



An exploration of the environmental and rider characteristics associated with disability paratransit trip delay



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ABSTRACT

Over the past two decades, a number of studies have been published on the efficiency of paratransit service for persons with disabilities. Although speed, delay, and pick-up duration can significantly affect overall efficiency of paratransit service, studies that have focused on these performance measures have been rare. This study examines how these performance measures are associated with local environmental characteristics such as density and the characteristics of the trip makers. It uses a dataset containing detailed information on a large volume of trips made by the registered clients of Access Link, a paratransit service operated by NJ TRANSIT for persons with disabilities. To measure speed and delay, network distances for 1.91 million trips were estimated by the ArcGIS Network Analyst extension. Analysis of variance and regression models were used to examine the associations between the performance measures and a set of variables pertaining to trips, passengers, and characteristics of pick-up and drop-off locations. Models for the entire study area as well as specific Access Link regions show that there is a significant association between local environmental and personal characteristics of passengers and the performance measures. Evidence was found that higher density of population, employment, and intersections at the local level may have a significant adverse effect on service efficiency because of lower speed and higher delay. Planning implications of the findings are discussed.

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1. Introduction

The primary objective of this study is to examine how local environmental characteristics and personal characteristics of passengers are associated with travel time, delay, and pick-up duration of paratransit trips by persons with disabilities. Although it has been recognized by past studies that trip delay significantly affects overall efficiency of paratransit systems, efforts have been made only rarely to study the effect of environmental characteristics such as population, employment, and intersection density on service efficiency. A limited number of past studies examined the association between regional density and aggregate service efficiency to compare the efficiency of systems located in different parts of a country, but efforts to examine how local environmental characteristics affect service efficiency have been rare. Furthermore, since past studies generally focused on economic efficiency, little is known about performance measures such as travel time and delay, even though these performance measures ultimately affect overall efficiency of service. Considering that persons with

different types of disabilities and demographic characteristics may have different travel patterns and needs in terms of mobility equipment, operator's attention, etc., this study also examines how these characteristics influence trip delay and pick-up/drop-off duration.

It is not difficult to hypothesize that local conditions such as congested roads affect vehicle speed and delay of paratransit trips. Because of variations in population density, employment density, and network characteristics, there is often a wide variation in traffic congestion between different parts of the same region. The variations in the level of congestion can conceivably lead to variations in travel time and delay of paratransit trips. Similarly, because of variations in the local built environment, such as distance between homes and curbside pick-up and drop-off locations, pick-up and drop-off durations may be different in different parts of a region.

One of the reasons for the limited emphasis of past studies on the association between local environmental conditions and paratransit service efficiency is the difficulty quantifying delay at a local level. Although overall traffic congestion and delay are often reported for metropolitan regions, obtaining such data for numerous locations within a large region is difficult. In the case of paratransit for persons with disabilities, duration of trips can

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be easily measured from data recorded by operators at the pick-up and drop-off sites. However, estimating speed and delay is usually difficult because actual trip distance cannot be estimated in the absence of route-specific movement of vehicles. This study overcomes this obstacle by obtaining and using a proxy distance variable. This proxy variable was obtained by estimating network distances of approximately 1.91 million paratransit trips with the ArcGIS Network Analyst extension.

The trip data used by this research pertain to Access Link, a complementary paratransit service provided by NJ TRANSIT pursuant to the Americans with Disabilities Act (ADA) of 1990. These trips were made by the system's registered clients between October 1, 2010 and September 30, 2012. Access Link service is provided in 18 of 21 counties of New Jersey, but not in three counties in the northwestern part of the state. As shown in Fig. 1, the Access Link service area is divided into six regions.

Access Link service is provided in all six regions by private contractors. The service, provided curbside to curbside, is available in all locations within areas designated as urban core and within 3/4 mile buffers along local bus routes. Access Link clients are

required to book a trip between 1 and 7 days in advance. Two types of bookings are allowed: subscription and demand. Subscription bookings are made for multiple trips involving identical pick-up and drop-off locations at a fixed time of the day, whereas demand bookings are for one trip only.

Basic information, including number of vehicles, monthly ridership, and number of clients is presented in Table 1 for each Access Link region. Among the six regions, Region 5 is the largest in terms of clients and ridership. The region consists of the City of Newark, the largest city of the state, as well as several smaller urban centers. Large parts of Region 5 and Region 6 are designated as urban core. Although other regions also contain areas designated as urban core, a substantial proportion of trips in those regions are generated in 3/4 mile buffers along bus routes. Population and job density varies widely among the regions. To exemplify the variation among the regions, population density of the regions is shown at the census tract level in Fig. 1.

Data on Access Link pick-ups and drop-offs, including geographic location and time, are recorded from the vehicles. Time is recorded at the time of arrival and departure at every location

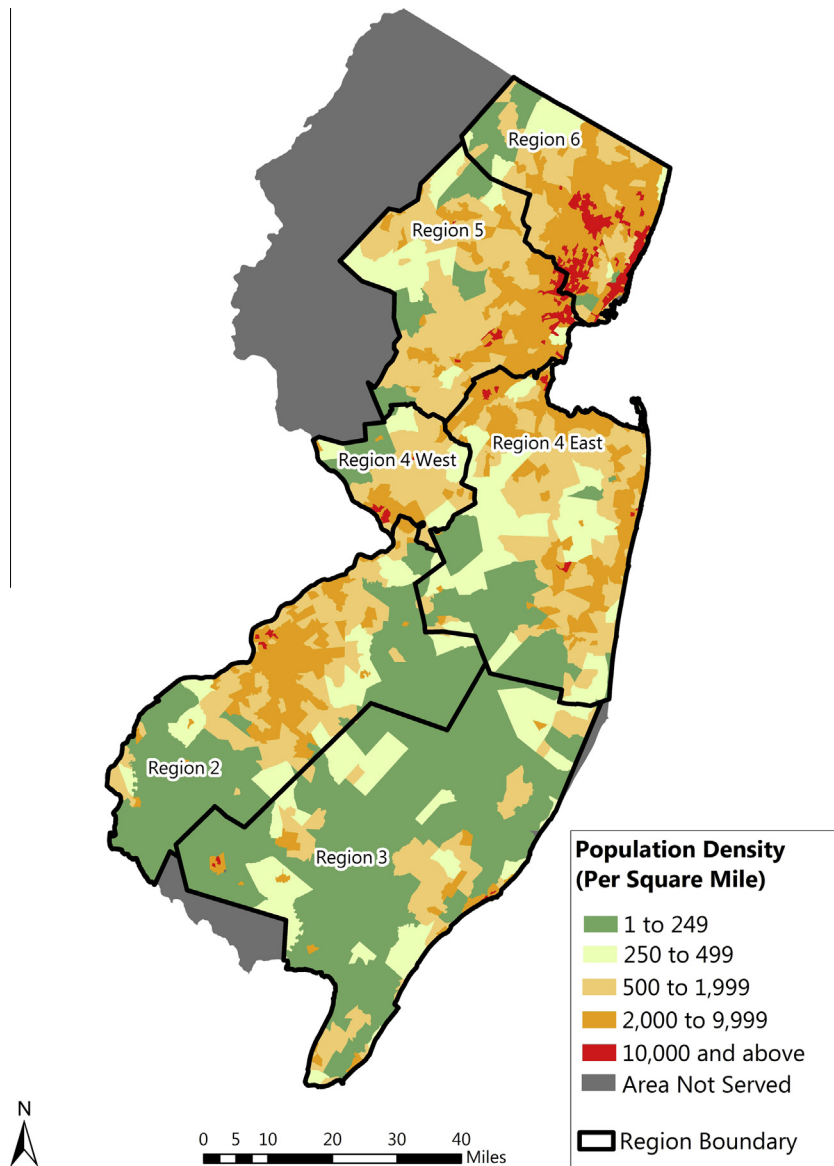


Fig. 1. Access Link service regions with census tract population density.

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