

2013 **SURTC**RESEARCH DIGEST





UPPER GREAT PLAINS TRANSPORTATION INSTITUTE SMALL URBAN AND RURAL TRANSIT CENTER

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Message from the Director

This issue of SURTC's *Research Digest* highlights studies completed during 2012, which marked SURTC's 10th year of operation. The six studies completed in 2012 adhere to SURTC's user-based approach to research. We never want our studies to "gather dust on a shelf." We want to share research results that help move the industry forward. Given the wide variety of research projects relating to rural and small urban areas, it's likely that we've completed at least one report that addresses a topic of interest to you. During our 10 years, we have completed 70 research reports and 14 peer-reviewed journal articles. During that time we've also conducted training and education activities that keep us closely engaged with the transit industry. A complete list of our publications is located at the end of this digest. Accessing our full reports is just a few "clicks" away. Visit **www. surtc.org** to browse our documents and peruse our other resources.



Jill Hough Director

Message from the Editor

The 2013 issue of the *SURTC Research Digest* includes articles on six research projects completed by SURTC in 2012. Topics covered include the following:

- The use of alternative fuels and hybrids by small urban and rural transit agencies
- An economic cost study of rural transit agencies in North Dakota to determine the most efficient method for organizing transit in small communities
- A survey of North Dakota State University students regarding transit
- A study of travel behavior and mobility of transportation-disadvantaged groups
- An effort to implement transit coordination in North Dakota
- The development of national transit livability statistics and the Community Livability Index

The articles are highly-condensed, non-technical summaries of the full studies, but they provide more depth and detail than what is published in our newsletter.

SURTC's mission is to be a research support and outreach center to assist small urban and rural transit systems and other transit entities by conducting relevant research and offering outreach and training. This publication is an effort to make our research more accessible to a wider audience and accomplish the outreach portion of our mission.

We look forward to your feedback on our research and on the *SURTC Research Digest*. The full reports for all of these studies are available on the SURTC website: **www.surtc.org/research**.



Jeremy Mattson Editor



Use of Alternative Fuels and Hybrid Vehicles by Small Urban and Rural Transit Systems

Jeremy Mattson

Transit agencies of all sizes across the country have been or are considering using alternative fuels or hybrid-electric vehicles. The use of these alternatives has increased in recent years because of concerns about environmental and energy issues and increased incentives and regulations from local, state, and federal governments that have encouraged their use. Transit agencies have been leaders in using alternative fuel vehicles. However, smaller transit agencies, including those operating in small urban and rural areas, may face greater difficulties in transitioning to alternative fuel or hybrid vehicles. Infrastructure or capital costs could be prohibitively expensive, or they could lack the resources and expertise to successfully operate these vehicles. Furthermore, the supply of alternative fuel or hybrid vehicles that are designed to meet their standards could be limited, as could an adequate and dependable supply of the alternative fuels in rural and small urban areas. Reliability and maintenance issues could also be a concern for smaller agencies that could face significant disruptions in service if any of their vehicles are out of service.

Small urban and rural transit agencies need to be fully informed of the costs and benefits of alternative fuels and hybrid vehicles before adoption. They can learn from the experiences of those that have been using these alternatives. Decision makers also need to understand the needs and concerns of transit agencies. An understanding of the factors motivating an agency to adopt an alternative fuel and the deterrents that prevent them from doing so could also be helpful for policy makers and industry leaders who desire increased use of alternative fuels and hybrid vehicles.

Survey of Small Urban and Rural Transit Agencies

Previous research has identified advantages and disadvantages of using alternative fuels and hybrid buses. However, less is known about the factors that motivate agencies to adopt these alternatives or the degree to which different deterrents prevent adoption, especially among

small urban and rural transit agencies. In this study, a survey was conducted of small urban and rural transit agencies. Objectives were to identify and describe the usage of alternative fuel and hybrid vehicles by small urban and rural transit agencies; identify the motivating factors for adoption; document the deterrents to adoption; describe the experience of transit agencies that use alternative fuels or hybrid vehicles; determine how use varies by characteristics of transit agencies and beliefs about deterrents and benefits; and determine which factors explain the difference between those agencies with a satisfactory experience and those that have experienced difficulties. The survey focused on biodiesel, E85, propane, natural gas, and hybrid-electric vehicles.

A total of 115 survey responses were received from transit agencies in 36 different states. Biodiesel is the most commonly used alternative fuel among small urban and rural transit operators. Thirty-one of the responding agencies use biodiesel, while ten use compressed natural gas (CNG), eight use E85, and four use propane. Twenty-four of the agencies own hybridelectric vehicles.

Larger agencies and those operating in urban areas tend to be more likely to adopt alternatives than smaller, rural providers. Results from a statistical model show that agencies that operate more vehicles and provide more vehicle miles of service are more likely to use biodiesel, and agencies in urban areas were found to be substantially more likely to use biodiesel or hybrids.

Perceived Benefits and Deterrents

Agency characteristics do not completely explain why some use alternative fuels or hybrids while others do not. It was found that beliefs about benefits and deterrents have some influence on adoption. In general, users tended to be more likely to identify benefits of using the alternative. One notable difference for biodiesel, CNG, and hybrid users was that they were more likely to think that improved public perception is a major benefit. Regarding deterrents, non-users were substantially more likely to view infrastructure costs and adequate fuel supply as deterrents for biodiesel; vehicle costs, development of new fuel infrastructure, modifications to maintenance facilities, adequate fuel supply, and maintenance issues as deterrents for CNG; and vehicle availability, depot modification costs, concerns about reliability, and battery replacement costs as deterrents for hybrids.

Additional research could investigate whether the perceived deterrents are valid. The deterrents may be valid in some areas and less valid elsewhere. For example, concerns by biodiesel non-users about infrastructure costs suggest a misperception about required investments. Providing more and better information to transit providers may reduce possible misperceptions and increase adoption rates.

Results showed that agencies that view emissions reductions as a major benefit of biodiesel were significantly more likely to use that fuel, and agencies that consider improved public perception as a major benefit were significantly more likely to use biodiesel or hybrids. Findings suggest that beliefs about the benefits of emission reductions, improved public perception, and costs savings are the greatest motivating factors for adoption of biodiesel and hybrid vehicles. Results also indicate that concerns about infrastructure costs and fuel supply are most likely to influence the decision to adopt biodiesel or hybrids.

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Reducing emissions was commonly mentioned as a major reason for using hybrid or CNG vehicles. A number of agencies also mentioned emission reductions as a major reason for using biodiesel, but is was more often noted as a minor reason. Similarly, a greater percentage of hybrid users mentioned energy dependency concerns and improving public perception as major reasons for adoption than did biodiesel users. Fuel cost savings was also a major reason most hybrid users and half of CNG users adopted those vehicles, while fuel cost savings did not tend to be a motivating factors for biodiesel user.

Satisfaction with Alternative Fuels and Hybrids

In general, transit agencies tended to be satisfied with their use of alternative fuels or hybrid vehicles, though some have reported problems. Results from a model analyzing satisfaction with biodiesel indicated that larger agencies and those that make a greater commitment to biodiesel were more likely to have success. Previous research suggests that providing training for employees is important for achieving success. The survey revealed that such training is fairly common for agencies adopting CNG, propane, or hybrid vehicles, but not for those using biodiesel or E85.

The experiences of agencies that have adopted these alternatives can differ from the expectations or perceptions of non-users. For those agencies that use these alternative fuels or hybrids, fuel cost was most likely to be a problem for biodiesel or E85 and was only a minor problem or not a problem at all for propane, CNG, or hybrids. Maintenance issues were more likely to be a problem for biodiesel or propane. For all alternatives, though, 50% or more of agencies have experienced no maintenance problems, and many of the problems they have had were minor. The responses regarding reliability were similar, with the greatest problems for biodiesel and propane. Adequate and dependable fuel supply was most likely to be a problem for E85, but most of the fuel supply problems for E85 and other fuels were considered minor.

Conclusion

The survey revealed a general satisfaction with use of alternative fuels and hybrid vehicles, though some problems were identified, and some respondents expressed dissatisfaction. Significant deterrents also exist for many of the agencies that have not adopted any of these alternatives. Improving public perception, reducing emissions, and reducing operating costs tend to be the greatest motivating factors for adopting these alternatives, in addition to political directives and incentives. Concerns about infrastructure development and costs, vehicle costs, maintenance, and fuel supply are the greatest deterrents to adoption. Use was much less common in rural areas, and these deterrents would have to be addressed before widespread adoption occurs.

This study was published as UGPTI Departmental Publication No. 250 and is available at http://www.ugpti.org/pubs/pdf/DP250.pdf

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Organizing Transit in Small Urban and Rural Communities

David Ripplinger*

As the primary financial supporter of rural transit, the federal government has an interest in ensuring that service is delivered in an efficient, effective manner. Reorganization of rural transit agencies is one potential method of meeting these goals. Federal support for rural transit is administered by states that are given flexibility in developing and overseeing locally provided rural transit service. However, there is little guidance for reorganization, whether the reorganization is consolidation, assignment of new services, or reassignment of existing service.

To provide some guidance in how to organize transit in small urban and rural communities, this study addressed the following six research questions:

- 1. Is increased service in an existing service area more efficiently provided by a single existing rural transit agency or by adding a new one?
- 2. Is increased service in an expanded area more efficiently provided by a single rural transit agency or by creating a second agency?
- 3. Are demand-response and fixed-response service most efficiently provided by a single firm or should two agencies provide each service exclusively?
- 4. Do rural transit firms have significant unused vehicle capacity?
- 5. Is a single regional transit agency always more efficient at providing multimodal service or are there cases where two agencies can provide service more efficiently?
- 6. Is there economic justification for government support of transit on the basis of increasing returns to scale or natural monopoly?

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The answers to these questions have immediate, practical, real-world implications for federal and state transit policies and the design and operation of transit agencies. The project's research questions address the economic concepts of economies of density, economies of firm size, economies of scope, excess capacity, and natural monopoly.

In this study, the cost structure of rural transit was estimated, and the resulting policy implications were identified. A cost model was developed using intermediate outputs, factor prices, capital utilization, network size, technological variables, and time to explain the cost of providing rural transit service. Our analysis relied on data from North Dakota transit agencies that provide service to rural areas.

Findings

If service is to be increased within the service area of an existing transit agency, the study found it is more efficient for the existing agency to provide that service than to create a new agency to do so. If new service is to be added outside the service area of an existing agency, the more efficient option is influenced by the size of the existing agency. It was found to be more efficient for small transit operators to increase service into a new area than for a second agency to do so. However, for larger regional systems, the study found it may be more efficient for a second agency to provide the new service. In economic terms, the study found returns to density and returns to size, but the effects diminish for larger agencies.

The study also found economies of scope to be present, but they disappeared for larger transit systems The implication of this finding is that it is more efficient for small transit systems to provide both fixed-route and demand-response service than to have two different agencies specializing in each. However, for larger regional systems, the results differ, and it may be more efficient to have providers specialize in one mode.

In many cases, a single transit agency operating as a monopoly was found to provide service at a lower cost than two transit agencies would, but this was not always the case. For the average service area of North Dakota agencies, the study found single-service provision to be desirable. However, when service area expands to a large-enough size, costs of providing service by two firms is lower than that for a monopoly.

Significant amounts of excess capacity were found for all transit agencies evaluated. Previous studies of urban transit systems have also found excess capacity. The presence of excess capacity suggests that short-run costs are higher than would otherwise be the case, as agencies incur expenses to own and maintain relatively little-used vehicles.

Policy Implications

The findings have policy implications at the state and federal levels. These implications include guidance on the design of individual transit agencies, which is currently under the purview of states and guidelines on vehicle purchases and disquisition which is both a state and federal issue. We limit our investigation of state-level implications to North Dakota and leave conjecture to other states open to the reader, but caution against drawing strong conclusions as the cost structure may differ from that experienced by the agencies in our sample.

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The regionalization of transit agencies is often perceived, if not intended, to imply the consolidation of smaller transit agencies into a single transit operating agency. Regionalization is typically considered for delivery of service across relatively large geographic areas, for example an 8,000-square-mile area considered in this study. Provision of transit service by a single agency across an area this large on the basis of economic efficiency is not supported by our analysis. This finding does not align with conventional wisdom, where many feel that rural transit is a natural monopoly. We find transit provision across large areas is better served by two agencies, one providing demand-response service while the other provides fixed-route service.

Our analysis focuses solely on economic costs. This is just one, albeit important dimension, of regional or statewide transit planning. It ignores the issue of effectiveness of service, which is defined as the amount of transit rides provided relative to inputs or miles of service. A single agency may be able to employ planners and coordinators who are able to design and operate a system with higher ridership. At the same time, successful coordination of a number of transit agencies in a region may achieve similar outcomes. Consolidation of local transit agencies may cause resentment, loss of local political and financial support, and possibly a decline in ridership. What may be most politically palatable and economically efficient would be support for regional fixed-route service and as few demand-response systems as possible. Here the fixed-route service would provide service within individual communities. Coordination between the service types would be fundamental to its success in terms of service effectiveness as riders would need to be willing and able to make use of multiple systems to make trips from small communities to large ones.

Given the presence of significant levels of excess capital, which aligns with the findings of other studies, federal vehicle purchase and disquisition guidelines should be reviewed and possibly modified. Requiring transit agencies, especially small ones, to keep unused vehicles on their roster is inefficient, as they could be put in service elsewhere by other transit agencies, government agencies, government sponsored non-profits, or the private passenger transportation sector. In addition there is a cost to owning these vehicles even if they sit idle, including insurance, minimum maintenance, and storage. While individual communities may desire to have their own vehicle, without the requisite amount of service being delivered, it is more efficient for a vehicle to be shared.

Conclusion

The purpose of this study was to evaluate the justification of government support of rural transit on the basis of the presence of natural monopoly and to determine the most efficient regional organization of transit. The study found returns to density, size, and scope at most levels of output. Cost subadditivity, where a monopoly firm can provide service at a lower cost than two firms, was found for many, but not all, observations. The findings and implications of the study are directly applicable to rural transit in North Dakota and should be helpful in informing future federal policy as well as rural transit policy, service design, and operation in other states. However, as the analysis was conducted using North Dakota data only, one should draw conclusions for other states and circumstances with caution. The study is first step in providing the rural transit industry with the type of rigorous economic information needed to guide policy and planning at the federal, state, and regional level.

This study was published as UGPTI Departmental Publication No. 251 and is available at http://www.ugpti.org/pubs/pdf/DP251.pdf



North Dakota State University Student Transit Survey, 2010-2011

Jeremy Mattson, David Ripplinger*, and Del Peterson

The Small Urban & Rural Transit Center (SURTC) conducted surveys of North Dakota State University (NDSU) students in Fargo, ND, during the fall and spring semesters of 2010-2011 regarding travel behavior and experience with Metro Area Transit (MATBUS). This research updated previous surveys of NDSU students conducted by SURTC.

An on-vehicle survey of MATBUS riders on two NDSU campus routes was conducted in the winter of 2010, and an online survey of NDSU students was conducted in the spring of 2011. The onboard survey was conducted both by paper and with the use of smartphones.

The survey collected information on student access to vehicles, transportation modes used to travel to campus, factors influencing mode choice, use of transit services, opinions on MATBUS service, thoughts on how to improve service, opinions on marketing efforts and preferred methods of accessing information, interest in wireless Internet access onboard, willingness to pay for transit services, and issues concerning parking.

The two surveys captured a significant amount of information regarding student travel behavior, use of transit, and opinions about current MATBUS service. The on-vehicle survey collected responses from 120 individuals, mostly NDSU students, while the online survey of NDSU students received 858 responses, including responses from both transit users and non-users. Following are some of the major findings.

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Travel Modes

A substantial percentage of respondents (86%) have regular access to a motor vehicle, including most off-campus students (95%) and about three-fourths of on-campus students.

Off-campus students reported using a variety of transportation modes when traveling to campus. Fifty-seven percent said the automobile was their most commonly used mode of travel, while 24% reported they most often walk and 13% said riding MATBUS is their most used mode of transportation. Students living closer to campus are much more likely to walk, ride bicycle, or ride MATBUS and are less likely to drive than those living farther away.

For students less than one-quarter mile from campus, walking tends to be just as fast as driving and is faster than riding MATBUS, which explains why walking is the most preferred option. For distances greater than a quarter mile, MATBUS tends to be faster than walking, and it gains mode share. Time savings for automobile travel expectedly increases with distance from campus, corresponding with the automobile's increase in mode share. Comparing travel times with mode shares suggests that the former has a major influence on the latter.

Convenience, travel time, and weather are found to be the most significant factors influencing which mode of transportation is used to travel to campus. Travel time and convenience become more important for those living farther from campus, while those living close to campus are highly influenced by the weather when deciding how to travel to campus. The survey found that students are more willing to walk longer distances when the temperature is above freezing.

Use of MATBUS

Fifty-nine percent of respondents to the online survey said they use MATBUS. Almost half of these respondents have been riding MATBUS for less than a year, and a few have been riding for more than five years. Some of the students are regular bus riders, making multiple trips per day, while others are infrequent riders. Students predominantly ride the bus for school-related trips.

Survey respondents gave mostly favorable ratings for MATBUS overall quality, as well as driver safety and skill and driver attitude. Seventy-five percent of respondents to the online survey said MATBUS's current hours of service are adequate, as did 78% of respondents to the on-vehicle survey.

One area of concern, however, is buses being late. Sixty-two percent of respondents to the online survey said buses are occasionally late and 13% indicated that they are often late.

Although the students gave mostly favorable ratings of MATBUS service, a number of respondents also provided comments on how they think service could be improved. Comments included improving on-time performance, providing more direct routes, having more buses on each route (especially during peak times), increasing service frequency, adding additional routes and stops, extending hours, providing service on Sundays, providing more information, giving information on real-time bus location, and having warmer shelters. A number of students commented that travel times on MATBUS are too long.

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Marketing and Information about Transit Service

Most students agreed that information on MATBUS is readily available. Students prefer to get information from a number of different sources. The most preferred methods are brochure/ schedule, the NDSU transit webpage, and email.

Eighty-eight percent of respondents to the online survey said they would find a website that displays real-time location of buses useful. Although not as popular, about half of the students (53% of respondents to the online survey and 45% of respondents to the on-vehicle survey) said they would use information on bus arrival times if they were texted to their mobile device.

Most students have noticed the MATBUS advertisements in the bus shelters, while less than half have seen them in the campus newspaper, and a small percentage have seen them on Facebook. More than half said the advertisements have positively impacted their perception of transit, while 21% of onboard respondents and 10% of online respondents said the advertisements have affected their travel behavior.

Wireless Internet on Buses

Some transit agencies have begun adding wireless Internet access on their buses to improve the rider experience and attract new riders. The survey asked questions regarding student interest in using Wi-Fi on buses. About one-third, 35%, of those who completed the on-vehicle survey said they would use wireless service on MATBUS if it were available. The online survey, on the other hand, found that 75% of current transit riders might use it, though many said they would use it rarely (28%) or just occasionally (30%). Sixteen percent said they would use it frequently. The survey also revealed that one third of current riders already access the Internet on a mobile device when riding the bus. The increased prevalence of mobile devices with Wi-Fi capabilities could increase demand for Wi-Fi access.

The online survey found there may be some positive impact on ridership if Wi-Fi was provided. Twenty-seven percent of transit riders said they would ride MAT buses more often if they had free wireless Internet access. Of those who do not ride MATBUS, 9% said they would be more likely to ride the bus, and 25% answered that they could possibly be more likely to ride if it had free wireless Internet.

The short length of bus trips could limit the demand for Internet access, however. If riders are spending a short time onboard, they are less likely to find access to Internet to be worthwhile, especially if they are using a laptop computer. The increased prevalence of smartphones and tablets will likely reduce the time constraints as riders can quickly access the Internet on their easily accessible devices.

Willingness to Pay for Service

NDSU students are currently allowed to ride free on MATBUS on all routes and at all times as part of the U-Pass program. NDSU pays a fee to MATBUS to participate in this program. The survey asked students how much they would be willing to pay each semester, as part of their student fees, to keep MATBUS service fare-free.

About 22% of respondents to the two surveys said they would be willing to pay any semester fee to keep MATBUS fare-free. Respondents most commonly said they would be willing to pay up to \$20 per semester.

As might be expected, transit users were more likely to indicate a willingness to pay than nonusers. For example, just 11% of users responding to the online survey said they would not pay, compared to 37% of non-users. It might actually be surprising that a majority of non-users said they would be willing pay at least something in student fees to keep the service fare-free, indicating they value the service even if they do not use it.

This study was published as UGPTI Staff Publication No. 175 and is available at http://www.ugpti.org/pubs/pdf/SP175.pdf



Travel Behavior and Mobility of Transportation-Disadvantaged Populations: Evidence from the National Household Travel Survey

Jeremy Mattson

Older adults, people with disabilities, individuals in low-income households, and those living in rural areas can face significant mobility challenges. This study examined travel behavior and mobility of these transportation-disadvantaged groups by analyzing data from the National Household Travel Survey (NHTS).

The NHTS is a periodic national survey sponsored by the Bureau of Transportation Statistics and the Federal Highway Administration (FHWA). The most recent NHTS was conducted in 2009. Prior to 2009, the most recent survey was in 2001.

NHTS data on driving, trip frequency, staying in the same place all day or week, miles driven per year, mode choice, use of public transportation, trip purpose, trip distance, and issues and concerns regarding transportation were examined. Differences were shown by age group, gender, household income, whether a person has a disability or condition affecting ability to travel, and whether the individual lives in a rural or urban area. Differences between 2001 and 2009 were documented to identify trends in travel behavior. A number of differences between urban and rural areas were also highlighted in the analysis.

Summary of Key Findings

Main findings from the analysis are summarized below.

Aging and disabilities:

• Disabilities and medical conditions increase significantly with age. Half of those 85 or older have such a condition affecting their ability to travel. For most of them, the condition results in reduced day-to-day travel.

Driving:

- A gap exists between older men and women in terms of driving. For those 65 or older, 89% of men drive compared to 73% of women. For those 85 or older, 68% of men still drive, compared to just 39% of women. However, the gap is narrowing somewhat as the percentage of women 85 or older driving increased from 32% in 2001.
- While overall per capita vehicle miles traveled (VMT) decreased from 2001 to 2009, per capita VMT for women 65-84 increased (see Table 1 for a more detailed summary of statistics).

| | Men | | Women | | Condition ^a | | No condition | |
|-------------------------------|--------|--------|-------|-------|------------------------|-------|--------------|--------|
| Age | 2001 | 2009 | 2001 | 2009 | 2001 | 2009 | 2001 | 2009 |
| Number of Trips per Day | | | | | | | | |
| 19-64 | 4.3 | 4.0 | 4.5 | 4.2 | 3.3 | 3.0 | 4.5 | 4.2 |
| 65+ | 3.8 | 3.6 | 3.1 | 3.0 | 2.0 | 2.0 | 3.9 | 3.6 |
| 65-74 | 4.2 | 3.8 | 3.6 | 3.5 | 2.4 | 2.4 | 4.2 | 3.9 |
| 75-84 | 3.4 | 3.4 | 2.8 | 2.6 | 2.0 | 2.0 | 3.5 | 3.3 |
| 85+ | 2.5 | 2.3 | 1.5 | 1.8 | 1.1 | 1.3 | 2.6 | 2.6 |
| Yearly Miles Driven | | | | | | | | |
| 19-64 | 15,233 | 12,947 | 9,112 | 8,361 | _b | 5,280 | _b | 11,092 |
| 65+ | 9,789 | 8,572 | 3,422 | 3,614 | _b | 2,209 | _b | 6,942 |
| 65-74 | 11,752 | 10,165 | 4,398 | 4,993 | _b | 3,455 | _b | 8,190 |
| 75-84 | 7,702 | 7,446 | 2,646 | 2,499 | _b | 1,802 | _b | 5,645 |
| 85+ | 3,439 | 3,047 | 907 | 993 | _b | 679 | _b | 2,805 |
| Stayed in Same Place All Day | | | | | | | | |
| 19-64 | 8% | 10% | 10% | 11% | 26% | 29% | 8% | 9% |
| 65+ | 19% | 20% | 29% | 30% | 47% | 45% | 18% | 19% |
| 65-74 | 16% | 16% | 23% | 23% | 41% | 37% | 15% | 16% |
| 75-84 | 23% | 21% | 31% | 34% | 45% | 44% | 20% | 22% |
| 85+ | 39% | 39% | 56% | 50% | 67% | 58% | 35% | 34% |
| Stayed in Same Place All Week | | | | | | | | |
| 19-64 | 1% | 1% | 1% | 1% | 5% | 6% | 0% | 0% |
| 65+ | 3% | 3% | 4% | 6% | 11% | 13% | 2% | 2% |
| 65-74 | 2% | 2% | 3% | 3% | 8% | 9% | 1% | 1% |
| 75-84 | 4% | 3% | 5% | 7% | 10% | 12% | 2% | 3% |
| 85+ | 7% | 12% | 12% | 16% | 18% | 23% | 4% | 6% |

Table 1. Travel Behavior by Age, Gender, and Medical Condition, 2001 and 2009

^a Individuals defined as having a condition are those who indicated that they have a temporary or permanent condition or handicap that makes it difficult to travel outside the home.

^b Not calculated.

Source: 2001 and 2009 National Household Travel Survey, Person File and Travel Day Trip File.

Trip frequency:

- Older men also make more trips than older women, but this gap is narrowing. The number of trips taken by women 85 or older increased from 2001 to 2009.
- Despite a small increase in travel by older women since 2001, there is still a significant decline in travel, in terms of number of trips and trip distance, with age.
- Individuals with medical conditions or disabilities and those who do not drive make significantly fewer trips per day than others.
- The number of trips by non-drivers 85 or older, while low, increased from 2001 to 2009.

Staying in the same place all day or all week:

- Older adults, women, and those with a medical condition or disability are more likely than others to stay in the same place all day or week.
- Individuals from rural areas and those with lower household income are also more likely to stay in the same place, while being a driver or a transit user significantly decreased the likelihood of not making a trip.
- Of those not making a trip in the last week, younger individuals and those with medical conditions or disabilities are more likely to want to get out more often; though large percentages of all groups say they would like to get out more.

Mode shares:

- Automobile mode shares for all age groups decreased from 2001 to 2009.
- Transit mode shares for nearly all age groups in both urban and rural areas increased from 2001 to 2009 (see figure 1).



Figure 1. Transit Mode Shares by Age Group, 2001 and 2009

• Concerns about getting into an accident, congestion, price of travel, aggressive or distracted drivers, access to transit, and lack of walkways are important issues for a large percentage of the population, but they tend to be more important for people with disabilities or medical conditions and for low-income individuals.

Characteristics of those Not Making Trips

A statistical model was used to estimate the impacts of individual characteristics, ability to drive, and use of transit on whether an individual stayed in the same place all day or all week. Results show that older adults, women, people with conditions or disabilities, those in rural areas, individuals from larger households, those with lower household income, those who do not drive, and those who do not use transit were significantly more likely to not make any trips.

Findings demonstrate the importance of being able to drive and use of transit on the likelihood of making a trip. Those who drive have 66% lower odds of staying home for the day and 74% lower odds of staying home all week. Those who have used transit within the last month were 32% less likely to stay in the same place all day and 45% less likely to stay in the same place all week. These results show how use of transit increases the number of trips taken and provides rides to individuals who would otherwise not make the trip.

Results from the analysis also show that for those who did not take a trip during the day, the number of days since the last trip increases with age and is also greater for women, those with a medical condition or disability, those living in rural areas, those from a larger household, and those with lower household income.

Identifying Transportation-Disadvantaged Groups

Cluster analysis was used as an additional tool for identifying transportation-disadvantaged groups. Cluster analysis can be used to group relatively similar individuals together into a given number of groups. NHTS survey respondents were clustered based on the following socioeconomic characteristics: household income, age, gender, household size, and if they had a medical condition or disability affecting their ability to travel. Each of the clusters, or groups, was further divided into rural and urban groups to identify differences in travel behavior between urban and rural areas. The travel behavior for each cluster was analyzed by calculating average trips per day, bicycle trips per week, walking trips per week, transit trips per month, whether public transit was used on the survey day, and miles driven per year.

The most transportation-disadvantaged groups, those taking the fewest trips and traveling the fewest miles, were found to be those with a higher percentage of older adults, especially women, who have a medical condition or disability. Some of these transportation-disadvantaged individuals are able to partially offset their lack of mobility through use of Internet deliveries. The group consisting of middle-to-higher-income older women with a disability or condition took the second fewest trips among the twelve clusters identified but also had the most Internet deliveries. The most mobile clusters tend to be high-income or younger groups comprised of people without disabilities or medical conditions that hinder travel.

Conclusions

Overall, the results demonstrate the differences in mobility between different population groups. The strong desire to get out more often by those not making a trip within the last week shows the importance of mobility on quality of life. People with disabilities or medical conditions are shown to make significantly fewer trips than others, while expressing a desire to get out more often. Trends from 2001 to 2009 show increased use of transit. Older women are driving more and making more trips, slowly closing the gap between older men and women. These trends may continue as the active baby boom generation retires and expects to maintain its mobility.

This study was published as UGPTI Departmental Publication No. 258 and is available at http://www.ugpti.org/pubs/pdf/DP258.pdf



Implementing Transit Coordination in North Dakota Pilot Regions

Jon Mielke, Keven Anderson, and Carol Wright

A desire to coordinate public transportation services, reduce fragmentation and duplication, and increase effectiveness and efficiency of public transit led to the North Dakota state legislature passing a bill in 2009, Senate Bill No. 2223, that directed the North Dakota Department of Transportation (NDDOT) to develop two public transportation coordination pilot projects in the state.

NDDOT subsequently contracted with SURTC to study existing services and to prepare findings and recommendations concerning enhanced coordination in the selected south central and west central pilot regions. SURTC completed that study in 2010, and NDDOT forwarded the resulting report and recommendations to the Legislative Council in January 2011.

In October 2011, NDDOT executed a second contract with SURTC to pursue implementation of recommendations contained in the prior report. The project's work plan included 17 tasks focused on increased local input regarding existing and evolving mobility needs, increased coordination among the regions' operators, more uniform operating standards and policies, and short- and long-term budgets for continued and expanded coordination.

There are nine transit service providers in the 19 counties that comprise North Dakota's west central and south central regions. The characteristics of these providers vary greatly. Some systems provide strictly transit services while others are multi-service providers that operate senior citizen centers, provide local meal services, etc. Some are government-run, while others are private, nonprofit organizations. Some operate very small fleets and serve only one community while others have dozens of vehicles and serve large, multicounty areas.

The regions' transit managers were heavily involved in the project. These managers were asked to complete a coordination self-assessment, which helped identify opportunities for increased coordination. Composite route maps and fare structures were developed to identify prospects

for consolidating routes, which could increase mobility options for area residents, and moving toward more standardized fares. Related meetings were held with various subsets of operators, and plans were made regarding service modifications that would increase both operating efficiencies and personal mobility.

To help promote the availability of local transit services, SURTC worked with NDDOT's transit staff and local operators to establish or upgrade local transit websites. Seven of the region's local operators took advantage of this promotional opportunity. A concurrent effort was made to enhance NDDOT's transit website. Efforts were also made to create a library of materials related to local and statewide promotional efforts and policies that reflect industry best practices.

SURTC researchers also worked with NDDOT's Transit Section to develop guidelines that should increase uniformity and service reliability within the state's transit industry. Mechanisms were also developed to help NDDOT's Transit Section monitor the long-term impacts of coordination.

Regional Transit Coordinators

Concurrent with the work on this project, NDDOT's Transit Section contracted with North Dakota Community Action and Bis-Man Transit to hire regional transit coordinators for the south central and west central pilot regions. This action was consistent with the provision of Senate Bill No. 2223, which states that each pilot region must have a regional coordination administrator. SURTC worked with NDDOT's transit staff to develop corresponding multi-year budgets for these positions. It is estimated that each of these positions will require up to \$76,000 per year in federal funds. This total includes salaries and benefits, travel, and office-related expenses.

It is anticipated that these coordinators will eventually be capable of overseeing coordinationrelated activities in more than the initial pilot regions. It is also assumed that the legislature envisioned that enhanced coordination would be beneficial and cost-effective, and that it would ultimately be expanded to the entire state.

During the course of this project, NDDOT's Transit Section contracted with Cities Area Transit of Grand Forks to provide regional coordination services in the northeast quadrant of the state. A coordinator position also already exists in the Fargo-Moorhead urban area.

Given these expectations and related actions, this project developed a phased implementation plan and related budgets to accomplish statewide coordination. The plan divides the state into several coordination regions. Initial coverage is being provided in the two pilot regions in the south central and west central parts of the state, the northeast region, and the Fargo urban area.

It is anticipated that within two years, the coordinators assigned to the two pilot regions will be able to assume expanded roles encompassing all of the southeast and southwest quadrants of the state. Continuing discussions will need to take place with Fargo area transit officials to determine if the urban area's transit coordinator is able to assume additional responsibilities involving the entire southeast portion of the state. If so, the coordinator of the south central pilot region could be reassigned to the northwest region. If not, an additional position would need to be created to coordinate transit services in that region. It appears, therefore, that statewide transit coordination will eventually require either four or five regional transit coordinators. It is also possible that statewide coverage can be achieved with fewer regional coordinators. Assessments regarding the appropriated number of coordinators will need to be made as the overall implementation process continues.

NDDOT already has contracts in place for coordinators in the south central and west central pilot regions, the northeast region, and the Fargo urban area. Achieving statewide coverage will, therefore, require no more than one additional position. The federal share of the four existing positions, including salaries, travel, and office-related expenses, is approximately \$280,000 per year. Optimal coverage can be accomplished with five coordinators, one for each region of the state and one for the Fargo urban area. Given the availability of additional federal funds and cost sharing with the state of Minnesota for the Fargo position, the incremental cost of a five- vs. four-coordinator scenario is estimated at \$35,000 in federal funds.

It is projected that statewide coverage can be accomplished within four years, and that it can be undertaken with currently appropriated federal funding that will cover 80% of associated costs. The remaining 20% of related costs would need to come from local sources. NDDOT also has the option of funding related efforts with federal administrative funds that require no local match. Doing so would, however, reduce the amount of money that is available to fund transit services in rural areas.

Conclusion

The value of enhanced coordination has been demonstrated by this project's documented accomplishments. Given these facts, related federal mandates, and the availability of funding, transit coordination efforts should be continued in the prescribed pilot regions and eventually expanded to encompass the entire state. Doing so will increase overall operating efficiencies and enhance personal mobility for state residents and guests.

It is also recommended that NDDOT's Transit Section use its existing central office transit staff or contractors to undertake additional efforts to further facilitate coordination and effective and efficient local transit operations across North Dakota. Related activities include the operations of local transit advisory boards, more uniform policies and fares, the publicizing of existing transit services, the use of performance measures to monitor operations and to encourage related modifications, and the documentation of ongoing coordination-related achievements and benefits.

This study was published as UGPTI Departmental Publication No. 257 and is available at http://www.ugpti.org/pubs/pdf/DP257.pdf



2011 Transit and Community Livability Report

David Ripplinger*, Elvis Ndembe, and Jill Hough

The essential purpose of the Federal transit law is not simply to fund the capital and operating costs of transit systems; more generally, the purpose is to improve the quality of life in urban and rural communities through the use of transit systems, recognizing them as the lifeblood of livable communities. — Federal Transit Administration

Improving community livability is an important goal for the U.S. Department of Transportation (DOT). Livability is a subjective concept and is based on individual perceptions and expectations. In general, it is defined by the environmental and social qualities of a community. More specifically, the livability of a community is determined by many factors, including the presence of transportation alternatives, affordable housing, access to jobs, and quality schools.

Public transportation is an integral component of livability. Transit provides low-cost, environmentally sustainable access and mobility to all community members. It provides individuals with a means of travel to work, school, shopping, services, and recreation. Many rely on transit as a primary mode of transportation, and for others, its availability ensures mobility when the occasional or unexpected need arises. Measures of transit availability, accessibility, desirability, and use provide insights into the level of mobility available to all members of a community and consequently its livability.

To assist individuals and organizations involved in improving community livability throughout the United States, SURTC initiated the Community Livability Project. The aim of this project is to investigate and measure the relationship between transit and community livability.

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Transit Livability Statistics

In this study, transit livability statistics were calculated to provide a complete understanding of the availability, accessibility, desirability, and use of public transportation in the United States. These statistics were calculated using data collected from the 2009 American Housing Survey (AHS). The AHS is a survey funded by the U.S. Department of Housing and Urban Development (HUD) and conducted by the U.S. Census Bureau in odd-numbered years. This survey collects data on transportation alternatives and travel behavior, including transit availability, desirability, and use. The following measures were calculated using data from the AHS.

Transit Availability: The percentage of individuals who live in neighborhoods where transit is available.

Transit Accessibility: The average travel time from an individual's residence to the nearest transit stop in the case where transit is available.

Transit Use: The percentage of individuals who live in households where transit was used by at least one household member in the past week.

Transit Desirability: The percentage of individuals who chose their current housing unit because it was close to transit.

Transit to Work: The percentage of individuals who use transit as their primary method of transportation.

Vehicle Availability: The percentage of individuals who live in a household with at least one vehicle available.

Transit livability statistics can be used to make comparisons across regions, demographic groups, and community types. The calculation of these statistics revealed a number of differences (see Table 2).

| | Transit | Transit | Transit | Transit | Transit to | Vehicle |
|-----------------------------|--------------|---------------|---------|--------------|------------|--------------|
| | Availability | Accessibility | Use | Desirability | Work | Availability |
| National | 57% | 6:06 | 20% | 5% | 3% | 94% |
| Region | | | | | | |
| Northeast | 69% | 6:00 | 30% | 4% | 3% | 87% |
| Midwest | 53% | 5:42 | 16% | 5% | 4% | 95% |
| South | 41% | 6:37 | 13% | 3% | 3% | 96% |
| West | 75% | 5:58 | 19% | 5% | 3% | 96% |
| Community Type | | | | | | |
| Urban City Center | 86% | 5:15 | 28% | 8% | 4% | 87% |
| Suburban | 66% | 6:36 | 15% | 5% | 4% | 96% |
| Small Urban | 37% | 5:55 | 10% | 1% | 4% | 94% |
| Rural | 13% | 8:11 | 9% | 0% | 3% | 97% |
| Individual Characteristics | | | | | | |
| Low Income | 65% | 5:45 | 30% | 5% | 3% | 79% |
| Senior | 53% | 6:33 | 11% | 4% | 3% | 91% |
| Male | 57% | 6:05 | 20% | 5% | 3% | 95% |
| Receiving Disability | | | | | | |
| Payments | 57% | 6:12 | 18% | 8% | 3% | 89% |

Table 2. National Transit Livability Statistics

Nationwide, 57% of individuals live in areas where transit is available. Those living in the West are most likely to have transit available, while those in the South are least likely. Most residents of city centers, 86%, have transit available in their neighborhood, compared to only 13% of rural residents.

The national average travel time between an individual's residence and the nearest bus stop, train station, or subway stop is six minutes. Individuals living in the Midwest, on average, live closest to a stop while those living in the South typically live farthest away.

Twenty percent of individuals nationwide live in households where at least one person uses transit at least once weekly. Transit use grows to 30% for individuals living in the Northeast but averages only 13% in the South. Individuals living in the city center are most likely to use transit while those living in rural areas are least likely. Thirty percent of low-income households have at least one member who uses transit.

Five percent of movers nationwide consider available transit services when selecting their new homes. Individuals living within the city center are more than 20 times more likely to consider transit when selecting a home than people living in non-metro rural communities.

The study showed that community transit characteristics vary by region, which may be due to a number of reasons including differences in travel attitudes and behavior, service availability, historical differences, and differences in the built environment. The study also showed how the transit livability statistics vary by the relative urban-rural make-up of a neighborhood.

As new data become available, changes in these statistics over time can be identified. Comparing these statistics over time would be useful for evaluating the impacts of funding changes and identifying changes in behavior that may or may not be impacted by federal transportation policy. For example, increases in rural transit funding should make a noticeable difference in the availability and accessibility statistics. While calculations can be made for relatively large areas or subpopulations, the sample size is not large enough to evaluate the impact of local programs or to evaluate small population groups.

Community Livability Index

Public transportation is one of many factors that impact community livability. However, all significant factors must be accounted for to have a complete understanding of livability. To account for both transportation and other community livability factors, this study developed a Community Livability Index using data from the 2009 American Housing Survey.

The Community Livability Index was developed to serve as a national measure of livability in the United States. It is designed to capture the essential social and environmental qualities associated with livability. These include transportation alternatives, environmental quality, affordable housing, quality of neighborhood schools, safety, and access to jobs.

The variables in the Community Livability Index were limited to those that have a clear relationship with livability. Seven social and environmental indicators were used to construct the Community Livability Index: community services, crime, education, environment, housing affordability, retail opportunities, and transit. These seven indicators are :

- The *Community Service Indicator* aims to capture the availability and quality of community services. It was constructed based on the percentages of individuals who gave favorable ratings for city or county services and who said there are community recreation facilities in their neighborhood.
- The *Crime Indicator* is intended to capture the presence of crime and the satisfaction of neighborhood residents with police service, and it was calculated based on the percentages of individuals who stated that serious crime had not occurred in their neighborhood in the past 12 months and who agreed that neighborhood police protection is satisfactory.
- The *Educational Indicator* is expected to capture information on the availability and quality of neighborhood schools. It was calculated based on the percentages of individuals who reported that an elementary school is located within one mile of where they live and who reported being satisfied with their neighborhood public elementary school.
- The *Environmental Quality Indicator* is designed to measure the amount of bothersome odor, noise, and litter in an area. It was calculated based on the percentages of individuals who did not report problems with bad smells, noise pollution, litter, or undesirable properties or areas in their neighborhood.
- The *Housing Affordability Indicator* is expected to capture the relative affordability of housing in an area for its current residents. It is the percentage of households whose monthly housing costs are less than 30% of gross household income.
- The *Retail Indicator* is intended to gauge the amount of retail opportunities available to residents in their neighborhood and the level of satisfaction with those shopping options.
- The *Transit Livability Indicator* is intended to capture the availability and relative accessibility of public transportation in a community. Transit availability is indicated by the percentage of survey participants who said that public transportation is available in their area, and transit accessibility is determined by the mean time that survey respondents reported that it takes them to travel to the nearest transit stop.

The Community Livability Index is the equally weighted average of these seven indicators. This index can be used to evaluate, at a high level, the impact of federal programs and policies. Updating the data over time could show trends in livability and impacts of programs and policies.

This index also allows for comparisons of livability across regions and community types, which can be used to better understand the actual and perceived differences in social and environmental qualities. For example, the analysis found high availability of community facilities in the Midwest and few in central cities and rural areas; higher crime and lower satisfaction with neighborhood schools in central cities; less affordable housing in the Northeast, West, and central cities; and lowest availability of transit in the South and in small urban and rural areas. Overall, the Community Livability Index was highest in the Midwest and West, as well as in suburban areas.

This index provides useful information, but it is not without its limitations. Most components are calculated using equally weighted averages. However, some researchers, policy makers, or practitioners may consider some factors or variables more important. The calculations were also limited by the availability of data from the AHS.

Conclusion

Transit livability statistics and the Community Livability Index provide a snapshot of transit and livability in the United States. They provide a deeper understanding of current transit service, livability, and its social and environmental components. Transit livability statistics provide a more complete picture of transit availability, accessibility, and use than has been previously available.

Being able to compare these statistics across regions and socioeconomic groups should be helpful to policy makers in identifying shortcomings and inconsistencies in the delivery and effectiveness of existing federal transit policies. They can also be used to evaluate, at a high-level, the degree of equity in transit service. The statistics can also guide the development of new policies and programs. Similarly, transit livability statistics could be used to establish targets for redesigned programs.

The Community Livability Index and its component indicators provide an assessment of the current livability of American communities as perceived by residents. Comparisons across regions and community types demonstrate the variability that exists in livability, which may be the result of objective differences or residents' perceptions and expectations.

Calculation of updated transit livability statistics and the Community Livability Index as new AHS data are released will allow for identification of trends and evaluation of livability programs.

This study was published as UGPTI Departmental Publication No. 262 and is available at http://www.ugpti.org/pubs/pdf/DP262.pdf

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