Estimating Ridership of Rural Demand-Response Transit Service for the General Public: Executive Summary

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SURTC RESEARCH SUMMARY

Abstract

The objective of this study is to develop a model for estimating demand for rural demand-response transit services for the general public. Lack of data for demand-response service characteristics and geographic coverage has limited the development of such models. This study developed two models for estimating demand. The first used data from the 2013 rural National Transit Database, and the second used more detailed service data collected from surveys of transit agencies. Ridership was found to significantly increase when the percentage of the population comprised of older adults or people without access to a vehicle increased. The second model analyzed the impacts of service span and reservation requirements on ridership. Results showed that providing more days of service had an expected positive impact on ridership, while allowing users to reserve rides on shorter notice also had a significant positive effect.

Introduction

Few studies have provided a method for estimating ridership for demand-response transit services. Lack of data for demand-response service characteristics and geographic coverage has limited the development of such models. While demand models have been previously estimated, such as in TCRP Report 161 (Vanasse Hangen Brustlin, Inc, et al. 2013), they lack many service characteristics that will likely impact ridership, such as fares, span of service, and reservation requirements.

The objective of this study is to develop a model for estimating demand for rural demand-response transit services for the general public. Specific objectives are to estimate the impacts of service characteristics (such as span of service, service coverage, fares, and reservation requirements) and service-area characteristics (such as population and demographic characteristics) on ridership.

Two models were developed. The first used data from the 2013 rural National Transit Database (NTD) and the American Community Survey (ACS). Because data limitations of the rural NTD restrict the number of variables that can be analyzed, a second model was developed using data collected from surveys of rural transit agencies. Both models estimate demand for non-sponsored demand-response service for the general public. Demand for sponsored, or program-related, trips or ADA paratransit was not considered.

According to rural NTD data, there were 1,092 agencies across the country that provided rural demand-response service in 2013. These agencies provided a total of 55 million demand-response rides in 2013, with the median agency providing about 23,000 rides. As shown in Table 1, there was significant variation in ridership, with 10% of agencies providing fewer than 3,202 rides and the largest 10% providing about 119,000 rides or more.

Factors Affecting Ridership

It is expected that ridership will be determined by the demand for services, the level of service provided, and the cost of service. Demand for services can be estimated based on population and demographic characteristics. It is expected that demand will be greater in areas with a higher population and that concentrations of transportation-disadvantaged populations will

Table 1. Rural Demand-Response Transit Trips, Percentile Rankings per Agency, 2013

Percentile	Regular Unlinked Trips
10th	3,202
25th	8,727
50th	22,938
75th	53,636
90th	118,733

Source: Rural National Transit Database, 2013

create greater demand. As noted in previous research, it is expected that demand for rural transit will be greater in areas with a larger population of older adults, people with disabilities, and people without access to a personal vehicle.

While population characteristics can be used to estimate demand, ridership will also be influenced by the characteristics of the service provided and the fare levels. Important service characteristics include the number of days per week and hours per day that service is provided, as well as the advance reservation requirements. It is hypothesized that reservation requirements serve as a deterrent and that requiring reservations further in advance will negatively impact ridership.

Other service characteristics could also affect ridership. Some rural transit agencies operate both fixed-route and demand-response service. In those cases, some of the transit demand is being met by fixed-route services, so demand-response ridership is expected to be lower than it would have been had the fixed-route services not been available. In other cases there may be overlap in service areas, with more than one provider serving an area. Ridership is expected to be lower for demand-response agencies that are sharing service area with other agencies. It may also be expected that ridership for tribal transit may differ from that of other rural transit systems because of the unique geographic and economic characteristics of Native American reservations.

Due to the difficulties of providing service in rural areas, transit agencies in rural, low-density areas with long travel distances may not be able to provide as many trips as agencies serving more concentrated and densely population areas. Agencies that strictly serve a municipality, on the other hand, may be able to provide more trips per capita than those serving larger geographic areas because of shorter trip distances and greater population density.

Methods

First, a model was developed that estimated ridership as a function of service area population, demographic characteristics of the service area, and fare levels, and it took into consideration whether the transit agency provides a fixed-route service, has a service area that overlaps with that of another demand-response transit provider, operates only in a municipality, or is a tribal agency. It also accounted for the region of the country in which the agency operates.

This first model used data from the rural NTD for 731 rural demand-response transit agencies, but since this database does not include important service quality characteristics, those factors could not be included in the model. Previous studies have also not included this information due to lack of data.

As noted in the Transit Capacity and Quality of Service Manual (Kittelson and Associates et al. 2013), key measures of demand-response transit quality of service include geographic service coverage, service span (days and hours of service), and response time, which refers to the amount of time users must reserve a ride in advance. These three variables are measures of service availability and are expected to have an impact on ridership.

To model the impacts of these service characteristics on ridership, a second model was developed using data obtained through a survey of rural demand-response transit agencies. Some of these data were obtained through a previous study conducted by Godavarthy et al. (2015). This model used data from 68 rural transit agencies, and it estimated ridership as a function of total service area population; percentages of service area population receiving service 6 or more days per week, 5 days per week, 12 or more hours per day, or fewer than 5 hours per day; advance reservation time; and fare levels.

Results

Similar to previous research, the first model showed that demographic characteristics are important. Ridership was found to significantly increase when the percentage of the population comprised of older adults or people without access to a vehicle increased. This model also showed that demand-response ridership is lower if the agency also operates a fixed-route service or if its service area overlaps that of another transit agency. Agencies serving only a municipality were found to have greater ridership, indicating that systems serving smaller geographic areas with more concentrated demand and shorter trip lengths will have higher levels of ridership, after accounting for population and all other variables.

Both models showed a negative effect of fares on ridership. The first model estimated a price elasticity of -0.24, and the second estimated an elasticity of -0.12. Given that the first model used data from a much larger number of transit agencies, its results may be more reliable.

The second model demonstrated the importance of service characteristics, as agencies providing more days of service were found to have higher levels of ridership. This ridership increase could be due to there simply being more hours of service, but there could also be increases in trips per service hour if riders find the higher level of service more reliable and useful.

This model also showed that advance reservation time is important. Agencies that allowed users to reserve rides on shorter notice had higher levels of ridership, and the magnitude of the effect was significant. This could have important implications as agencies attempt to improve service qualities to serve more riders. The results suggest that transportation network companies could be successful in rural areas by providing rides with a short response time. More detailed results are shown below.

Population

A 1% increase in population was found to increase ridership by 0.69-0.83%.

Demographics

The first model showed that areas with a higher percentage of older adults or households without access to a vehicle have higher levels of ridership. If the percentage of the population that is aged 65 or older increases by one percentage point, ridership was found to increase by 8%. If the percentage of the population that lives in a household without a vehicle increases by one percentage point, ridership was found to increase by 21%. The percentage of population with a disability, however, was not found to have a statistically significant impact.

Fares

Fares have a negative impact on ridership. A 1% increase in fares was found to reduce ridership by 0.12-0.24%. The low fare elasticities show that ridership is fairly inelastic to price, as would be expected given that many users of demand-response service have few alternative options. Although it is inelastic, fare levels still have some effect, showing that even though many riders may be transit-dependent, ridership will decrease with increases in fares.

Span of Service

The second model showed that ridership is impacted by the number of days that service is available. As the percentage of service area population with service 5 days per week increases by one percentage point, ridership was found to increase 1.41%; and ridership was found to increase 1.65% as the percentage of service area population with service 6 or 7 days per week increases by one percentage point. The effect of service hours per day was not found to be statistically significant, but that could be because of the limited number of observations.

Advance Reservation Requirement

The second model showed that advance reservation time has a negative impact on ridership. Compared to agencies that require a reservation two or more days in advance, ridership is 124% higher for providers that require a reservation one day in advance and 201% higher for agencies that allow same-day service.

Other Results

- Agencies that provide both fixed-route and demand-response service have lower levels of demand-response ridership than agencies that provide just demand-response service.

- Agencies that serve areas where more than one transit provider is available have lower levels of ridership.
- Demand-response providers that strictly serve a municipality have higher levels of ridership than those serving a larger geographic area, after accounting for population and other factors.
- There are some regional differences in ridership not accounted for by these variables. Notably, agencies in region 5 (Illinois, Indiana, Minnesota, Michigan, Ohio, and Wisconsin) have higher levels of ridership, and agencies in regions 3 and 4 (the mid-Atlantic states and the southeast) have lower levels.

Note that predicting ridership for an individual agency, given the many community-specific or agency-specific factors that are not accounted for in the data, is difficult. To evaluate the accuracy of the first model, which was estimated with 2013 rural NTD data, it was used to predict ridership for 2014, and predicted ridership was then compared to actual ridership. Results showed that there is still significant variation in ridership that is not explained by the model, but the model developed in this study performed better than the simpler model described in TCRP 161.

The report provides instructions on how individual transit agencies or transportation planners can use results from the two models. Guides are given for how to obtain the necessary data and use the formulas to estimate ridership.

Conclusions

This study provides two new tools for estimating ridership for rural demand-response transit services for the general public. These tools can be used in conjunction with existing models or peer analysis. The inclusion of a greater number of variables and more specific service information improves the performance of the models. These tools can be used by transit agencies or transportation planners to forecast demand for new demand-response services; estimate the impact of service changes, such as changes in geographic coverage, span of service, fares, reservation requirements; and project future ridership based on projected population and demographic changes.

References

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