
# SURTC 2012 RESEARCH DIGEST


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# Message from the Editor

This edition of the *SURTC Research Digest* includes articles on five research projects completed by the Small Urban & Rural Transit Center (SURTC) in 2011. Topics covered include tribal transit funding, the cost structure of small urban transit and justifications for subsidies, impacts of the built environment on transit ridership, segmenting intercity travelers by their attitudes, and vehicle supplier attributes valued by procurement decision-makers. 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**.

Jeremy Mattson
Editor

# 5311(c) Tribal Transit Funding: Assessing Impacts and Determining Future Program Needs

Jon Mielke

The federal government has invested a significant amount of money in tribal transit in recent years. SURTC surveyed Native American and Alaska Native communities receiving funds to learn more about the investment's impacts and help policymakers assess merits of the program and determine future funding levels.

Since the enactment of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) in 2005, the Federal Transit Administration's (FTA) 5311(c) tribal transit program has distributed $75 million to federally recognized tribes and Alaska Native villages in rural areas. The money has been used to plan, start, and enhance local transit services. In 2009, an additional $17 million in American Recovery and Reinvestment Act (ARRA) stimulus money was granted to tribes and Alaska Native villages to finance transit-related capital improvement projects.

Photo: Alaska DOT

Tribal transit services grew significantly during the first decade of the 21st century. According to the Community Transportation Association of America (CTAA), only 18 of the nation's 564 federally recognized tribes and Alaska Native villages received transit funding from the FTA in 1999. Conversely, a review of related Federal Register notices indicates that 101 tribes and Alaska Native villages received 5311(c) start-up and service enhancement grants between 2006 and 2010. Nearly 60 additional grants were awarded to conduct tribal transit planning studies.

Despite this significant increase in federal spending on tribal transit, the National Congress of American Indians and the Intertribal Transportation Association's Joint Task Force on Tribal Transportation have urged Congress to increase funding for the tribal transit program even further. The task force has called for future appropriations starting at $35 million per year with subsequent increases of $10 million per year until a funding level of $85 million is reached. At a minimum, the task force advocated future funding at no less than the current $15 million per year.

The continuation of the tribal transit program and related funding levels will obviously be a point of discussion when Congress considers future transportation legislation.

**Demographic Need Indicators and Existing Tribal Transit Services**

Most Indian reservations and Alaska Native villages are, by definition, rural. Only 10 of the reservations in the lower 48 states are located in metropolitan areas and none of the 229 federally recognized Alaska Native villages are urban. Despite this commonality, reservations are quite diverse in terms of their geographic size and population.

Of the 101 tribal entities that have received 5311(c) start-up and/or enhancement grants, 14 have land areas of less than 10 square miles but 22 cover more than 1,000 square miles and several have land areas in excess of 5,000 square miles. The average geographic size of all grantees is 1,120 square miles. The average population density for these entities is about 21% less than the national average for non-metropolitan areas, and nearly 25% of these grantees have population densities of less than six per square mile, classifying them as extremely rural. Low population densities and large land areas make the provision of transit services challenging, often resulting in higher-than-average per-trip and per-passenger operating costs.

Many reservations, especially in the Upper Great Plains and southwest regions of the country, are also very remote relative to the nearest regional population center, thereby making access to medical services, shopping, employment, and educational opportunities difficult. One-way trips of 50 to 100 miles or more are not unusual.

In addition to low population densities and remoteness, there are several demographic indicators that suggest that the provision of transit services should be a high priority on many reservations, including a higher percentage of older adults and low-income households.

**5311(c) and ARRA Tribal Transit Grants**

It is widely accepted that personal mobility is an essential component of economic vitality, that many tribal areas are economically depressed, and that people living in these areas are often without means of personal mobility. Congress' 2005 creation of the tribal transit program addressed these needs. The $75 million provided by the 5311(c) tribal transit program through FY 2011 contributed to the creation and expansion of many local tribal transit programs. These funds were provided with no requirements for a local match, which is common with other federal tribal transportation programs. The 5311(c) program spurred a significant amount of interest in initiating tribal transit services. Federal allocations to tribal transit programs were further increased by capital assistance funding provided by the 2009 American Recovery and Reinvestment Act (ARRA).

**Grantee Services and Program Results**

During the first five years of the 5311(c) tribal transit program, 101 tribal and Alaska Native village entities received 5311(c) start-up or enhancement grants. SURTC surveyed these entities to quantify program results. This survey was conducted electronically during July and August, 2011. Usable responses were received from 58 of these entities.

Fifty-nine percent of all survey respondents indicated that their transit services had been started as a result of the 5311(c) program, and many of the existing providers increased their service under the program. Between the new startups and the increase in service, 5311(c) funding may be credited with providing 1.2 million rides in FY 2010 among these 58 tribal entities.

Fifty-three respondents reported an aggregate fleet size of 381 vehicles, 121 of which were purchased with 5311(c) funds. It is assumed that a significant number of the non-5311(c) vehicles were purchased with 2009 ARRA stimulus funds.

Numerous respondents indicated that a reduction in 5311(c) funding would result in service cuts or even a complete discontinuance of service. Ten respondents indicated that there is a need for longer service hours and service on weekends, and another 10 said they need to increase service to remote areas on their respective reservations.

Respondents providing financial data indicated that 33% of their respective operating budgets came from the 5311(c) program. Most respondents said that funding from other sources did not decrease during this period, so it appears that providing 5311(c) funding resulted in an increase in transit-related expenditures, rather than simply replacing funding from other sources.

**Future Funding Discussions**

Much of the growth in tribal transit service may be directly attributed to SAFETEA-LU and the 100% funding it provides to new and existing tribal transit programs. Funding for the FTA's 5311(c) tribal transit program started at $8 million in 2006 and grew to $15 million in 2009. Subsequent continuing resolutions by Congress have kept funding levels at $15 million per year. Funding requests from tribal entities increased from $22.1 million for FY 2006 to $36.8 million for FY 2010.

The exact degree of dependence on 5311(c) funding is difficult to ascertain. Program participants may be dependent on program funding for between 32% and 41% of their overall operating budget. Based on 2009 NTD reports, it appears that the 5311(c) program provides about 26% of the funding for all of the nation's local tribal transit systems.

There appears to be some rationale for the $35 million per year target advocated by the National Congress of American Indians and the Intertribal Transportation Association's Joint Task Force on Tribal Transportation. Assuming an average operating and capital budget of $450,000, the nation's 120 tribal operators would have an aggregate budget of $54 million. Financing one-third of this amount with 5311(c) money would require an annual appropriation of $18 million. Taking the 5311(c) commitment up to 40% would require $22 million. Conversely, assuming an average budget similar to all rural operators ($816,000), a one-third federal subsidy would require $33 million per year, and a 40% federal share would require $39 million annually.

Several factors suggest that funding in the $20 million per year range may be insufficient. The first of these is the current demand for funding. FY 2010 grant applications requested $36.8 million, $21.8 million more than the $15 million that was available; 37 of the 96 applications were not funded.

The second factor is inflation. Fuel prices, for example, have risen since FY 2009 and are having a significant impact on all transit operators. This and other cost increases have undoubtedly resulted in either larger budgets or cuts in service for many tribal transit operations.

Third is the growth in each operator's scope of service, which is directly related to the fact that the vast majority of the nation's tribal transit services are less than 10 years old. As with any start-up system, it is assumed that demands for service have increased, both in terms of areas served and service hours and days. Average budgets may, therefore, have increased beyond those reported to the NTD for FY 2009.

Another factor that may create an increase in demand for program funds is a possible increase in the number of tribal transit systems in operation in the country. A number of tribes are contemplating the initiation of local transit services. This would cause a significant impact on the demand for 5311(c) funds, especially during the start-up phase when the need for vehicles and facilities is high and the availability of other funds may be low.

Going forward, it may be prudent to continue to provide 100% funding to encourage new start-ups and address extreme poverty situations. In many instances, however, tribal transit operators should seek diversity in funding sources. In actuality, current 5311(c) funding levels are already forcing most tribes and Alaska Native villages to seek funding from multiple sources.

Not all tribal transit operators receive 5311(c) funding every year, while some operators depend on program funds for 100% of their budget. These factors, combined with the growing number of tribal transit systems in the country, make it impossible to accurately project how much program funding will be needed in future years.

It is widely agreed, however, that many reservations and Alaska Native villages are impoverished areas and that personal mobility is a significant contributor to economic growth, employment and educational opportunities, access to health services, and overall quality of life. Given these factors, the lack of other transportation options, and the high cost of personal transportation (or the total lack thereof), Congress has provided 100% money via the FTA's 5311(c) tribal transit program to encourage the initiation and expansion of tribal transit services. Therefore, future discussions will focus on how to appropriately fund this program. It is hoped that this report's presentation will help frame these discussions.

*This study was published as UGPTI Departmental Publication No. 243 and is available at http://www.ugpti.org/pubs/pdf/DP243.pdf*

# Marginal Cost Pricing and Subsidy of Transit in Small Urban Areas

Jeremy Mattson and David Ripplinger

Recent economic conditions have forced public transportation agencies across the country to make significant changes to their service and fare structure. The resulting impacts on system users and social welfare have been considerable. At the same time, advocates are emphasizing the importance of transit and its role in community livability and sustainability.

SURTC research found that close to half of transit agencies in small urban areas have either reduced service or increased fares over the last two years, and the main reason for these actions has been a decrease in funding. Most transit agencies reporting increased demand said they are facing limitations in their ability to add service to meet that demand.


Photo: Hanson Photo

Studying the impacts of transit on the community, the environment, and other transportation system users is necessary to ensure that discussion of national transit policies under consideration are fully informed. This requires identifying the costs and benefits that result from transit, which in turn impacts how the system should be financed, including fare structure and level of subsidy. This study quantifies the internal and external costs of transit operations in small urban areas, determines if there are increasing returns to scale and density for these agencies, which would justify subsidies, and estimates the subsidy required to maximize social welfare. A survey of 141 small urban transit providers was also conducted to collect information on recent fare and service changes, as well as changes in funding levels and their views on the rationale for subsidizing transit.

**Economies of Scale as a Justification for Subsidizing Transit**

There are a number of possible justifications for providing subsidies for public transportation. These include providing mobility for those who cannot drive or access other forms of transportation, the existence of subsidies to other modes of travel, or the possibility that transit operates under conditions of economies of scale (1). Small urban transit agencies surveyed for this study also commented that transit subsidies are justified to enhance quality of life, promote livable communities, and enhance mobility for all segments of the population.

This study analyzed economies of scale and density as a rationale for subsidizing transit agencies in small urban areas. If economies of scale or density exist, then the average cost per trip decreases (or the quality of service improves) as the number of riders or

the level of service increases. Improved service, such as greater service frequency or coverage, could also result in less cost to the user in terms of reduced waiting times or access times.

Understanding the difference between marginal cost and average cost is important for determining how to subsidize transit. Marginal cost differs from average cost in that it refers to the cost of producing one more unit of output, such as one more mile of service. Knowing the marginal cost is important because social welfare is maximized when prices equal the marginal cost of providing the service (2).

If a transit agency has increasing returns to scale, then its marginal cost is lower than its average cost. The agency would need to set fares equal to average total cost to cover all of its costs, but doing so would result in a decrease in total social welfare. Setting price equal to marginal cost, therefore, would require a subsidy so it could cover its costs. The subsidy is required to maintain optimal allocation of resources and efficient levels of production.

Previous research on economies of scale in transit has provided conflicting results. A number of studies have suggested, though, that smaller agencies may operate under increasing returns to scale, while larger ones may experience constant or decreasing returns to scale (2,3).

This study focuses on transit operations in small urbanized areas and builds upon previous research by considering both internal and external costs and benefits. External costs are those costs caused by the existence of transit but not paid for by the transit agency or its users. These costs include air pollution, greenhouse gas emissions, roadway facilities costs, and costs from bus crashes. These external costs are assumed to average $0.53 per vehicle mile based on results from previous studies, but there is much uncertainty and variation associated with this result (4).

External benefits from additional transit supply also result when transit agencies increase service frequencies and reduce headways. These benefits result from reduced waiting times for passengers. This study attempted to quantify this benefit, referred to as the marginal external waiting benefit.

A full social cost function for transit operations in small urbanized areas, which accounts for economies of scale and externalities, was estimated. Results were then used to estimate the optimal fare, which is equal to marginal social cost of service. The needed subsidy is calculated as the difference between the revenue generated by the optimal fare and that needed to maintain efficient levels of production.

**Key Findings**

The model was developed and estimated using data from the National Transit Database for 168 agencies that directly operated fixed-route bus service in small urban areas (population 50,000 to 200,000) over a four-year period from 2006 to 2009. The model used vehicle revenue miles as transit output. Key findings are as follows:

- Small urban transit agencies experience economies of density and scale. This provides justification for government intervention.
- With increasing returns to scale and density, marginal cost is less than average cost and a subsidy is required to maximize social welfare for all but the largest agencies studied.

- The results align with those from previous studies that have shown increasing returns to scale for smaller bus systems, constant returns to scale for mid-sized ones, and decreasing returns for larger transit agencies.
- After accounting for external costs and benefits, a majority of small urban transit agencies operate with marginal costs below average cost, justifying a need for subsidies to obtain marginal social cost pricing.

To maximize social welfare, a subsidy equal to the difference between average cost and marginal cost is required. For many transit agencies, this would require a subsidy of about $0.50 to $0.83 per vehicle mile, before accounting for external costs and benefits, to allow fares to be set to marginal cost, while greater subsidies are required for smaller agencies (see Table 1).

**Table 1.** Returns to Density, Marginal Cost, and Required Subsidy by Size of Agency

| Output Percentile | Returns to Density* | Average cost | Marginal cost | Required subsidy |
|---|---|---|---|---|
| | | ---------- per vehicle mile ---------- | | |
| 1-10 | 1.65 | 4.59 | 2.78 | 1.80 |
| 11-30 | 1.40 | 4.02 | 2.88 | 1.14 |
| 31-50 | 1.27 | 3.96 | 3.12 | 0.83 |
| 51-70 | 1.17 | 3.52 | 3.02 | 0.50 |
| 71-90 | 1.04 | 3.02 | 2.89 | 0.13 |
| >90 | 0.88 | 1.51 | 1.71 | -0.20 |

*Estimates greater than one indicate increasing returns to density.

When accounting for external costs and benefits, estimates from a sample of 58 systems found a marginal external waiting benefit of $0.63 per vehicle mile and a required subsidy of $1.39 per vehicle mile (see Figure 1). The transit systems in this sample tended to be smaller than the average from the full set of providers, so the required subsidy is higher.

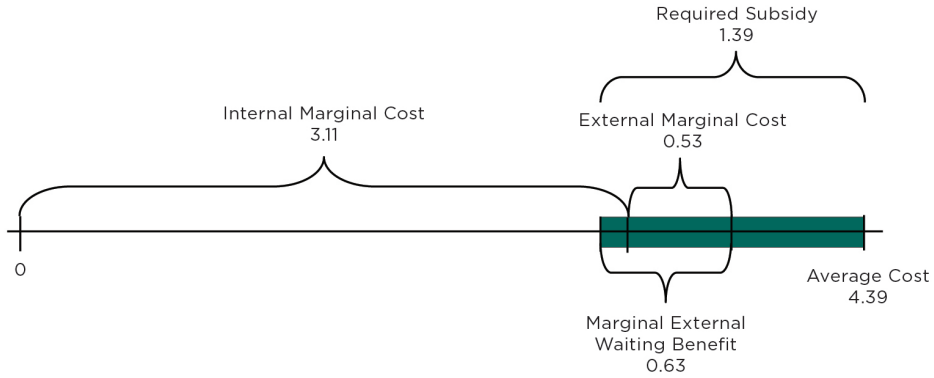


**Figure 1.** Average Estimates, Per Vehicle Mile, for Sample of 58 Small Urban Transit Systems

The marginal external waiting benefit varies depending on how much the passengers value their waiting time, the number of passengers, and characteristics of the transit system, including headway and network size.

**Areas for Future Research**

Marginal cost pricing could be used to obtain optimal fares and subsidy levels. A number of other factors, however, also need to be taken into consideration, including other possible justifications for subsidies. This study does not take into consideration the external costs of automobile travel. As the survey showed, 76% of small urban transit agencies believe that offsetting the social costs of automobile travel, such as pollution, greenhouse gas emissions, and congestion, provide justification for subsidies. If automobile travel is being priced below the marginal social cost, then there may be justification to price transit below its social marginal cost, requiring even greater subsidies. With lower fares, more motorists may switch to transit, reducing the negative externalities associated with single-occupancy automobile travel.

Enhancing mobility for the underprivileged is the most commonly cited rationale for subsidies by small urban transit providers. A significant benefit of transit service results from the creation of new trips that would otherwise not have been made. As transit provides access to work, health care, education, shopping, etc., additional trips will be made for these purposes, resulting in increased earnings, improved health, involvement in social activities, and additional spending in the local community. Furthermore, the service reduces the likelihood of transportation-disadvantaged individuals experiencing isolation and depression. Estimation of these benefits may provide greater justification for transit.

**Policy Implications**

The findings of economies of density and economies of scale indicate that adding new service, through increasing route density, service frequencies, or service coverage, will result in lower average costs per vehicle mile and will reduce waiting and access costs for riders.

The policy implication is important at a time when many agencies have experienced recent reductions in operational funding. The survey found that close to half of transit agencies in small urban areas have either reduced service or increased fares over the last two years, and the main reason for these actions has been a decrease in funding. Most transit agencies reporting increased demand said they are facing limitations in their ability to add service to meet that demand.

*This study was published as Mountain-Plains Consortium Publication No. 11-241 and is available at http://www.mountain-plains.org/pubs/pdf/MPC11-241.pdf*

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# Transit Ridership and the Built Environment

Del Peterson

There has been a focus recently on improving our understanding of how the built environment, which refers to everything humanly made, arranged, or maintained, influences how we travel. Evidence is mounting that the quality of the built environment influences many key areas of concern to federal, state, and local policy makers, including neighborhood livability and safety, air pollution, traffic congestion, and transit use, among others (1, 2, 3). Planners need evidence showing why land use matters as they advocate for the adoption of different planning principles. This is especially true in small urban areas where planners seldom utilize innovative land use principles, such as smart growth, within their planning process (4).

Photo: Hanson Photo

This research identified the relationship between the built environment and transit ridership in the Fargo-Moorhead community. Built environment variables were analyzed along with socio-economic and level of service variables. Fifteen fixed routes were studied within the Metro Area Transit (MAT) system in Fargo-Moorhead, while routes specific to a certain population (i.e., college students) were excluded as they do not accurately represent traditional transit service. A combination of ridership, route specific, and regression analysis were utilized to capture different system attributes.

**Background**

Previous research has highlighted the association between the built environment and various human behaviors, including travel behavior and health-promoting activities. Travel behavior research focuses largely on mode choice, specifically the decision to drive versus walk, bike, or use public transit.

Built environment factors that could influence transit ridership include residential density, retail density, land-use mix, and street design. Low residential densities have been shown to encourage automobile travel as increased distances between different land uses, which are usually represented by low residential densities, do not allow for alternative modes of travel such as walking or biking (5).

Diverse land uses in a given area have also been found to encourage alternative travel options. Intuitively, as land-use mix increases, the likelihood that travelers will choose transit should increase as well. This is because if different land uses exist within a specific route area (e.g., commercial, residential, institutional, etc.) riders can travel from their homes to other venues for shopping, eating, etc. without walking long distances or transferring to other routes.

Street network patterns can also influence travel patterns. A denser street network such as those found in downtown areas can create an environment conducive to walking as opposed to a sparse street network which is often located in suburbs and within new housing developments.

Pedestrian-oriented environments are more conducive to transit use than are car-oriented environments, and they are also of interest to public health researchers studying the barriers to physical activity. Built environments friendly to pedestrian travel could encourage more active lifestyles, which would have positive health benefits.

**Methodology**

To determine how built environment factors influence ridership in the Fargo-Moorhead area, weekly transit ridership data by route were analyzed, taking into consideration socio-economic characteristics of the population along the route (e.g., median household income, vehicle ownership, gender, ethnicity, and age), and level of service.

The built environment was studied for the area within a half mile on either side of each route. This area was referred to as the route buffer area. Three main measurements were calculated: residential density (housing units per area), street network patterns (intersection density), and land use (land-use mix). These three variables were then used to calculate the walkability of the neighborhood within the route buffer area.

Land-use mix was defined as the proportion of eight land-use types within the route buffer area. The land-use types included park, industrial, commercial, institutional, office, mixed use, vacant and residential. The neighborhood walkability index was calculated using a combination of residential density, intersection density, and land-use mix.

**Results**

Overall, built environment results indicated that residential density and walkability were significant in predicting transit ridership and performed as anticipated. Higher density areas tended to result in greater transit ridership, and the most-used routes also tended to have high walkability indexes. Land-use mix was also significant, but results were mixed with respect to their influence on transit ridership. Many of the routes showed the expected relationship between land-use mix and ridership, with those routes serving areas with a greater mix of land use having greater ridership. A few routes, however, showed unexpected results. These routes had high ridership, despite a low level of land use mix. The high ridership was found to be primarily because of the main stops they served and not the land-use characteristics within the route area.

Regression analysis indicated that all three of the built environment variables were significant in determining transit ridership. Because all variables (household income, level of service, land-use mix, etc.) should be considered when determining the total effect on transit ridership, regression analysis is an excellent tool that can provide insight into which variables are of significance, and also in determining the magnitude of a specific variable and its influence on ridership.

Results showed that characteristics of the built environment influence transit ridership. Policy makers looking to support land uses that increase both transit use and walkability should consider these implications. Public health and welfare concerns such as air pollution, traffic congestion, and physical activity can all be addressed by investing in walkable, transit friendly environments. Small, medium, and large communities can benefit from planning techniques that give travelers options rather than car centric neighborhoods that do not provide the needed flexibility necessary for different transportation modes.

*This study was published as Mountain-Plains Consortium Publication No. 11-239 and is available at http://www.mountain-plains.org/pubs/pdf/MPC11-239.pdf*

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# Travel Behavior of the Lone Rangers: An Application of Attitudinal Structural Equation Modeling to Intercity Transportation Market Segmentation

David Ripplinger, Jeremy Mattson, and Del Peterson

SURTC researchers constructed attitude-based market segments to assist transportation policy makers and service providers in rural and small urban areas in making policy, investment, and service design decisions and to determine the suitability of attitude-based markets in estimating travel demand. This research allows transportation providers to identify their potential customers, what they are like, and how they can be reached. Transportation providers can use the results to allocate resources to markets that represent the greatest potential. The research is also useful in assessing the potential impacts of proposed federal transportation policy.

Market segmentation has long been used in transportation. While aggregate data is helpful, segmenting a market into smaller groups allows for more targeted planning, promotion, operation, and evaluation. Traditionally, segments have been constructed on the basis of demographic differences (1, 2). However, more recent efforts have relied on dividing markets using traveler attitudes (3, 4). While many studies have focused on urban travel, market segmentation of intercity transportation has also been conducted (2, 5, 6). Fewer studies have been conducted, though, on intercity travel between small cities and rural areas, where attitudes may differ from those in large urban areas.

Travel behavior information becomes more important in light of the crossroads facing transportation. Transportation policy must address many challenges. It needs to provide the vision, structure, and financial mechanisms for the nation's transportation system to remain a foundation of its economic vitality and personal wellbeing. At the same time, travel behavior is changing. Changing economic conditions and shifting demographics have impacted how and when the nation travels.

Estimates of the impact of changes in federal transportation policy and ridership changes resulting from new or modified transportation services are valuable. Segmenting markets should lead to improved estimates.

**Constructing Attitude-Based Market Segments**

Travel attitude and behavior data for residents of North Dakota and western Minnesota were collected by a survey. The survey included a series of questions on respondent attitudes regarding six key factors with regard to regional intercity travel. The six attitudinal factors studied were concern for environmental issues, desire for service reliability and ability to make productive use of time when traveling, sensitivity to time, desire for flexibility, desire for privacy, and preference for comfort.

Socioeconomic characteristics may impact an individual's attitudes regarding travel. For example, those in the workforce or those with children may be more sensitive to time or may be more likely to desire the ability to make productive use of time when traveling. They may also have a greater desire for flexibility.

The relationships between socioeconomic characteristics, traveler attitudes, and responses to the attitudinal questions in the survey were modeled as a structural equation model (SEM), which has often been relied upon for constructing attitude-based market segments (4, 7). This method allows for investigating the role of unobserved variables. This is particularly important when modeling attitudes, as they are not directly measurable.

Cluster analysis was then used to identify intercity transportation market segments. The analysis found that sensitivity to time, desire for flexibility, and desire for privacy have the greatest explanatory power for segmenting the market. Eight market segments were constructed using these three attitudinal factors, as shown in Figure 2.

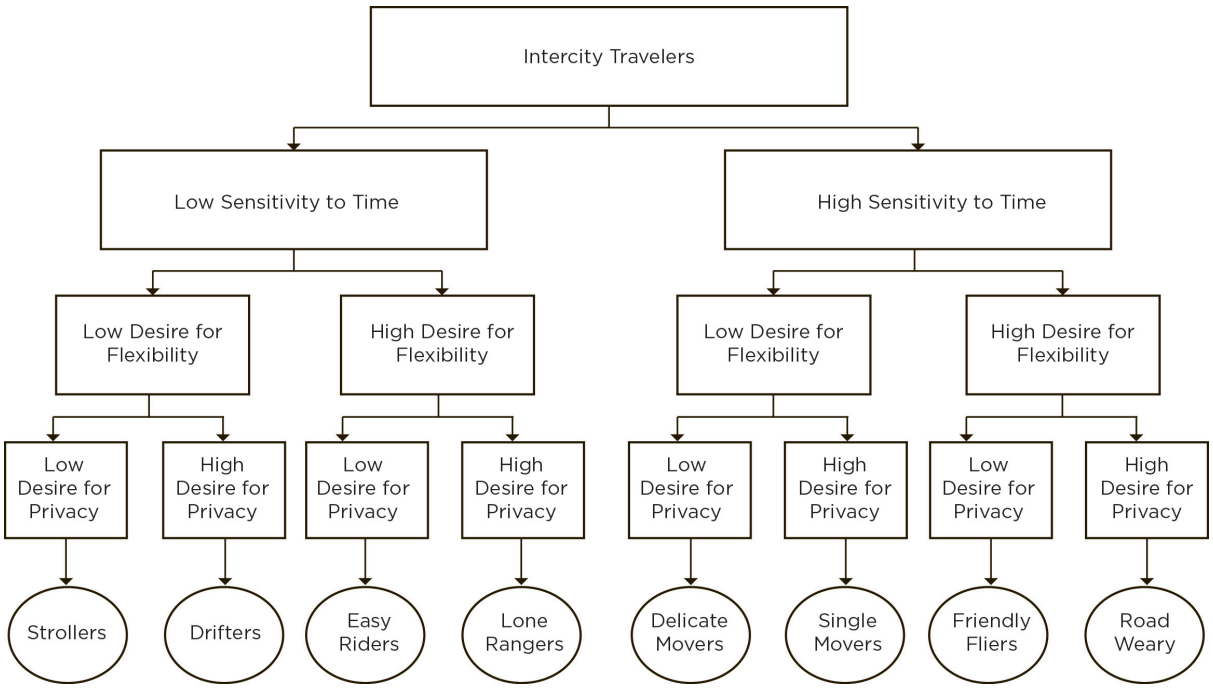


**Figure 2.** Intercity Transportation Market Segments

By assigning individual residents to each market segment based on their socioeconomic characteristics, the profiles of each entire market segments can be identified. The name, travel attitudes, travel behavior, and socioeconomic characteristics of each of the eight segments are as follows:

- *Strollers* have a low sensitivity to travel time and schedule as well as a low desire for privacy. They tend to be male, married, and part of larger households, and they have, on average, the highest income of all the groups.
- *Drifters* have a low sensitivity to travel time and flexibility but prefer privacy. They have, on average, a higher income and are more likely to be male, middle-aged, and married. They are most likely to be self-employed.
- *Easy Riders* have a low sensitivity to time, a high desire for flexibility, and a low desire for privacy. They are more likely female and older with moderate incomes.
- *Lone Rangers* have a low sensitivity to time but highly desire flexibility and privacy. They tend to be older and male.
- *Delicate Movers* are highly sensitive to travel time but not to schedule or privacy. They tend to be seniors with lower education, lower income, and smaller household size. Delicate movers are more likely than others to travel by train, bus, and shuttle van.
- *Single Movers* have a high sensitivity to time, but not to schedule, and desire privacy. They are more likely to be unmarried and male, with low to middle incomes, less education, and kids.
- *Friendly Fliers* have a high sensitivity to travel time and schedule and low desire for privacy. They are more likely to be working age, members of households with children, more highly educated, and with moderate to high incomes. They are also more likely to be female. This group is most likely to make regional trips by air.
- *Road Weary* travelers are similar to the Friendly Fliers but are more sensitive to privacy. They are also likely to be male, married, members of larger households, and have middle incomes.

The sizes of market segments were found by assigning individuals to each market segment. The Road Weary (25%) and Friendly Fliers (25%) are the largest market segments, followed by the Easy Riders (14%), Strollers (12%), and Single Movers (11%). The smallest market segments are the Delicate Movers (1%), Drifters (4%), and Lone Rangers (8%).

**Intercity Travel Behavior by Market Segment**

Market segments are expected to respond differently to changes in price and product characteristics. In the case of intercity transportation, these differences can be quantified as variations in mode share. The Delicate Movers, Lone Rangers, and Easy Riders are the most likely to travel by bus, rail, or van. The Delicate Movers and Easy Riders have a lower desire for privacy, explaining why they may be more likely to use these alternative modes, and the Easy Riders and Lone Rangers also have a low sensitivity to travel time. The Delicate Movers also do not require a flexible schedule, making them more likely to choose an alternative to the automobile, but they are sensitive to time. These groups also all have middle-to-low-incomes, making the travel by non-automobile modes, especially intercity bus transportation, more appealing. Furthermore, these three groups have the highest percentages of seniors, and older adults were found to be less likely to travel by air or to drive themselves.

Changes in the costs of travel and the characteristics of travel modes can impact the market shares of these modes. To study the importance of travel time on mode choice, an increase in the relative speed of intercity bus and passenger rail modes was analyzed. In the medium-speed scenario, bus and rail travel time is 10% greater than that for the automobile, while in the higher-speed scenario, the travel time for rail equals that for automobile.

The impact of a decrease in travel time for intercity bus and rail was found to have a significant positive impact on mode share. For 120-mile trips, market shares for bus and rail increased by 11% in the medium-speed scenario, and rail's mode share increased by 19% in the higher-speed scenario. Bus and rail shares increased by 55-56% in the medium-speed scenario for 480-mile trips, while the share for rail more than doubled for 480-mile trips with speeds set equal to automobile speed.

**Strategic Marketing and Service Design**

Market segmentation research allows transportation providers to identify who their potential customers are, what they are like, and how they can be reached. Transportation providers can use the results to efficiently allocate resources to markets that represent the greatest potential. Target markets are groups of individuals that will respond favorably to certain services or messages, and the provider can develop unique marketing strategies to appeal to the selected target markets (8).

Travelers with certain attitudes toward travel may be attracted to non-automobile modes. Strollers, with their low sensitivity to time, flexibility, and privacy would be a target market for intercity bus or rail service. This group makes up 12% of the population of the market area. Members of this group might be drawn to using bus or rail through strategic marketing instead of significantly increasing the level of service.

The Delicate Movers, Lone Rangers, and Easy Riders are the most likely to travel by bus, rail, or van. These groups are older and have middle-to-low incomes. An analysis of demographic data for the region can show where the greatest concentrations of these market segments are located. Such information would be useful for designing and marketing service. Local access to intercity bus, rail, or van service should be improved in these areas.

**Policy Implications**

Changing demographics will likely influence demand for different travel modes. Those market segments with higher percentages of seniors were most likely to travel by bus, train, or van for intercity trips, and they were less likely to travel by air. The size of these market segments will continue to grow as the population ages, creating increased need for these services.

At the federal level, there is considerable discussion over the direction of national transportation policy. Knowledge of travel behavior by market segment can determine what the response of system users will be to proposed changes. Planning for high-speed rail systems that will require billions in investment has begun. Results show that a decrease in travel time for intercity bus or rail service would result in these modes capturing a much larger market share. Regardless of the level of funding, an improved understanding of the impacts of federal spending on transportation results in better stewardship of taxpayer funds.

Similarly, there has been discussion of internalizing the environmental costs of many daily activities including travel by automobile using a "carbon tax." Such a tax would increase the relative cost of travel by personal automobile, making other modes more desirable. Although it was not a key factor, the study's analysis verifies environmental sensitivity as a significant attitudinal factor. Travelers with environmental sensitivity may also be more likely to choose bus or, especially, rail due to the environmental advantages of these modes.

While government support for intercity bus and rail may be included in the next transportation bill, the increase in ridership predicted using the demand model may also support service that the private sector could undertake on its own. At the same time, knowledge of the relative size of market segments that find bus and rail attributes appealing is provided by the study as well. If intercity bus and rail are able to provide more reliable, more frequent service they may be able to attract riders from all segments except those most sensitive to privacy.

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# Developing Input to "Best-Value" Vehicle Procurement Practice: An Analysis of Supplier Evaluation and Selection in the U.S. Public Transportation Industry

Marc Scott

SURTC researchers studied information from 278 transit agencies to develop a practice of "best-value" vehicle procurement, a procurement method in which multiple supplier attributes are evaluated. The results provide a deeper understanding of which supplier attributes are most important to procurement decision-makers.

Photo: Hanson Photo

Many of the public transportation providers in the United States that receive federal and state government funds are stipulated by law to comply with vehicle procurement regulations. These regulations reflect federal and state government positions on vehicle procurement. However, given the multi-agency aspect of public procurement processes, these governmental positions are not the only ones that exist. Two other positions influence decision-making in vehicle procurement processes – those of the public transportation agency purchasing the vehicle and the vehicle supplier. This research focused on the position of the public transportation agency purchasing the vehicle and, more specifically, the positions of their procurement decision-makers.

Governmental procurement-related efforts are concentrated on the development and implementation of procurement regulation. However, less attention to public transportation agency positions on procurement issues can lead to disconnects between government policy objectives and industry practice. Procurement policy and regulations need to accommodate the goals and objectives of public transportation agency procurement decision-makers who actually conduct vehicle purchases.

The literature is replete with research on procurement strategies and practices in the private sector. However, public sector procurement and purchasing practices receive significantly less focus (1, 2). This research was motivated by a lack of information and understanding of how public transportation agency procurement decision-makers make decisions when purchasing vehicles. The primary objective of the study was to gain a deeper understanding of which supplier attributes are most important to procurement decision-makers.

Federal government procurement regulations and initiatives that directly pertain to this research are those related to supplier evaluation. In practice, suppliers are evaluated and rated on specific criteria. The FTA encourages, when permissible, that public transportation agencies employ the "best-value" approach. In the "best-value" procurement approach, grantees acquire a product or service they consider to possess more technical superiority than another product or service that is priced lower (3).

The intent was for the information obtained in this study to be leveraged and used as input into developing the practice of "best-value" procurement, a procurement method by which multiple supplier attributes are evaluated as opposed to just the supplier's price.

Data were collected through a survey administered electronically to public transportation procurement decision-makers throughout the United States. Responses were received from 327 participants representing 278 agencies.

**Results**

The research identified the vehicle supplier attributes that procurement decision-makers perceived to be most important when evaluating suppliers of both conventional fuel vehicles and alternative fuel vehicles. For suppliers of both types, the five supplier attributes perceived to be most important were quality, reliability, after-sales support, warranties and claims, and integrity.

However, results showed the level of perceived importance for each of these top five attributes changed according to which type of supplier was being evaluated. The ranking of attributes when suppliers of conventional fuel vehicles were evaluated was 1) reliability, 2) quality, 3) integrity, 4) warranties and claims, and 5) after-sales support. However, when suppliers of alternative fuel vehicles were evaluated, the order of the perceived importance of these attributes changed to 1) quality, 2) reliability, 3) after-sales support, 4) warranties and claims, and 5) integrity. The change in rank of the attributes' perceived importance was primarily attributed to the increased engineering and technological composition of alternative fuel vehicles and the resulting alterations in requirements on their suppliers.

Statistical analyses confirmed that quality, after-sales support, and technical capability were relatively more important when evaluating suppliers of alternative fuel vehicles. It was also concluded that price is more important when evaluating suppliers of conventional fuel vehicles. Another test led to the conclusion that price is a more important supplier attribute for procurement decision-makers in non-urban areas than it is to those in urban areas.

Results revealed that an agency's urban classification, its vehicle fleet size, its capital expenditure level, and its decision-makers' education level or years of experience had no statistically significant influence on the perceived importance a procurement decision-maker assigns to a specific supplier attribute. However, two tests were significant and revealed that the FTA region to which a public transportation agency's procurement decision-maker belongs influences the manner in which they evaluate suppliers of conventional fuel vehicles on their integrity and how they evaluate suppliers of alternative fuel vehicles on the warranties and claims they offer.

The research results suggest that supplier attribute combinations, and not procurement decision-maker characteristics, can explain the variation in supplier choice and attribute importance with more accuracy and statistical significance. A discrete choice experiment was used to determine the importance of specific supplier attributes in practice. Results showed that price was the most important supplier attribute, followed by quality, after-sales support, technical capability, and delivery.

As mentioned, this research represents the first scholastic foray into the dynamics of vehicle supplier evaluation and selection in the public transportation industry. As such, it is exploratory in nature and utilizes models and quantitative techniques to facilitate exploratory analyses. The research process and information garnered from the results shed light on various areas of the vehicle supplier evaluation and selection process that require more focus.

It was determined that the vehicle supplier evaluation and selection process is complex and that such complexities vary on a per agency basis. Accurately capturing the entirety of complexities and their associated dynamics in one study or model is extremely challenging, if not impossible. This study, however, facilitates a deeper understanding of vehicle supplier attribute importance and its role in the supplier evaluation and selection process. It provides various facets of output that can serve as input to more tactical and definitive supplier evaluation operations.

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