VHCL HR - administrative salary and fringe benefits per vehicle hour.

OPSAL&FB/VHCL ML - operating salary and fringe benefits per vehicle mile.

OPSAL&FB/VHCL HR - operating salary and fringe benefits per vehicle hour.

PASSREV/VHCL MILE - passenger revenue per vehicle mile.

PASSREV/VHCL HOUR - passenger revenue per vehicle hour.

PASSREV/TOTEXP - passenger revenue per total expense.

OPREV/TOTEXP - operating revenue per total expense.[5]

OPREV/OPEXP - operating revenue per operating expense.

PASSREV/ACT VHCL - passenger revenue per active vehicle.

PASSREV/PASS - passenger revenue per passenger.

OPREV/VEHICLE MILE - operating revenue per vehicle mile.

OPREV/ACT VEHICLE - operating revenue per active vehicle.

OPREV/PASS - operating revenue per passenger.

OPEXP/ACT VEHICLE - operating expense per active vehicle.

OPEXP/TOTEXP - operating expense per total expense.

MAINTEXP/VHCL ML - maintenance expense per vehicle mile.

MAINTEXP/VHCL HR - maintenance expense per vehicle hour.

MAINTEXP/TOTEXP - maintenance expense per total expense.

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[5]Operating revenue is defined as passenger revenue plus contract revenue.

In Table 1, the values or scores for each performance measure are listed for each of the eight rural transit systems. In addition, the group means and standard deviations are shown. These data and statistics are used later in the report to compute standardized scores and statistical indexes which allow a more concise comparison of each transit system's scores to the mean or average scores for the group.

The data used in calculating the performance measures were obtained from a detailed survey of each of the eight transit projects and from on-site interviews. The survey used is shown in Appendix A.

TABLE 1
PERFORMANCE INDICATORS

1. SOCIAL EFFECTIVENESS	JAMES RIVER	SOUTH CENTRAL	SOUTH WEST	KIDDER COUNTY	WEST RIVER	MINOT	NELSON COUNTY	HELPING HANDS	MEAN	STD. DEV.
%RIDES TO ELD/H	95	70	82	99	99	90	95	85	89.38	9.99
PASS/CAP	1.62	0.89	1.63	1.22	0.88	0.93	0.48	0.28	0.99	0.49
VEHICLE MILES/CAP	2.69	3.15	3.57	7.31	2.64	1.84	4.54	2.27	3.50	1.75
VEHICLE HOURS/CAP	0.20	0.22	0.33	0.34	0.22	0.16	0.39	0.83	0.34	0.22
VEHICLES/CAP	0.0003	0.0002	0.0004	0.0003	0.0002	0.0001	0.0002	0.0002	0.0002	0.0001
EHPASS/EPOP	11.44	3.49	9.04	8.49	7.24	7.39	1.97	1.56	6.32	3.58
VEHICLE MILES/EPOP	20.07	17.60	24.16	50.73	22.09	16.28	19.74	14.72	23.17	11.55
2. SERVICE EFFECTIVENESS										
PASS/VEHICLE MILE	0.60	0.28	0.46	0.17	0.33	0.50	0.11	0.13	0.32	0.18
PASS/VEHICLE HOUR	8.04	4.10	4.87	3.60	3.92	5.69	1.23	0.34	3.97	2.43
PASS/ACT VEHICLE	6500	5384	6359	4685	5222	10166	2500	1500	5289.5	2643.32
3. COST EFFECTIVENESS										
TOTEXP/PASS	2.39	2.97	3.69	5.08	3.98	2.79	9.85	9.89	5.08	3.07
OPEXP/PASS	1.94	2.74	2.43	4.53	2.80	2.59	7.29	7.45	3.97	2.23
ADMINEXP/PASS	0.45	0.23	1.26	0.28	1.18	0.20	2.56	2.43	1.07	0.97

TABLE 1 (CONT.)

4. LABOR EFFICIENCY	JAMES RIVER	SOUTH CENTRAL	SOUTH WEST	KIDDER COUNTY	WEST RIVER	MINOT	NELSON COUNTY	HELPING HANDS	MEAN	STD. DEV.
VEHICLE HOURS/EMP	746.2	751	870	650	1037	1190	1014	2190	1056.03	492
VEHICLE MILES/EMP	10000	10857	9292	14000	12222	13443	11881	6000	10961.88	2568.04
ACT VHCLS/ADMEMP	4.00	2.00	2.00	1.00	3.50	2.00	1.00	1.00	2.06	1.15
ACT VHCLS/OPEMP	1.20	0.80	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.11
ACT VHCLS/EMP	0.92	0.57	0.67	0.50	0.78	0.67	0.50	0.50	0.64	0.15
LABEXP/TOTEXP	0.66	0.67	0.68	0.50	0.64	0.72	0.68	0.68	0.65	0.07
5. ADMINISTRATIVE EFFICIENCY										
ADMEXP/TOTEXP	0.19	0.08	0.34	0.11	0.30	0.07	0.26	0.25	0.20	0.10
ADMEXP/ACT VHCL	2906	1227	8020	2575	6149	2048	6398	3650	4121.63	2427.83
ADMEXP/VHCL MILE	0.27	0.07	0.58	0.09	0.39	0.10	0.27	0.30	0.26	0.17
6. VEHICLE EFFICIENCY										
VHCL MLS/ACT VHCL	10833	19000	13938	28000	15714	20165	23762	12000	17926.5	5951.43
VHCL HRS/ACT VHCL	808	1315	1305	1300	1333	1785	2028	4380	1781.75	1110.88
MAINTEXP/ACT VHCL	1156	1407	1729	2648	1406	2667	969	200	1522.75	831.17
FUELEXP/TOTEXP	0.11	0.15	0.12	0.22	0.10	0.11	0.12	0.14	0.13	0.04
7. COST EFFICIENCY										
TOTEXP/VHCL MILE	1.43	0.84	1.68	0.85	1.32	1.41	1.04	1.24	1.23	0.30
TOTEXP/VHCL HOUR	19.21	12.14	17.99	18.32	15.59	15.86	12.15	3.39	14.33	5.16
OPEXP/VHCL MILE	1.17	0.78	1.11	0.76	0.93	1.30	0.77	0.93	0.97	0.20

TABLE 1 (CONT.)

COST EFFICIENCY (CONT.)	JAMES RIVER	SOUTH CENTRAL	SOUTH WEST	KIDDER COUNTY	WEST RIVER	MINOT	NELSON COUNTY	HELPING HANDS	MEAN	STD. DEV.
OPEXP/VHCL HOUR	15.62	11.21	11.84	16.34	10.98	14.72	8.99	2.55	11.53	4.43
TSAL&FB/VHCL MILE	0.95	0.57	1.15	0.43	0.85	1.02	0.71	0.84	0.82	0.24
TSAL&FB/VHCL HOUR	12.67	8.16	12.27	9.27	10.03	11.47	8.30	2.30	9.31	3.31
ADMSAL&FB/VHCL ML	0.17	0.05	0.45	0.05	0.30	0.08	0.22	0.20	0.19	0.14
ADMSAL&FB/VHCL HR	2.25	0.67	4.85	1.02	3.49	0.93	2.53	0.55	2.04	1.54
OPSAL&FB/VHCL ML	0.78	0.52	0.70	0.38	0.55	0.93	0.49	0.64	0.62	0.18
OPSAL&FB/VHCL HR	10.42	7.49	7.42	8.25	6.54	10.54	5.77	1.75	7.27	2.80
8. REVENUE EFFICIENCY										
PASSREV/VHCL MILE	0.17	0.20	0.19	0.19	0.20	0.13	0.14	0.33	0.19	0.06
PASSREV/VHCL HOUR	2.34	2.93	2.06	4.05	2.29	1.49	1.58	0.91	2.21	0.97
PASSREV/TOTEXP	0.12	0.24	0.12	0.22	0.15	0.09	0.13	0.27	0.17	0.07
OPREV/TOTEXP	0.30	0.46	0.12	0.22	0.15	0.09	0.13	0.27	0.22	0.12
OPREV/OPEXP	0.37	0.50	0.17	0.25	0.21	0.10	0.18	0.36	0.27	0.13
PASSREV/ACT VHCL	1890	3846	2691	5267	3059	2667	3200	4000	3327.5	1033.64
PASSREV/PASS	0.29	0.71	0.42	1.12	0.59	0.26	1.28	2.67	0.92	0.80
OPREV/VEHICLE MILE	0.43	0.38	0.19	0.19	0.20	0.13	0.14	0.33	0.25	0.12
OPREV/ACT VEHICLE	4609	7289	2691	5267	3059	2667	3200	4000	4097.75	1591.63
OPREV/PASS	0.71	1.35	0.42	1.12	0.59	0.26	1.28	2.67	1.05	0.77

TABLE 1 (CONT.)										
9. OPERATING EFFICIENCY	**JAMES RIVER**	**SOUTH CENTRAL**	**SOUTH WEST**	**KIDDER COUNTY**	**WEST RIVER**	**MINOT**	**NELSON COUNTY**	**HELPING HANDS**	**MEAN**	**STD. DEV.**
OPEXP/ACT VEHICLE	12622	14734	15456	21243	14638	26275	18231	11180	16797.38	4947.62
OPEXP/VHCL MILE	1.17	0.78	1.11	0.76	0.93	1.30	0.77	0.93	0.97	0.20
OPEXP/VHCL HOUR	15.62	11.21	11.84	16.34	10.98	14.72	8.99	2.55	11.53	4.43
OPEXP/TOTEXP	0.81	0.92	0.66	0.89	0.70	0.93	0.74	0.75	0.80	0.10
10. MAINTENANCE EFFICIENCY										
MAINTEXP/ACT VHCL	1156	1407	1729	2648	1406	2667	969	200	1522.75	831.17
MAINTEXP/VHCL ML	0.11	0.07	0.12	0.10	0.09	0.13	0.04	0.02	0.09	0.04
MAINTEXP/VHCL HR	1.43	1.07	1.33	2.04	1.05	1.49	0.48	0.05	1.12	0.62
MAINTEXP/TOTEXP	0.08	0.09	0.07	0.11	0.07	0.09	0.04	0.01	0.07	0.03

The comparison of each system's scores or values to the mean for the group is one method of evaluating the performance of rural transit systems. If the performance level of a given transit system falls below the group mean, it can generally be concluded that the enterprise is not achieving its potential in terms of effectiveness or efficiency. Such "within-group" analysis does not indicate how the systems are performing relative to those operating in other states. Table 2 addresses this question, comparing mean performance measures of the North Dakota group to the means for other states.[6]

North Dakota compares favorably with other states in many social and service effectiveness measures. Mean passengers per vehicle mile for the North Dakota sample compare favorably to the mean passengers per vehicle mile for Florida and are equal to the mean passengers per vehicle mile for Kentucky. This is somewhat surprising, as the Kentucky sample contains some small urban Section 18 projects. Michigan and Iowa have slightly more passengers per vehicle mile than Kentucky. North Dakota passengers per vehicle hour also compare favorably with those in Kentucky, while Michigan systems generally have more passengers per vehicle hour. Passengers per active vehicle are greater in both Kentucky and Michigan than they are in the North Dakota sample. Passengers per capita in the North Dakota sample compare favorably with Kentucky, while Michigan transports the most passengers per capita. Vehicle miles per capita in North Dakota and vehicle hours per capita in North Dakota are both larger than the Kentucky values, but smaller than the Michigan values.

North Dakota does not compare favorably to other states in most efficiency measures. Total expense per passenger is higher for the North Dakota sample than for any of the other

[6]Comparison states' performance measures are all calculated from 1987 statistics.

TABLE 2
COMPARISON OF SAMPLED SECTION 18 PROJECTS TO THOSE OF OTHER STATES

SOCIAL EFFECTIVE-NESS	NORTH DAKOTA (SAMPLE)	KENTUCKY	FLORIDA	MICHIGAN	IOWA
PASS/CAP	0.99	0.78	na	3.33	na
VEHICLE MILES/CAP	3.50	2.41	na	9.89	na
VEHICLE HOURS/CAP	0.34	0.22	na	0.55	na
SERVICE EFFECTIVENESS					
PASS/VEHICLE MILE	0.32	0.32	0.23	0.34	0.33
PASS/VEHICLE HOUR	3.97	3.48	na	6.12	na
PASS/ACT VEHICLE	5290	6067	na	9770	na
COST EFFECTIVENESS					
TOTEXP/PASS ($)	5.08	3.09	4.45	3.45	2.43
LABOR EFFICIENCY					
VEHICLE MILES/EMP	10962	21460	14600	15200	na
VEHICLE HOURS/EMP	1056	2003	3340	835	na
ACT VEHICLES/EMP	0.64	1.14	na	0.52	na
VEHICLE EFFICIENCY					
VHCL MLS/ACT VHCL	17927	18686	na	29000	na
VHCL HRS/ACT VHCL	1782	1744	na	1600	na
COST EFFICIENCY					
TOTEXP/VHCL MILE	1.23	1.00	0.95	1.16	0.77

Source: Schimpeler Corradino Associates

comparison states. This may be explained in part by the higher vehicle miles and vehicle hours per capita, which in turn are partly a function of geography and population density. Vehicle miles per employee are less for the North Dakota sample than for any other state.

Vehicle hours per employee for the North Dakota sample exceed only those in the state of Michigan. The mean active vehicles per employee in North Dakota is greater than in Michigan, but less than in Kentucky. Vehicle miles per active vehicle for the North Dakota sample are less than the means for Kentucky and Michigan. However, vehicle hours per active vehicle in North Dakota exceed those of the comparison states. The same is true for total expenses per vehicle mile.

The state-to-state comparison highlights several important factors concerning rural transit operations in North Dakota. First, in most social or service effectiveness measures, North Dakota values are comparable to those of Kentucky. However, the scores for both Kentucky and North Dakota are generally much different (and smaller) than those for Michigan. This relationship is both expected and logical. The population and geographic factors affecting rural transit services in North Dakota and Kentucky are more similar than they are different. Of the 20 systems evaluated in the Kentucky study, only four (Lexington-Fayette County, Paducah, Frankfort, and Northern Kentucky) operate in the geographic vicinity of populous urban centers. The remainder of the Kentucky systems constitute multi-county rural operations or small city enterprises. Both states are relatively sparsely populated with substantial elderly and handicapped populations. Michigan, on the other hand, is a populous state with many small urban systems. Thus, passengers per vehicle hour and per capita are understandably larger.

Second, as Table 2 shows, the costs of providing rural transit services are higher in North Dakota than in any other state included in the comparison group. This relationship holds true regardless of whether total expense per passenger or per vehicle-mile is used as the criterion. Again, these comparisons underscore the effects of population density and

geography on unit costs.

V. ANALYSIS OF OUTLIERS

In order to determine which performance indicators are significantly different from the mean or central tendency of the group, t-statistics are calculated (Table 3). The t-distribution is symmetrical like the normal distribution, but is flatter. As degrees of freedom increase, the t-distribution approximates the normal distribution. The t-distribution allows the use of the sample mean and sample standard deviation, whereas the normal distribution only allows the use of the population mean and standard deviation. The t-statistic is calculated as follows:

$$t = \frac{Project\,Value - Group\,Mean}{Standard\,Deviation}\sqrt{n-1}$$

Project values are considered to be significantly different from the group mean when the absolute values of their t-statistics are greater than 2.365. This is based on a 95% confidence level (or a 5% level of significance) with a two-tailed test and seven degrees of freedom.

Outliers are highlighted and analyzed in detail for several reasons: (1) to determine if they show a positive trend towards efficiency or a negative trend, (2) to discover reasons for negative trends towards efficiency, and (3) to suggest ways in which performance trends can be improved. Outliers are highlighted by an asterisk in Table 3. In addition to the numerical presentation of outliers in Table 3, Table 4 presents outliers in verbal form. In Table 4, "strong" indicates this performance measure is above average and "NI" indicates that this performance measure shows a need for improvement. All measures left blank indicate that the performance measures are not outliers.

TABLE 3
ANALYSIS OF OUTLIERS (T-STATISTIC)

1. SOCIAL EFFECTIVENESS	JAMES RIVER	SOUTH CENTRAL	SOUTH WEST	KIDDER COUNTY	WEST RIVER	MINOT	NELSON COUNTY	HELPING HANDS
%RIDES TO ELD/H	1.49	-5.13*	-1.96	2.55*	2.55*	0.16	1.49	-1.16
PASS/CAP	3.43*	-0.55	3.48*	1.25	-0.61	-0.33	-2.79*	-3.88*
VEHICLE MILES/CAP	-1.23	-0.53	0.10	5.77*	-1.30	-2.51*	1.57	-1.86
VEHICLE HOURS/CAP	-1.68	-1.43	-0.08	0.05	-1.43	-2.18	0.66	6.09*
VEHICLES/CAP	2.65*	0.00	5.29*	2.65*	0.00	-2.65*	0.00	0.00
EHPASS/EPOP	3.77*	-2.10	2.00	1.60	0.67	0.78	-3.22*	-3.52*
VEHICLE MILES/EPOP	-0.71	-1.28	0.23	6.32*	-0.25*	-1.58	-0.79	-1.94
2. SERVICE EFFECTIVENESS								
PASS/VEHICLE MILE	4.12*	-0.59	2.06	-2.21	0.15	2.65*	-3.09*	-2.79*
PASS/VEHICLE HOUR	4.43*	0.14	0.98	-0.40	-0.05	1.87	-2.98*	-3.95*
PASS/ACT VEHICLE	1.21	0.10	1.07	-0.61	-0.07	4.88*	-2.79*	-3.79*
3. COST EFFECTIVENESS								
TOTEXP/PASS	-2.32	-1.82	-1.20	0.00	-0.95	-1.97	4.11*	4.15*
OPEXP/PASS	-2.41*	-1.46	-1.83	0.66	-1.39	-1.64	3.94*	4.13*
ADMINEXP/PASS	-1.70	-2.30	0.51	-2.17	0.29	-2.38*	4.05*	3.70*
4. LABOR EFFICIENCY								
VEHICLE HOURS/EMP	-1.67	-1.64	-1.00	-2.18	-0.10	0.72	-0.23	6.10*
VEHICLE MILES/EMP	-0.99	-0.11	-1.72	3.13*	1.30	2.56*	0.95	-5.11*
ACT VHCLS/ADMEMP	4.46*	-0.14	-0.14	-2.44*	3.31*	-0.14	-2.44*	-2.44*
ACT VHCLS/OPEMP	4.81*	-4.81*	0.00	0.00	0.00	0.00	0.00	0.00
ACT VHCLS/EMP	4.94*	-1.24	0.53	-2.47*	2.47*	0.53	-2.47*	-2.47*
LABEXP/TOTEXP	0.25	0.65	1.05	-6.15*	-0.55	2.65*	1.05	1.05
5. ADMINISTRATIVE EFFICIENCY								
ADMEXP/TOTEXP	-0.26	-3.06*	3.57*	-2.30	2.55*	-3.32*	1.53	1.28
ADMEXP/ACT VHCL	-1.33	-3.15*	4.25*	-1.69	2.21	-2.26	2.48*	-0.51
ADMEXP/VHCL MILE	0.17	-2.87*	4.89*	-2.57*	2.00	-2.42*	0.17	0.63
6. VEHICLE EFFICIENCY								
VHCL MLS/ACT VHCL	-3.15*	0.48	-1.77	4.48*	-0.98	1.00	2.59*	-2.63*
VHCL HRS/ACT VHCL	-2.32	-1.11	-1.14	-1.15	-1.07	0.01	0.59	6.19*
MAINTEXP/ACT VHCL	-1.17	-0.37	0.66	3.58*	-0.37	3.64*	-1.76	-4.21*
FUELEXP/TOTEXP	-1.63	1.12	-0.94	5.92*	-2.32	-1.63	-0.94	0.43

TABLE 3 (CONT.)

7. COST EFFICIENCY	JAMES RIVER	SOUTH CENTRAL	SOUTH WEST	KIDDER COUNTY	WEST RIVER	MINOT	NELSON COUNTY	HELPING HANDS
TOTEXP/VHCL MILE	1.82	-3.45*	4.05*	-3.36*	0.84	1.64	-1.66	0.12
TOTEXP/VHCL HOUR	2.50*	-1.12	1.88	2.05	0.65	0.78	-1.12	-5.61*
OPEXP/VHCL MILE	2.61*	-2.45*	1.83	-2.71*	-0.50	4.29*	-2.58*	-0.50
OPEXP/VHCL HOUR	2.44*	-0.19	0.18	2.87*	-0.33	1.90	-1.52	-5.36*
TSAL&FB/VHCL MILE	1.43	-2.76*	3.64*	-4.30*	0.33	2.20	-1.21	0.22
TSAL&FB/VHCL HOUR	2.69*	-0.92	2.37*	-0.03	0.58	1.73	-0.81	-5.60*
ADMSAL&FB/VHCL ML	-0.38	-2.65*	4.91*	-2.65*	2.08	-2.08	0.57	0.19
ADMSAL&FB/VHCL HR	0.36	-2.35	4.83*	-1.75	2.49*	-1.91	0.84	-2.56*
OPSAL&FB/VHCL ML	2.35	-1.47	1.18	-3.53*	-1.03	4.56*	-1.91	0.29
OPSAL&FB/VHCL HR	2.98*	0.21	0.14	0.93	-0.69	3.09*	-1.42	-5.22*
8. REVENUE EFFICIENCY								
PASSREV/VHCL MILE	-0.88	0.44	0.00	0.00	0.44	-2.65*	-2.20	6.17*
PASSREV/VHCL HOUR	0.36	1.96	-0.41	5.02*	0.22	-1.96	-1.72	-3.55*
PASSREV/TOTEXP	-1.90	2.89*	-1.90	2.10	-0.70	-3.09*	-1.50	4.09*
OPREV/TOTEXP	1.77	5.21*	-2.09	0.05	-1.45	-2.74*	-1.88	1.13
OPREV/OPEXP	2.06	4.66*	-1.95	-0.35	-1.15	-3.36*	-1.75	1.85
PASSREV/ACT VHCL	-3.68*	1.33	-1.63	4.96*	-0.69	-1.69	-0.33	1.72
PASSREV/PASS	-2.08	-0.70	-1.65	2.58*	-1.09	-2.18	1.19	5.79*
OPREV/VEHICLE MILE	3.97*	2.87*	-1.32	-1.32	-1.10	-2.65*	-2.43*	1.76
OPREV/ACT VEHICLE	0.85	5.31*	-2.34	1.94	-1.73	-2.38*	-1.49	-0.16
OPREV/PASS	-1.17	1.03	-2.17	2.23	-1.58	-2.72*	0.79	5.57*
9. OPERATIONS EFFICIENCY								
OPEXP/ACT VEHICLE	-2.23	-1.10	-0.72	2.38*	-1.16	5.07*	0.77	-3.00*
OPEXP/VHCL MILE	2.61*	-2.45*	1.83	-2.71*	-0.50	4.29*	-2.58*	-0.50*
OPEXP/VHCL HOUR	2.44*	-0.19	0.18	2.87*	-0.33	1.90	-1.52	-5.36*
OPEXP/TOTEXP	0.26	3.06*	-3.57*	2.30	-2.56*	3.32*	-1.53	-1.28
10. MAINTENANCE EFFICIENCY								
MAINTEXP/ACT VHCL	-1.17	-0.37	0.66	3.58*	-0.37	3.64*	-1.76	-4.21*
MAINTEXP/VHCL ML	1.32	-1.32	1.98	0.66	0.00	2.65*	-3.31*	-5.29*
MAINTEXP/VHCL HR	1.32	-0.21	0.90	3.93*	-0.30	1.58	-2.73*	-4.57*
MAINTEXP/TOTEXP	0.84	1.67	0.00	3.35*	0.00	1.67	-2.51*	-5.02*

TABLE 4
ANALYSIS OF OUTLIERS

1. SOCIAL EFFECTIVENESS	JAMES RIVER	SOUTH CENTRAL	SOUTH WEST	KIDDER COUNTY	WEST RIVER	MINOT	NELSON COUNTY	HELPING HANDS
%RIDES TO ELD/H		NI		Strong	Strong			
PASS/CAP	Strong		Strong				NI	NI
VEHICLE MILES/CAP				Strong		NI		
VEHICLE HOURS/CAP								Strong
VEHICLES/CAP	Strong		Strong	Strong		NI		
EHPASS/EPOP	Strong						NI	NI
VEHICLE MILES/EPOP				Strong				
2. SERVICE EFFECTIVENESS								
PASS/VEHICLE MILE	Strong					Strong	NI	NI
PASS/VEHICLE HOUR	Strong						NI	NI
PASS/ACT VEHICLE						Strong	NI	NI
3. COST EFFECTIVENESS								
TOTEXP/PASS							NI	NI
OPEXP/PASS	Strong						NI	NI
ADMINEXP/PASS						Strong	NI	NI
4. LABOR EFFICIENCY								
VEHICLE HOURS/EMP								Strong
VEHICLE MILES/EMP				Strong		Strong		NI
ACT VHCLS/ADMEMP	Strong			NI	Strong		NI	NI
ACT VHCLS/OPEMP	Strong	NI						
ACT VHCLS/EMP	Strong			NI	Strong		NI	NI
LABEXP/TOTEXP				Strong		NI		
5. ADMINISTRATIVE EFFICIENCY								
ADMEXP/TOTEXP		Strong	NI	Strong	NI	Strong		
ADMEXP/ACT VHCL		Strong	NI				NI	
ADMEXP/VHCL MILE		Strong	NI	Strong		Strong		
6. VEHICLE EFFICIENCY								
VHCL MLS/ACT VHCL	NI			Strong			Strong	NI
VHCL HRS/ACT VHCL								Strong
MAINTEXP/ACT VHCL				NI		NI		Strong
FUELEXP/TOTEXP				NI				

TABLE 4 (CONT.)

7. COST EFFICIENCY	JAMES RIVER	SOUTH CENTRAL	SOUTH WEST	KIDDER COUNTY	WEST RIVER	MINOT	NELSON COUNTY	HELPING HANDS
TOTEXP/VHCL MILE		Strong	NI	Strong				
TOTEXP/VHCL HOUR	NI							Strong
OPEXP/VHCL MILE	NI	Strong		Strong		NI	Strong	
OPEXP/VHCL HOUR	NI			NI				Strong
TSAL&FB/VHCL MILE		Strong	NI	Strong				
TSAL&FB/VHCL HOUR	NI		NI					Strong
ADMSAL&FB/VHCL ML		Strong	NI	Strong				
ADMSAL&FB/VHCL HR			NI		NI			Strong
OPSAL&FB/VHCL ML				Strong		NI		
OPSAL&FB/VHCL HR	NI					NI		Strong
8. REVENUE EFFICIENCY								
PASSREV/VHCL MILE						NI		Strong
PASSREV/VHCL HOUR				Strong				NI
PASSREV/TOTEXP		Strong				NI		Strong
OPREV/TOTEXP		Strong				NI		
OPREV/OPEXP		Strong				NI		
PASSREV/ACT VHCL	NI			Strong				
PASSREV/PASS				Strong				Strong
OPREV/VEHICLE MILE	Strong	Strong				NI	NI	
OPREV/ACT VEHICLE		Strong				NI		
OPREV/PASS						NI		Strong
9. OPERATIONS EFFICIENCY								
OPEXP/ACT VEHICLE				NI		NI		Strong
OPEXP/VHCL MILE	NI	Strong		Strong		NI	Strong	
OPEXP/VHCL HOUR	NI			NI				Strong
OPEXP/TOTEXP		NI	Strong		Strong	NI		
10.MAINTENANCE EFFICIENCY								
MAINTEXP/ACT VHCL				NI		NI		Strong
MAINTEXP/VHCL ML						NI	Strong	Strong
MAINTEXP/VHCL HR				NI			Strong	Strong
MAINTEXP/TOTEXP				NI			Strong	Strong

The following is an analysis of the outliers shown in Tables 3 and 4 relative to the 10 performance measures used to gauge the efficiency and effectiveness of the eight transit projects under study.

1. Social Effectiveness

The first group of performance measures look at social effectiveness. Social effectiveness measures a project's ability to provide adequate service to those persons whom their system is designed for.

James River Senior Citizens Center

James River Senior Citizens Center has three outliers in the social effectiveness category. These three outliers indicate above average social effectiveness for the group. The amount of passengers per capita, vehicles per capita, and elderly/handicapped passengers per elderly population in the service area are all significantly above the average for this group.

South Central Senior Services

South Central Senior Services has one outlier in the social effectiveness category. This outlier is on the negative side for the percentage of rides provided to the elderly and handicapped. This outlier could represent increased effectiveness in serving the general public while still serving the elderly handicapped population effectively. However, this does not seem to be the case, as indicated by a negative t-statistic with an absolute value over two for elderly and handicapped passengers per elderly population. This latter measure indicates that proportionately fewer elderly and handicapped riders are using the system.

Southwest Senior Services

Southwest Senior Services has two outliers in the social effectiveness category. The two outliers are for passengers per capita and vehicles per capita. Both outliers have positive signs, indicating that these performance measures are significantly above those for the group.

Kidder County Senior Services

Kidder County Senior Services has four positive outliers in the social effectiveness category. These outliers are the percentage of riders that are elderly and handicapped, vehicle miles per capita, vehicles per capita, and vehicle miles per elderly population. Again, these scores indicate above average performance.

West River Transportation Council

West River Transportation Council has one positive outlier in the social effectiveness category. This outlier is for the percentage of the project's rides that are provided to the elderly and handicapped. This positive outlier indicates above average performance in this category.

Minot Commission on Aging

Minot Commission on Aging has negative outliers for vehicles per capita and vehicle miles per capita. However, the presence of a city bus system in Minot decreases the importance of these outliers. This project's performance measures for the service of the elderly and handicapped population are near the group mean. The Minot system, in fact, is one of the most cost-effective operations, as will be illustrated later.

Nelson County Council on Aging

Nelson County Council on Aging has two outliers in the social effectiveness category. The t-statistics for elderly and handicapped passengers per elderly population and passengers per capita are significantly below the group average, indicating that the system is attracting proportionately fewer passengers.

Helping Hands Taxi and Delivery

Helping Hands Taxi and Delivery has two negative outliers in the social effectiveness category: passengers per capita, and elderly and handicapped passengers per elderly population. Vehicle hours per capita are significantly above average. This apparent discrepancy can be explained by the fact that the auto/taxicab used by this project has very limited capacity. Only three to four passengers can be transported at a time.

2. Service Effectiveness

The second group of performance indicators explores service effectiveness. Service effectiveness measures the level of utilization of the transit system.

The following systems do not have any outliers in the service effectiveness category:

- South Central Senior Services
- Southwest Senior Services
- Kidder County Senior Services
- West River Transportation Council

James River Senior Citizens Center

James River has two service effectiveness measures which are significantly above the group average. These measures are passengers per vehicle mile and passengers per vehicle hour.

Much of the above average service effectiveness might be explained by the extensive marketing and distribution of information by this project. James River Senior Citizens Center distributes a brochure, lists its schedule in the local newspaper, distributes schedules on activity calendars, and receives public service announcements from the local radio station.

Another factor which might explain some of the strong performance in service effectiveness by James River Senior Citizens Center is the newness of the project's vehicles. The vehicles of a transit system project an image which can influence ridership. Half of James River Senior Center's six vehicle fleet is 1987 models or newer. Other factors within or beyond the project's control may also influence the effectiveness measures.

Minot Commission on Aging

Minot Commission on Aging has two service effectiveness measures which are significantly above the mean: (1) passengers per vehicle mile and (2) passengers per active vehicle. These measures may partly be the result of driver courtesy. The ridership survey for this project showed several riders to be enthusiastic about the drivers' helpfulness and courtesy. In addition, the vehicles are in good condition, and all are wheelchair-accessible. Finally, Minot Commission on Aging receives extensive publicity from United Way, brochures, newsletters, and flyers.

Nelson County Council on Aging

Nelson County Council of Aging has significant negative outliers for passengers per vehicle mile, passengers per vehicle hour, and passengers per active vehicle. A possible reason for these below average service effectiveness measures is the lack of coordination of the Nelson County Council on Aging's services with other elderly/handicapped transportation services in the area. There are several elderly and handicapped retirement/rest homes in the

service area that also provide transportation services. Coordination with these homes could increase elderly and handicapped ridership.

Helping Hands Taxi and Delivery

Helping Hands Taxi and Delivery also has negative outliers for passengers per vehicle mile, passengers per vehicle hour, and passengers per active vehicle. This is again explained in part by the limited capacity of the vehicle used.

3. Cost Effectiveness

The third group of performance measures addresses cost effectiveness. Cost effectiveness measures the project's ability to transport passengers while minimizing costs. Generally, the lower the absolute score, the more cost-effective the operation is.

The following systems do not have any outliers in the cost effectiveness category:

- South Central Senior Services
- Southwest Senior Services
- Kidder County Senior Services
- West River Transportation Council

James River Senior Citizens Center

James River Senior Services Center has one performance measure in the cost effectiveness category that is significantly below the mean -- operating expense per passenger. Low per passenger operating expense is partially the result of the high service effectiveness measures, but may also represent low expenditures by the enterprise.

Minot Commission on Aging

Minot Commission on Aging has a negative outlier for administrative expenses per passenger. These low administrative expenses per passenger indicate high administrative effectiveness, and are not only the result of high service effectiveness measures. This will be shown in the administrative efficiency category to follow.

Nelson County Council on Aging

Nelson County Council on Aging has three cost effectiveness measures which are significantly above the group average. Total expense per passenger, operating expense per passenger, and administrative expense per passenger are all significantly higher than the group average. In general, these high scores are the direct result of poor service effectiveness.

Helping Hands Taxi and Delivery

Helping Hands Taxi and Delivery also has three outliers in the cost effectiveness category. Total expense per passenger, operating expense per passenger, and administrative expense per passenger are all significantly above the group average. This is probably due to relatively low service effectiveness ratings.

4. Labor Efficiency

The fourth group of performance measures looks at labor efficiency. Labor efficiency measures the level of output per worker, or the productivity of labor. Of the eight systems evaluated, only Southwest Senior Services does not have any outliers in the labor efficiency category.

James River Senior Citizens Center

James River has three positive outliers in this category. Active vehicles[7] per administrative employee, active vehicles per operating employee, and active vehicles per employee all are significantly above the group average.

South Central Senior Services

South Central Senior Services has one negative outlier in the labor efficiency category. Active vehicles per operating employee is significantly below the group average. However, the fact that cost effectiveness and cost efficiency measures are better than average for this system indicates that the negative outlier in labor efficiency is relatively meaningless.

Kidder County Senior Services

Kidder County Senior Services has two outliers showing greater labor efficiency than average and two showing worse labor efficiency than average. Vehicle miles per employee are significantly above the group average, and labor expense per total expense is significantly below the group average. Both measures indicate efficient labor. Active vehicles per administrative employee and per employee are significantly below average. These measures indicate inefficient labor. However, when looking at all four measures in conjunction with cost effectiveness and cost efficiency indexes, labor efficiency doesn't appear to be a problem.

West River Transportation Council

West River Transportation Council has positive outliers for active vehicles per administrative employee and active vehicles per employee. Both indicate a higher proportion of capital investment as opposed to labor. However, since West River did not exhibit outliers

[7]vehicles in service

for service effectiveness, the mix of labor and capital appears to be working.

Minot Commission on Aging

Minot Commission on Aging has one outlier indicating better than average labor efficiency. Vehicle miles per employee are significantly above the group average. However, labor expense as a percentage of total expense is significantly higher than normal for this project. This incidence of high labor expense is supported by some of the cost efficiency measures which will be discussed later.

Nelson County Council on Aging

Nelson County Council on Aging has two outliers in labor efficiency. Active vehicles per employee and per administrative employee are significantly below average. However, cost efficiency measures show labor to be efficient for this project.

Helping Hands Taxi and Delivery

Helping Hands Taxi and Delivery has several outliers in the labor efficiency category. Vehicle miles per employee, active vehicles per employee, and active vehicles per administrative employee are all significantly below average. However, vehicle hours per employee are significantly above average. This trend, which shows good labor productivity, is supported by cost efficiency measures.

5. Administrative Efficiency

The next group of efficiency measures addresses administrative efficiency. Administrative efficiency measures the system's ability to minimize administrative costs while providing transportation service.

The following systems do not have any outliers in the administrative efficiency category:

- James River Senior Center
- Helping Hands Taxi and Delivery

South Central Senior Services

South Central Senior Services has significantly lower values than the mean for administrative expense per total expense, administrative expense per active vehicle, and administrative expense per vehicle mile. These measures indicate efficient administration of this project.

Southwest Senior Services

Southwest Senior Services has three outliers in the administrative efficiency category. Administrative expenses per total expense, per active vehicle, and per vehicle mile are significantly higher than the group mean. This is also reflected in administrative salaries per vehicle mile and hour, and may indicate that some administrative activities should be restructured or combined.

Kidder County Senior Services

Kidder County Senior Services has significantly lower administrative costs as a percentage of total expenses, and lower administrative costs per vehicle mile than the group mean. These scores suggest that the project is administratively efficient.

West River Transportation Council

West River Transportation Council has significantly higher administrative expenses as a percentage of total expenses than the group average. Administrative expenses per active vehicle and per vehicle mile are significantly above the group mean at the ten percent level. Thus they are positive outliers. This indicates that this project could improve by

streamlining its administrative functions.

Minot Commission on Aging

Minot Commission on Aging also has significantly lower administrative costs than the group average, expressed either as a percentage of total costs or in relation to vehicle miles.

Nelson County Council on Aging

Nelson County Council on Aging has significantly higher administrative expenses per active vehicle than the group average. However, because of high utilization of its active vehicle, Nelson County Council on Aging's administrative expenses per vehicle mile are near the group mean.

6. Vehicle Efficiency

This group of performance measures monitors vehicle efficiency. Vehicle efficiency measures the shape of the system's fleet and the suitability of fleet size. Maintenance costs will typically be lower for adequate sized fleets in good shape.

The following systems do not have any outliers in the vehicle efficiency category:

- South Central Senior Services
- Southwest Senior Services
- West River Transportation Council

James River Senior Citizens Center

James River has significantly lower vehicle miles per active vehicle than the group average. This may indicate excess capacity in fleet size.

Kidder County Senior Services

Kidder County Senior Services has a significantly larger value for vehicle miles per active vehicle than the group average. This indicates more intense utilization of vehicle capacity. Furthermore, it is probably the reason that maintenance expense per active vehicle and fuel expense per total expense are significantly higher for this project than the group mean.

Minot Commission on Aging

Minot Commission on Aging has a maintenance expense per active vehicle that is significantly higher than the group mean.

Nelson County Council on Aging

Nelson County Council on Aging has a significantly higher than average value for vehicle miles per active vehicle. This outlier may be explained by the fact that much of this project's miles are accumulated on rural highways at more efficient cruising speeds.

Helping Hands Taxi and Delivery

Helping Hands Taxi and Delivery has lower maintenance expense per active vehicle than the group average and higher vehicle hours per active vehicle than the group average. However, vehicle miles per active vehicle are significantly lower than the group average, partially explaining the lower unit maintenance cost. In addition, the fact that the vehicle used by Helping Hands is a car rather than a bus also explains the lower unit maintenance cost.

7. Cost Efficiency

The following group addresses cost efficiency. Cost efficiency measures the transit systems ability to minimize costs while providing adequate service in terms of vehicle miles and vehicle hours. Nelson County Council on Aging does not have any outliers in this grouping.

James River Senior Citizens Center

The five significant outliers in the cost efficiency category for James River indicate that operations costs and salary costs are high in relation to the level of service provided. High service effectiveness makes up for the higher costs, but these measures indicate potential improvements could be achieved by reducing costs.

South Central Senior Services

The four significant outliers for South Central Senior Services in this category indicate that services are provided in a very economical manner by this enterprise.

Southwest Senior Services

Southwest Senior Services has five significant outliers which indicate below average cost efficiency, particularly on the administrative side.

Kidder County Senior Services

All of the significant outliers in this group, with one exception, indicate that Kidder County Senior Services is cost efficient both on the administrative and operating side.

West River Transportation Council

The West River Transportation Council has a significant outlier here indicating a higher than average administrative salary per vehicle hour.

Minot Commission on Aging

Minot Commission on Aging has outliers for operations expenses and operations salaries. These expenses per vehicle mile, and salaries per vehicle hour and mile are significantly above the group average.

Nelson County Council on Aging

Nelson County Council on Aging has one negative outlier in the cost efficiency category. This outlier is negative for operating expense per vehicle mile. This outlier in combination with several negative scores which have absolute values greater than 1, shows this project to be cost efficient.

Helping Hands Taxi and Delivery

Overall, the outliers for this project in the cost efficiency category show it to be a very cost efficient operation.

8. Revenue Efficiency

This next grouping of performance measures looks at revenue efficiency. Revenue efficiency measures the revenue generated by the project in comparison with the amount of service provided.

The following systems do not have any outliers in the revenue efficiency category:

- Southwest Senior Services
- West River Transportation Council

James River Senior Citizens Center

Operating revenue per vehicle mile is significantly above the group average, while passenger revenue per active vehicle is significantly below the group average.

South Central Senior Services

South Central Senior Services has five outliers which collectively show operating revenue and passenger revenue per service to be well above average for this system.

Kidder County Senior Services

The three outliers for Kidder County Senior Services indicate passenger revenues per service to be above the group average.

Minot Commission on Aging

Minot Commission on Aging has seven outliers which indicate that Minot Commission on Aging's operating and passenger revenue per service are well below the group average.

Nelson County Council on Aging

Nelson County Commission on Aging has one outlier indicating below average operating revenue per service.

Helping Hands Taxi and Delivery

For the most part, the outliers for Helping Hands indicate above average revenue per service.

9. Operations Efficiency

This group of performance measures looks at operating efficiency. Operating efficiency measures the ability of the project to minimize operating expenses for the amount of service provided.

James River Senior Citizens Center

James River has two positive outliers in this category suggesting that operating expenses for the amount of service provided are higher than the group mean.

South Central Senior Services

South Central Senior Services shows lower than average operating expense per vehicle mile, but higher than average operating expense as a percentage of total expense.

Southwest Senior Services

Southwest Senior Services has a negative outlier for operating expenses as a percentage of total expenses. A negative outlier in this category normally signifies high operating efficiency. However, this appears to be solely the result of higher than average administrative costs.

Kidder County Senior Services

Operating expense per vehicle mile is significantly lower than average while operating expenses per vehicle hour and per active vehicle are significantly higher than average. This may be the result of the large amount of highway miles covered by this project. Many miles are covered in a short amount of time.

West River Transportation Council

West River Transportation Council has a negative outlier for operating expenses as a percentage of total expenses. While this would normally indicate above average operating efficiency, it also appears to be the result of the high administrative costs shown earlier.

Minot Commission on Aging

The three outliers for Minot Commission on Aging suggest that this project's operating expenses per service are significantly higher than the group average.

Nelson County Council on Aging

Nelson County Council on Aging has one negative outlier suggesting that operating expenses per service unit for this project are significantly lower than the group average.

Helping Hands Taxi and Delivery

The two negative outliers for this project suggest that operating expenses per service unit are significantly lower for Helping Hands than the group mean.

10. Maintenance Efficiency

Maintenance efficiency is analyzed in this section of the report. This set of performance measures addresses the efficiency and utilization of vehicle maintenance resources and programs.

The age of vehicles is a major factor in maintenance costs. In general, newer vehicles will require fewer maintenance dollars per mile or hour of operation. The opposite is true of older vehicles. So, maintenance efficiency is somewhat a function of the vehicle.

Another important factor in maintenance costs is the vehicle usage. Routine maintenance activities such as oil changes and tune ups generally increase with vehicle usage. However, maintenance expenses expressed on a per mile or per hour basis take this into account.

Relatively high maintenance unit costs may be indicators of aging equipment, heavy vehicle usage, and/or inefficient maintenance activities due to obsolete technology, less efficient tools, or related factors.

The following systems do not have any outliers in the maintenance efficiency category:

- James River Senior Citizens
- South Central Senior Services
- Southwest Senior Services
- West River Transportation Council

Kidder County Senior Services

The three outliers for Kidder County suggest that this project's maintenance expenses per service are significantly higher than the group average.

Minot Commission on Aging

Minot Commission on Aging has two positive outliers in this category suggesting that maintenance expenses per service unit are significantly higher than the group mean.

Nelson County Commission on Aging

The three outliers present for this project suggest that maintenance expenses per service unit are lower than average.

Helping Hands Taxi and Delivery

All four performance indicators show outliers for the Helping Hands project. These outliers are negative indicating that maintenance expense per service unit is lower for this project.

VI. RIDERSHIP SURVEY RESULTS

A one page ridership survey was developed for surveying riders on each of the eight transit systems studied (Table 5)[8]. The sample size for these surveys varied greatly. Many systems had less than ten riders on the bus trips which were evaluated. Furthermore, it was difficult to survey riders of irregular route, taxi, and small van services. However, some riders were surveyed for each system.

James River Senior Citizens Center

Only four riders were surveyed from the James River Senior Center. All four riders were over 60 years old. None of the four were handicapped. Only one of the riders had a vehicle at home, but this person didn't drive. The passengers surveyed stated that they used this service for personal business, to visit friends, to visit the senior center, and for medical appointments. The passengers rated the overall services as satisfactory, but two of the four rated "ease of boarding" as poor.

South Central Senior Services

Eight riders were surveyed from South Central Senior Services. Six of the eight passengers were over 60, and two were handicapped. Two of the eight had cars in their households. Passengers used the service for medical purposes, to visit friends, and for personal business. The service was rated as good overall by these passenger. None of the riders surveyed made additional suggestions or comments.

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[8]In Table 5, the abbreviations are defined as follows: FREQ. OF SERV is the frequency of service, ON TIME SERV. is on time service, AVAIL. OF INFO is the availability of information, SCHED.CHGE ANN is the announcement of schedule changes, COND.OF VEH. is the condition of the vehicles, COUR. OF EMP is the courtesy of system employees, EASE OF BDING is the ease of boarding.

Southwest Senior Services

Only five riders were surveyed for the Southwest Senior Services. All five were over 65, and three were handicapped. One of the five had a car in the household. These passengers used the service for medical, recreational, personal business, and shopping purposes. All five of the passengers rated the services as satisfactory, but one passenger rated the announcement of schedule changes and availability of schedule information as poor. No other suggestions were presented by these riders.

Kidder County Senior Services

Five riders were surveyed for Kidder County Senior Services. Four were over the age of 65 and none were handicapped. Four had vehicles in their households, but none were drivers. These riders use the service for medical, shopping, recreational, and personal business. All of the riders rated the service as good or very good and none of them supplied additional suggestions for the service.

West River Transportation Council

Only three riders were surveyed for the West River Transportation Council. Two of these riders were over age 65, and one was between 55 and 59. None of them were handicapped. One of the riders had a vehicle in their household. These passengers use this service for recreational, shopping, and medical purposes. All riders rated service as either very good or good, and no additional suggestions were made by those surveyed.

Minot Commission on Aging

Thirteen riders were surveyed for the Minot Commission on Aging. Ten of these riders were over age 65, and six were handicapped. Four of these passengers had vehicles in their households. These riders use this service for medical reasons, shopping, personal business,

church, to visit friends, and to visit the senior center. Passengers rated this service as satisfactory. One passenger suggested that they would like buses to run on Saturdays.

Nelson County Council on Aging

Only two passengers were surveyed for the Nelson County Council on Aging. Both passengers were over age 65, and both were handicapped. Both had cars, but neither one drove. These passengers use the service for shopping, medical purposes, to visit friends, and for personal business. These riders rated service as good or very good in every category. They did not present any additional suggestions for the service.

Helping Hands Taxi and Delivery

Four passengers were surveyed for the Helping Hands Taxi service. All four were over age 65, and two of the four were handicapped. One of the four had a vehicle in the household. These riders use the service for medical purposes, shopping, personal business, and church. All four rated the general service as satisfactory, but two riders thought that the service was too expensive.

Table 5
Ridership Survey

	JAMES RIVER					SOUTH CENTRAL					SOUTH WEST					KIDDER COUNTY				
NO. SURVEYED	4					8					5					5				
MALE	1					0					0					1				
FEMALE	3					8					5					4				
65 OR OLDER	3					4					5					4				
HANDICAPPED	0					2					3					0				
PURPOSE OF TRIP																				
MEDICAL/DENTAL	1					2					5					3				
SHOPPING	0					0					3					3				
RECREATION	0					0					1					1				
VISIT FRIENDS	1					2					0					0				
PERSONAL BUS.	1					2					1					1				
SENIOR CENTER	1					0					0					2				
RATING OF SERVICE	P	F	GD	VG	D K	P	F	GD	VG	D K	P	F	GD	VG	D K	P	F	GD	VG	D K
OPERATING HRS		1	2	1				2	6				2	3				2	3	
FREQ. OF SERV			2	1	1			2	6				2	3				3	2	
WAITING TIME		1	2	1			1	2	5				3	2				3	2	
ON TIME SERV.			3	1			1	2	5				3	2				3	2	
AVAIL. OF INFO			3	1				2	6		1		1	2	1			2	3	
SCHED.CHGE ANN			3	1				2	6		1		1	2	1			2	3	
COND.OF VEH.		1	3				1	. 2	5				1	4				2	3	
FARE STRUCTURE			4				2	1	5				5					2	3	
COUR. OF EMP.		1	2	1					8				1	4				2	3	
EASE OF BDING	2	1	1					2	6				1	4				2	3	

Table 5 (Cont.)

	WEST RIVER	MINOT	NELSON COUNTY	HELPING HANDS
NO. SURVEYED	3	13	2	4
MALE	0	0	0	1
FEMALE	3	12	2	3
65 OR OLDER	2	10	2	4
HANDICAPPED	0	6	2	2
PURPOSE OF TRIP				
MEDICAL/DENTAL	1	11	2	2
SHOPPING	3	4	2	3
RECREATION	1	1	0	1
VISIT FRIENDS	0	1	1	0
PERSONAL BUS.	0	2	1	1
SENIOR CENTER	0	1	0	0

RATING OF SERVICE	WEST RIVER					MINOT					NELSON COUNTY					HELPING HANDS				
	P	F	GD	VG	DK	P	F	GD	VG	DK	P	F	GD	VG	DK	P	F	GD	VG	DK
OPERATING HRS			2	1			2	6	5				2					2	2	
FREQ. OF SERV			2	1			1	6	5				2					2	2	
WAITING TIME			2	1			3	5	5				1	1				2	2	
ON TIME SERV.			2	1			2	6	5					2				1	3	
AVAIL. OF INFO			1	1	1			6	7				1	1					2	2
SCHED.CHGE ANN			1	1	1		1	6	3	3			1	1					2	2
COND.OF VEH.			1	2			1	.6	6				1	1				1	3	
FARE STRUCTURE			1	1	1			5	8					2			2	1	1	
COUR. OF EMP.			2	1			1	4	7					2				1	3	
EASE OF BDING			2	1			1	4	8				1	1				3	1	

VII. SUGGESTIONS FOR IMPROVEMENT

James River Senior Citizens Center

The James River Senior Citizens Center was found to have a low outlier for vehicle miles per active vehicle, and the t-statistic for vehicle hours per active vehicle was -2.32. This suggests that James River could provide the same services with one less vehicle. James River purchased one replacement vehicle per year in 89-90 and 90-91, and plans to purchase another in 91-92. If a vehicle needs to be retired in 91-92 then it should probably be retired without replacement. This suggestion is supported by the fact that the system exhibits a negative outlier for passenger revenue per active vehicle, while passenger revenue per mile and hour are not significant outliers. This relationship may indicate excess vehicle capacity.

Another possible improvement in this system could be made with operations. Operating expense per vehicle mile and vehicle hour are well above the average. Much of this is evident in operating salaries. Schimpeler, Corradino Associates suggest the following actions for reducing operating wages and fringes:

- Increase the use of volunteer or part-time workers
- Change employee policies
- Substitute service with privately contracted service
- Coordinate vehicle operations

The use of volunteer and part-time drivers can eliminate high wage costs. Policies on vacation, sick-leave, and fringe benefits should be examined for possible cost reductions. By contracting services to the private sector cost savings can be realized. Coordination of routing with other transit systems in the area which may provide the same time service (such as the Hi Acres Nursing Home and Central Dakota Nursing Home) can save costs because the same level of service can be achieved with lower costs.

South Central Senior Services

South Central Senior Services was found to have a negative outlier in the percentage of rides that are provided to the elderly and handicapped. In addition, the negative t-statistic with an absolute value greater than 2 for elderly and handicapped passengers per elderly population indicates that more of the elderly and handicapped population needs to be served by this project.

South Central Senior Services should concentrate on expanding its elderly and handicapped ridership. This can be accomplished through several steps. One step is to improve driver courtesy and on time performance. This will increase use by existing elderly and handicapped riders and will increase elderly/handicapped ridership through word of mouth. Another, perhaps more important, step is to install wheelchair ramps and lifts on more of its vehicles. This will also make riding more convenient for the elderly and handicapped. Finally, more advertising targeted at the elderly and handicapped is needed. Current newsletters, brochures, and word of mouth serve as forms of advertising for this service. Advertising in the local newspaper and on the radio may increase elderly and handicapped ridership. A direct mailing to all Senior Citizens in the service area may also increase elderly ridership.

Southwest Senior Services

Southwest Senior Services was found to have high costs per service unit. This was especially true for administrative expenses (administrative salary expenses in particular). Some of the improvements suggested in this area by Schimpeler, Corradino Associates are as follows:

- Reduce administrative staff by combining functions
- Streamline and reduce administrative activities
- Examine employee policies for benefit reduction
- Increase use of volunteer or part-time workers

By combining administrative functions, staff could be reduced, decreasing wages and fringe benefits. The reduction of administrative activities is consistent with the staff reduction. Employee policies on benefits could be examined for possible cost reduction. Using volunteer workers would decrease administrative wages and fringes. Using part-time employees for transportation rather than full-time employees who devote a certain percentage of their time to transportation may save money in fringe benefit costs.

Kidder County Senior Services

Maintenance efficiency performance standards show poor performance in this area for Kidder County Senior Services. This is also the case for vehicle efficiency. The vehicle owned by Kidder County Senior Services has in excess of 90,000 miles. A preventative maintenance program should be implemented consisting of daily checks and service, and periodic maintenance and inspection.[9] One alternative is to obtain a newer vehicle, and use the existing vehicle as a backup. Other suggestions would be to increase the use of part-time

[9]Schimpeler, Corradino Associates

labor, increase driver training, and buy parts together with another project.[10] Increased part-time labor would reduce labor costs. Increased driver training may cause reduced wear to vehicle parts. By jointly buying parts with another project, the system could take advantage of volume discounts.

West River Transportation Council

West River Transportation Council was found to have higher than average administrative expenses and administrative salaries.

The same recommendations provided for Southwest Senior Services apply here. 1.) Wages and fringe benefits could be reduced by combining administrative functions. 2.) Administrative activities could also be reduced, further reducing administrative expenses. 3.) Employee policies could be examined to find areas where excessive benefits or salaries could be reduced. 4.) Finally, the increased use of volunteer or part-time workers could reduce administrative salaries and fringe benefits.

Minot Commission on Aging

Minot Commission on Aging showed outliers for operations expenses per service provided. Operations expenses per service provided were significantly greater than the group mean, particularly for operations salaries and fringe benefits. Suggestions for reducing operations wages and fringe benefits are the same as those for the James River Senior Citizen Center. These suggestions include increasing volunteer and part-time workers, changing employee policies, and substituting service.

Revenue efficiency measures are also significantly lower than the group means. Since the service effectiveness measures are high for the Minot Commission on Aging, this suggests

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[10] Ibid.

that the fare structure is much lower for this service than others in this group. One way to increase passenger revenues without overcharging people who can't afford it would be to list the cost of the ride and to have a suggested donation amount. Riders could then pay what they can afford, but would be encouraged to pay higher amounts than the current fee.

Finally maintenance efficiency could also be improved by the Minot Commission on Aging. This would consist of improving preventative maintenance, rehabilitating or replacing old vehicles, increasing part-time labor, exploring the option of private sector maintenance, increasing driver skill through training, and purchasing parts in coordination with another project.

Nelson County Council on Aging

Nelson County Council on Aging has several outliers in many areas, but most of them can be attributed to the lack of service effectiveness. Some suggestions for improving service effectiveness are as follows.

First, Nelson County Council should increase its marketing activities. Currently two newsletters per year are sent out and schedules are printed in the local paper. Newsletters should be sent out more often, and should be sent to senior homes and centers, and nursing homes, in the area.

A second suggestion is to improve on time performance.[11] This may increase use of the system by existing riders.

A third way to improve service effectiveness is to coordinate services with other services in the area. There are several elderly rest homes that provide their own service. It is possible that much of Nelson County Council on Aging's service is duplicating service

[11]Ibid.

provided by these homes.

A fourth possibility for increasing ridership is to have Nelson County Council perform contract service for some of the elderly or handicapped rest homes in the service area. However, a handicapped-accessible vehicle would be necessary to do this.

Finally, it might be desirable to redesign routes to reduce areas where ridership is low.

Helping Hands Taxi and Delivery

Like Nelson County Council on Aging, the major problem faced by Helping Hands Taxi and Delivery is lack of ridership, or service effectiveness. However, lack of ridership can be explained by the limited size of the vehicle.

Increased marketing might also be a good strategy for this system. Currently, the service listed is in the yellow pages and is publicized through a public service announcement on the radio. In order to reach the targeted population (elderly and handicapped) material should be distributed directly to elderly and handicapped centers and rest homes.

Another suggestion is to replace the current vehicle with a slightly larger vehicle that is handicapped-accessible. It is difficult to coordinate with other agencies or to pursue contract service given the vehicle constraint.

Increased on time service may help increase ridership for this system. In addition, ridership may be increased by reducing the fee charged to riders. Some of the riders surveyed suggested that the fare charged may be too high. Passenger revenue per passenger is well above the group mean indicating that the fee charged to passengers could be reduced to increase ridership.

VII. RECOMMENDATIONS FOR FUTURE RESEARCH

In this study, eight rural transit systems in North Dakota were evaluated. All of the transit systems were grouped together, and the means and standard deviations of the group were used to identify outliers. Although the outlier analysis was effective and informative, more transit systems would have permitted classification of data into more homogeneous subgroups. For example, the transit systems could be grouped into urban centers, small towns, and multi-county networks. Such classification would allow a more concise evaluation of variances within groups.

This study provides a basis for future, broader analysis. By adding more systems to the data base through future surveys, the conclusions of this initial project can be expanded.

Several things became apparent from the study beyond the evaluation of eight systems. First, many of the enterprises surveyed did not develop performance measures as a routine matter of accounting and record keeping. In addition, they did not collect much of the underlying data (such as vehicle hours and miles) which are needed to compute measures of effectiveness and efficiency. Furthermore, several of the projects do not report their full transportation budgets to the DOT. They only report section 18 expenses and revenue. In order for accurate performance measures to be calculated, the projects' entire transportation expenses and revenues should be made available.

A standardized data collection schedule would perhaps prove useful to both transit managers and to the state DOT. A guidebook could be developed containing basic formulas which will allow managers to convert service schedules, distances, and average vehicle speeds to approximate measures of annual vehicle hours and miles. Second, more evaluations of North Dakota transit systems are needed to fully understand how performance and cost factors vary across systems and why. Third, rural transit operations need to be evaluated periodically, as the competitive and financial environment is rapidly changing.

Appendix A

Date_____

Agency Name_____

Name and Title of Person Completing Form_____

Address_____

Telephone_____

1.) Please name the types of service provided by your agency. Check all that apply.

Fixed Route_____ Taxi Subsidy_____ Unscheduled Fixed-Route_____

Volunteer Driver_____ Demand-Response/Dial-a-Ride_____ Other_____

2.) Approximately how many total annual miles do your vehicles travel (all vehicles)?_____

_____

3.) Please specify the hours of each day that you provide each category of service.

Type Of Service	**Day Of The Week**						
	Monday	Tuesday	Wednesday	Thursday	Friday	Sat	Sun
Fixed Route							
Unscheduled Fixed Route							
Dial-a Ride/ Demand Res							
Taxi Subsidy							
Volunteer Driver							
Other							

4.) What percentage of your service is provided to the following categories?

Elderly/Handicapped_____ Youth (under 16)_____ Low Income_____ General Pop._____

5.) Do you anticipate any major increases in ridership in these categories during the next two fiscal years (Y or N)?

Elderly/Handicapped_____ Youth (under 16)_____ Low Income_____ General Pop._____

6.) If so, what percentage increase in each category?

Elderly/Handicapped_____ Youth (under 16)_____ Low Income_____ General Pop._____

7.) How were these increases estimated?_____

_____

8.) Are there any restrictions on who can use your service? If so, please specify._____

_____

_____

9.) Based on the number of elderly and handicapped in your service area, what kinds of new of additional services would be needed to improve your ability to meet the needs of those groups and what would these additional services cost?

Additional Vehicles (Cost)_____
New or Expanded Routes (Cost)_____
Ramps or Lifts on Vehicles (Cost)_____
Radio Dispatching Services (Cost)_____
Extended Service Hours (Cost)_____
Training Programs (Cost)_____
Other (please specify and give cost)_____

10.) What percentages of each kind of trip do you provide?

Shopping_____ Medical_____ Employment_____ Education_____ Recreation_____

General Purpose_____ Other (Specify)_____

11.) What counties does your service area encompass?_____

_____

_____

12.)How many square miles is your service area?_____

13.) What is the approximate elderly/handicapped population in your service area?_____

14.) Do you expect a change in service area elderly/handicapped population during the next two years?

Yes_____ No_____

15.) If so, in what direction and by what percentage?

Increase_____ Decrease_____

16.) How was this change estimated?_____
_____

17.) What is your annual ridership? (total number of one-way passenger trips; each passenger that rides from an origin to destination represents a one-way passenger trip) _____
_____

18.) What are your total annual vehicle hours? (number of combined hours your vehicles are operated annually; all vehicles)_____

19.) Please list your specific routes, the annual ridership on each, the annual vehicle miles driven on each, and the annual vehicle hours on each._____
_____
_____
_____
_____
_____
_____
_____

20.) How many active vehicles are in your fleet?_____

21.) If you have fixed route service, what are the total number of scheduled trips for your vehicles per year?_____

22.) How many accidents have your drivers had within the past year?_____

23.) How many employees do you have in each category?

Total_____ Administrative_____ Operating_____

24.) Does your service expand its vehicle fleet during busy periods?

Yes_____ No_____

25.) How many breakdowns occurred on the road during the last year?_____

26.) Are there other operators in your service area? If so, have you made an attempt to coordinate with them?_____

27.) Please list the vehicles you have. List the make, year and condition of each.

Make Year Condition

28.) Which of the following performance measures do you monitor? (check all that apply).

Operating Expense Per Vehicle Hour_____
Total Passengers Per Vehicle Mile_____
Total Vehicle Miles Per Active Vehicle_____
Total Vehicle Miles Per Gallon Of Fuel Consumed_____
Passenger Revenue Per Operating Assistance_____
Vehicle Hours Per Service Area Population_____
Maintenance Expense Per Vehicle Mile_____
Ratio Of Operating Revenue To Operating Expense_____
Revenue Vehicle Hours Per Accident_____
Percent Of Trips By Elderly/Handicapped_____

29.) Operating Expenses	Actual 88-89	Actual 89-90	Projected 90-91	Projected 91-92
Wages and Fringe Benefits:				
Drivers				
Helpers				
Dispatchers and Schedulers				
Supervisors				
Total Wages and Fringe Ben.				
Maintenance and Fuel:				
Gas and Oil				
Tires				
Spare Parts				
Routine Maintenance				
Other Maintenance and Repairs				
Total Maintenance and Fuel				
Advertising and Promoting:				
Scheduling				
Maps				
Signs				
Other				
Total Advertising and Prom.				
Parking Costs (Storage)				
Inspections				
Insurance				
Vehicle Depreciation				
Other Expenses (please specify)				
_____				
Total Operating Expenses				

30.) Administrative Expenses	Actual 88-89	Actual 89-90	Projected 90-91	Projected 91-92
Wage and Fringe Benefits:				
Office Staff				
Guards and Security				
Total Wage and Fringe Ben.				
Office Supplies				
Telephone				
Utilities				
Taxes (license)				
Data Processing (record keeping)				
Rent (or facility depreciation)				
Office Equipment (depreciation)				
Other Expenses (please specify)				
_____				
Total Administrative Expenses				

31.) Capital Expenditures	Actual 88-89	Actual 89-90	Projected 90-91	Projected 91-92
Vehicles				
Radios				
Office Equipment				
Other (please specify)				
Total Capital Expenditures				

32.) Revenues	Actual 88-89	Actual 89-90	Projected 90-91	Projected 91-92
Farebox Revenue				
Local Revenue:				
General Fund				
Dedicated Tax				
Fund Raising				
County Mental Health				
Unrestricted Donations				
Local Service Clubs				
Foundations				
United Way				
Charter				
Other (please specify)				
Total Local Revenue				
Federal Revenues:				
UMTA Section 18 (rural areas)				
UMTA Section 16 (elderly/handicap)				
Older American Act (Title 3B)				
Adult and Family Service (Title 19)				
Community Services Block Grant				
Other (please specify)				
Total Federal Revenues				
Total Revenue				

33.) How many gallons of fuel are consumed by your vehicles annually?_____

_____

34.) Do you provide users with a formal opportunity to comment on and rate your services? If so, how is this done, and are the suggestions used for anything?_____

35.) What types of accommodations have been made to serve the handicapped?_____

36.) Does your agency do any advertising? If so, what types._____

37.) Has your agency developed a long range plan?_____

38.) What types of things would you like to see done by the government or your agency in order to make your operations more efficient?_____

1. Day of week: (1) __ Monday (2) __ Tuesday
(3) __ Wednesday (4) __ Thursday (5) __ Friday

2. Sex: (1) __ Male (2) __ Female

3. Age: (1) __ 18 or under (2) __ 19-24 (3) __ 25-54
(4) __ 55-59 (5) __ 60-64 (6) __ 65 or older

4. Are you handicapped? (1) __ Yes (2) __ No (3) __ Yes, require a w/c lift

5. How many people are in your household? __

6. How many operating cars, vans, or light trucks are in your household? __

7. What is the purpose of this trip? (1) __ work (2) __ college
(3) __ school (4) __ medical/dental (5) __ personal business
(6) __ recreation (7) __ visit friends/relatives (8) __ shopping
(9) __ workshop/senior center (10) __ other

8. How many one-way trips a week do you usually make by this transit service? __

9. Please rate our service regarding the following:

	Poor	Fair	Very Good	Don't Good	Know
(1) Operating hours	___	___	___	___	___
(2) Frequency of service	___	___	___	___	___
(3) Waiting time	___	___	___	___	___
(4) On time service	___	___	___	___	___
(5) Availability of information	___	___	___	___	___
(6) Announcement of schedule changes	___	___	___	___	___
(7) Condition of transit vehicles	___	___	___	___	___
(8) Fare structure	___	___	___	___	___
(9) Courtesy of system employees	___	___	___	___	___
(10) Ease of boarding or getting off	___	___	___	___	___

10. Do you have any comments or suggestions about our transit service?

_____
_____
_____
_____

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