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## Rider perception of a “light” Bus Rapid Transit system - The New York City Select Bus Service



Dan Wan <sup>a,\*</sup>, Camille Kamga <sup>b</sup>, Jun Liu <sup>c</sup>, Aaron Sugiura <sup>d</sup>, Eric B. Beaton <sup>e</sup>

<sup>a</sup> Department of Civil Engineering, City College of New York, the City University of New York, 160 Convent Avenue, Marshak Building, Suite 910, New York, NY 10031, United States

<sup>b</sup> Department of Civil Engineering, City College of New York, the City University of New York, 160 Convent Avenue, Marshak Building, Suite 917, New York, NY 10031, United States

<sup>c</sup> Center for Transportation Research, Department of Civil, Architectural & Environmental Engineering, The University of Texas at Austin, 1616 Guadalupe St, Suite 4.228, Austin, TX 78701, United States

<sup>d</sup> Transit Development Group, New York City Department of Transportation, 55 Water St, 6th Floor NW, New York, NY 10041, United States

<sup>e</sup> Transit Development Group, New York City Department of Transportation, 55 Water St, 6th Floor NW, New York, NY 10041, United States

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### ABSTRACT

The Bus Rapid Transit (BRT) system in New York City (NYC), called Select Bus Service (SBS), is a “light” BRT system with some but not all BRT features. Focusing on it, this study aims to contribute to a better understanding of riders' perceptions of BRT service implemented with limited space and capital funding. A total of 1700 SBS riders on four routes were interviewed using the survey methodology developed in this study. Statistical analysis and regression modeling were used to analyze rider socio-demographics, investigate the relationship between rider satisfaction levels, and the key factors driving them. The results show that, while most of them are transit dependent, new SBS riders are mainly attracted by better service and accessibility. Riders on different routes were found to have different socio-demographics. The statistical tests of satisfaction means provide further insight into the disparity in service evaluation between/among groups of riders (e.g. gender, experience, weather, route, trip purpose). Service frequency, speed, and on-time performance were found to have a positive influence on rider satisfaction across all routes. Variables related to off-board ticket machines and travel information are more valued than others. The effects of external factors vary according to characteristics of the routes and rider groups. This study suggests potential applications of the results for future planning and improvement to increase rider satisfaction and thereby retain and increase ridership.

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### 1. Introduction

In recent years, public transit consumer satisfaction with existing service has been investigated by several researchers to evaluate service quality and potential performance improvements, with the goal of retaining and attracting riders (de Oña et al., 2013; Eboli and Mazzulla, 2012; Shaaban and Khalil, 2013; TCRP Report, 2013; Tyrinopoulos and Antoniou, 2008; Beirão and Sarsfield Cabral, 2007). Like any other public transit mode, service of Bus Rapid Transit (BRT), which applies rail-like infrastructure and operates at comparatively low cost (Currie, 2005; Currie and Delbosc, 2011), is also characterized by performance attributes. As

a solution for moving large numbers of people at a relatively fast speed in densely populated urban areas, BRT has been implemented around the world for decades (Hensher and Golob, 2008). To meet the increasing demand of public transit and increase bus speeds in an environment of increasing population, limited capital funding, and constrained rights-of-way, New York City (NYC) established its BRT system known as the Select Bus Service (SBS) as a joint program between the New York City Department of Transportation, the street operator, and MTA New York City Transit, the bus service operator. With the relative flexibility of BRT implementation compared to other public transport modes, particularly rail (Eboli and Mazzulla, 2012; Hensher and Golob, 2008; McDonnell and Zellner, 2011; Scherer, 2010), NYC has incorporated some, but not all, of the features of BRT into its SBS. According to the BRT standard (McDonnell and Zellner, 2011) and the study of Hensher and Golob (Hensher and Golob, 2008), NYC's SBS is a “light” BRT system.

\* Corresponding author.

E-mail addresses: [dwan@ccny.cuny.edu](mailto:dwan@ccny.cuny.edu) (D. Wan), [ckamga@utrc2.org](mailto:ckamga@utrc2.org) (C. Kamga), [jun.liu@utexas.edu](mailto:jun.liu@utexas.edu) (J. Liu), [asugiura@dot.nyc.gov](mailto:asugiura@dot.nyc.gov) (A. Sugiura), [ebaton@dot.nyc.gov](mailto:ebaton@dot.nyc.gov) (E.B. Beaton).

A well-planned BRT system is reliable, convenient, comfortable and affordable, and thus retains current transit users and even potentially encourages a shift from private cars to transit (Litman, 2014). In order to design appropriate strategies and provide high-performance transit services, decision makers, planners, and operators need to understand passenger priorities and preferences by measuring service quality based on passenger perceptions (de Oña et al., 2013; Shaaban and Khalil, 2013; Tyrinopoulos and Antoniou, 2008). In NYC, there is little understanding as to how BRT features and rider socio-demographics influence rider satisfaction levels, especially from a bus rider perspective. Thus, this study attempts to gain an in-depth understanding of rider perception of BRT service by addressing this question. The empirical results could provide a reference for future implementations of BRT elements in similar environments with restricted space and funds.

## 2. Empirical literature and research background

The relevant research was reviewed with the goal of identifying the perceivable attributes which significantly contribute to BRT rider satisfaction and/or ridership. This literature review is followed by an introduction to NYC SBS and a description of the four corridors within that system which are analyzed in this study.

### 2.1. Literature review

#### 2.1.1. Measuring transit service quality and customer satisfaction

The prime goals of public transit service are to meet mobility demand and encourage mode shift by providing quality service. As for measurements of transit service quality, researchers suggested that, to obtain a comprehensive evaluation, understanding rider perception is the foundation while objective agency measurement is also useful (Eboli and Mazzulla, 2011; Hassan et al., 2013; Sheth et al., 2007). While both agency and passenger perspectives are recommended, customer satisfaction is commonly used to measure perceived service quality. It has been at the center of marketing, operation, and public service research for decades (Churchill et al., 1982). Specifically, customer satisfaction is composed of expectations and perceptions. Usually, the former is studied for proposed transit systems and the studies on the latter provide information for existing system evaluation and improvement. There are numerous investigations on both aspects. To assess customer perceptions, various forms of surveys were conducted. In the literature, public transit service quality include a wide range of service characteristics. Investigations define service aspects/dimension that are suitable for selected study systems, e.g. service performance (punctuality, speed, and frequency), comfort (room on vehicles and at stops, crowding, cleanliness), time (waiting, travel), purchase (fare, ticketing system), accessibility, and others. The attributes/items included in each aspect/dimension varied among studies. Subsequently, the significant attributes correlated to higher customer satisfaction differ. To improve service quality, increase customer satisfaction, and guide resource allocation, different strategies are recommended. In the following section, some recent studies on public transit are reviewed to determine the important perceivable attributes which could contribute to increasing customer satisfaction and transit ridership.

#### 2.1.2. Important perceivable attributes of public transit systems

Generally, public transit attributes can be classified into two categories: physical attributes and perceived attributes (Redman et al., 2013). The former can be understood by agencies by using in-house analysis based on data collected in the field. The latter

can only be studied by collecting and measuring riders' perceptions. Service quality surveys, the basis of customer satisfaction studies, have been conducted on various transport systems, e.g. bus (Currie and Wallis, 2008), BRT (Redman et al., 2013), railway (Nathanail, 2008), airline (Chang and Yeh, 2002). Since there are limited customer satisfaction studies on BRT, important attribute selection in studies on all kinds of transit service could provide guidance. Service aspects covered by some previous studies are listed in Table 1. For each aspect, specific attributes included may vary. As shown in Table 1, for a specific transit system, the significant attributes could be different from others. For all the mentioned transit systems, the most frequently covered attributes are reliability/punctuality, frequency, comfort/cleanliness/crowding, information, ticketing, security/safety, speed, price/fare, accessibility, and crew behavior/courtesy. They are also among the most important perceivable attributes for customer satisfaction. The commonly significant service aspects would be the investigation focus for rider satisfaction surveys.

With the purpose of providing "surface busway" service at lower cost and with simpler system, BRT has features aiming to reduce delay, increase reliability, and contribute to capacity while rail transit usually performs better on these aspects. From rider perspective, a study found that when travel time and cost are equal, riders show no evident preference between bus and rail (Ben-Akiva and Morikawa, 2002). Redman et al. (2013) reviewed the quality attributes of public transport that could attract car users. This review of public transport improvement studies pointed out that, for BRT, in descending order of number of studies, the improvement strategies focus on speed, reliability, comfort, frequency, convenience and access. Combined with the results in Table 1, it appears that quality improvements can raise customer satisfaction. However, other studies indicated that which improvements will have this effect and how large this effect might be can vary greatly. Friman pointed out that quality improvements can only increase rider satisfaction to a limited extent (Friman, 2004). Even within one system, the route or line characteristics may make differences. For example, Aydin et al. found that different rail transit lines in Istanbul need different improvements in service attributes (Aydin et al., 2015). So a rider perception study with system-specific attributes would be useful for practitioners and policy makers.

In view of the limited literature of BRT rider satisfaction, attributes contributing to increasing BRT ridership are reviewed in the next section.

#### 2.1.3. BRT attributes contributing to ridership increases

Analyses of existing and proposed BRT systems are well developed in many areas. Studies have generally shown increases in ridership resulting from implementing BRT (Currie, 2006; Deng and Nelsonb, 2012; Lin and Wu, 2007). Three sets of key characteristics relevant to BRT and public transit service, including service attributes (e.g., operating frequency, speed, and adherence to schedule), bus facilities (e.g., buses and stops/site), and external contexts (e.g., neighborhood) attributes, have been studied to investigate their association with ridership and customer satisfaction increases (Cervero et al., 2005; Currie and Delbosc, 2011; dell'Olio et al., 2011; McDonnell and Zellner, 2011). Among these characteristics, some are perceivable and the others are not.

A BRT transit system can be characterized by a variety of service-wise aspects, including operating frequency (quantified as headways, or buses per hour), speed, and fare and so on. Studies have shown significant correlations between these features and transit ridership (Ben-Akiva and Lerman, 1985; Cervero et al., 2005; Currie and Delbosc, 2011; Redman et al., 2013). Hensher and

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