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A perceptual study of commuters with respect to adoption of public transportation in Ahmedabad city

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Abstract
Great amount of fund is allocated by the state and Central Government in public transport to eradicate if not fully than at least partly reducing the problem of urban congestion and thereby contributing to environment sustainability. The public transport adoption by commuters depends on their perception of service quality of public transport. Non-Commuters too have a negative perception related to ease and use of public transport which make them apprehensive about wide usage of public transport making them readily adopt the private transport. The paper analyses the perception of commuters thereby identifying the factors which causes the adoption of public transport. The data is collected through the structured questionnaire and the same is analysed through SPSS. The findings of the study crystallize the factors causing the adoption of public transport. The findings also relate to reasons for preference of BRTS vs. AMTS. The author acknowledges and is thankful for the research grants given by Central Government under IMPRESS scheme of ICCSR for the current research.

Keywords: perceptual mapping, commuters, traffic congestion

Introduction
Urbanization in India has led to larger cities and increased rate of motorization which has eventually led to complete gridlock and congestion According to a study by BCG in 2018, traffic congestion in 4 major cities of India costs the economy 1.47 lakh crore annually India being a developing country, has experienced a rapid growth in transport-related challenges, including pollution, congestion, accidents, public transport decline, environmental degradation, climate change and energy depletion City efficiency depends largely on the effectiveness of its transport systems i.e. the efficacy with which people and goods are moved throughout the city. Traffic congestion: can be defined as more vehicles trying to use a given road facility than it can handle. Two major reasons for the congestion are Micro level factors such as irregular events, vehicle breakdowns, poorly timed traffic signals, rallies bad weather conditions etc. and other dominant reason can be categorised as Macro level such as employment patterns, income levels, vehicle ownership trends, infrastructure investment. Current transport system in Ahmedabad predominantly relates to AMTS (Ahmedabad Municipal Transport Service): Managed by AMC, it was launched in 1947, BRTS (Bus Rapid Transit System): Launched in 2009, it is a 100% subsidiary of Ahmedabad Municipal Corporation and Upcoming transport systems: MEGA (Metro-link Express for Gandhinagar & Ahmedabad) is an under-construction mass-transit rail system for the cities of Ahmedabad and Gandhinagar in Gujarat. It intends to promote integration with AMTS, BRTS and Railways Cities across the world are striving to meet urban sustainability standards by improving public transport, encouraging non-motorized modes, creating pedestrian zones, limiting the use of private cars, and trying to reverse the transformation of cities caused by automobile dominance.

Literature Review
According to Rao and Rao (2012) [11] traffic congestion in one of serious concern which Indian metro cities are facing which can be attributed mainly to infrastructure problems like no proper facility for linking the major junctions, bad shape of road, poor traffic sense among the citizens Vencataya Lomedra, Pudaruth Sharmila, Dirpal Ganess, Narain Vandisha (2018) in their research work highlighted the importance of policy maker in reducing the problem of traffic congestion. Hiroshi Makino, Kazuya Tamada, Koichi Sakai, Shunsuke Kamijo (2018) [2] proposed methods for the utilization and introduction of ITS (Intelligent Transport Systems) technologies to solve urban traffic issues in various countries, based on the lessons learned from deployment of ITS in Japan. Jun Guan Neoh, Maxwell Chipulu & Alasdair Marshall (2017) highlighted that non- household carpools (where two or more commuters from different residences travel together in the same private vehicle) bring public benefits Runing Ye and Helena Titheridge (2017) examined the role of travel mode, built environment and attitudes on commuters' satisfaction. They stressed the importance of travel attitudes on commuters' satisfaction, wherein congestion was a resultant effect of poor commuters' satisfaction.
According to Tilak and Reddy, (2016) [13] the factors for the traffic congestion can be divided into two i.e., micro-level factors, which include the high number of people on the roads at the same time, and the overflow of

vehicles on the limited road space, and macro-level factors, land use patterns, car ownership trends, and geographical economic development. Subeh Choudhary, Avishai, Cedar, Bradley Schwalger (2015) [12] worked on Commuter's perception of travel time and travel cost. The paper synthesized that traveller with a longer travel time are more willing to make transfer and therefore recommended that fare discounts need to be given in proportion to commuters' current costs. Ayanda Vilakazi, Prof. Krishna Govender (2014) [14] reported the results of an exploratory study conducted in Johannesburg, South Africa among a convenience sample of 902 commuters selected using the commuter intercept survey. Trand Nordfjaern, Ozlem Simsekoglu, Hans Brende Lind, Stig Halvard Jorgensen, Torbjorn Rundmo (2014) examined the factors in relation to mode use and preferences among Norwegian commuters.

Muhammad Ashraf Javid, Toshiyuki Okamura, Fumihiko Nakamura and Rui Wang (2013) cited that commuters' satisfaction has positive relationship with the improvement of symbolic and functional factors of wagon service Maya Abou Zeid and Moshe-Ben-Akiva (2011) [8] studied the effect of social comparisons on travel happiness and behavior. Social comparisons arise from exchanges of information among individuals. Fiona Dobbie, Susan McConville & Rachel Ormston (2010) conducted a survey of bus travellers in Scotland finding out why the people in Scotland do not prefer to use bus transport. Wakje Abrahamse, Linda Steg, Robert Gifford, Charles Vlek (2009) [15] cited that car use was one of the factors contributing to environmental and traffic problems therefore policies should be aimed at reducing commuter's car use by finding out the reasons for the car use. Guido Moser and Sebastian Bamberg in their paper (2008) studied data set of 141 studies evaluating three types of soft transport policy measures compiled mainly from already published narrative research reviews. Peter Bonsall, Jo Beale, Neil Paulley and Annette Pedler (2005) did a survey of almost 3000 people gathered evidence on people's experiences of problems on Britain's roads, their level of support for potential solutions, and on the different perspectives of transport professionals.

John Pucher, Ren Peng, Neha Mittal, Yi Zhu & Nisha Korattyswaroopam (2004) provided a comparative overview of urban transport in the world's two most populous countries and critically assessed government policies in each country and suggests a range of specific improvements. Jeffrey A. Joireman, Paul A. M., Van Lange D., Michael Kuhlman, Mark Van Vugt and Gregory P. Shelley (1998) [3] did an interdependence analysis of commuting decisions (i.e., commuting by car versus public transportation), delineating the determinants of an individual's outcomes in terms of own decisions, other commuters' decisions, and the combination or interaction of own and others' decisions (Kelley & Thibaut, 1978). Thus, it can be said that though much literature has been studied in the past related to both users as well as non-users of public transport as well as measuring urban congestion but majority of them is in Western Context. Therefore, sufficient gap exists pertaining to Indian context with Ahmedabad as core wherein traffic congestion has become a rising problem. The researchers desire to fulfil this gap through the current study.

Problem statement

Adoption of public transport as a preferred mode for commuting to serve as a measure for curbing the problem of traffic congestion it's imperative that local bodies handling the transport infrastructure understand the ways in which they can make the services better for commuters and at the same time get the non- commuters to also use the public transport service. The research therefore wishes to seek answers to following problem:

- To find out factors which are important to citizens for using a public transport system
- To find out if AMTS/BRTS is a preferred mode of public transport

Research Design

To fulfil the objectives mentioned above, research was conducted in Ahmedabad. Ahmedabad, being one of the fastest growing cities of Gujarat. Ahmedabad is also one of the cities having multiple modes of public transport i.e., AMTS and BRTS. Ahmedabad Municipal Corporation is continuously striving to improve public transport facilities and thereby reduce the traffic related issues. The project funded by ICCSR focused on studying perception and behavioural pattern of residents of Ahmedabad. One of the components of the project relating to perceptual mapping is covered in this research paper.

Data Analysis

Perceptual mapping is a graphic display explaining the perceptions of customers with relation to product characteristics. Perceptual map displays position of a product, product line, brand, or company relative to their competition. To develop a two-dimensional perceptual map for public transport services in Ahmedabad, two dimensions were identified from the 16 variables related to public transport service using factor analysis. Factor analysis is a technique that is used to reduce many variables into fewer numbers of factors. The output of the factor analysis is presented into Table 1. As shown in table, the variables related to the core aspects of public transport services are clubbed together into first factor, i.e., *Core Service*. And the second factor consists of variables related to comfort and convenience in using the public transport services. This second factor is named as *Convenience*. These two factors were used to perform perceptual mapping and to compare AMTS and BRTS which are the two public bus services provided by government in Ahmedabad city.

Table 1: Factors for Perceptual Mapping

Variables	***Factors***	
	Core Service	***Convenience***
Physical condition of bus stop	0.749	
Waiting time at bus stop	0.743	
Frequency of service	0.705	
Physical condition of bus	0.685	
Punctuality of service	0.678	
Safety and security during travel	0.651	
Travel time reliability	0.625	
Staff attitude	0.618	
Routes and schedule information	0.586	
Safety and security at bus stop	0.581	
Accessibility of bus stop	0.576	
Travel fare		0.79
Comfort level		0.651
Route coverage		0.623
Convenience level		0.57
Ticket and fare collection system		0.516

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Figure 1 and 2 presents the perceptual map for the two factors – Core Service and Convenience, developed using mean score and z-score (normalized score) for both the dimensions respectively. The Core Service dimension is plotted on y-axis and Convenience dimensions is plotted on x-axis. AMTS and BRTS are plotted as dots based on their scores on the two dimensions.

As shown in the chart, BRTS scores more on both the dimensions compared to AMTS. Further, as shown in z-score chart, the normalized score for BRTS is positive for both the dimensions and it is negative for AMTS for both the dimensions. That is the reason why, BRTS is in the 1st quadrant of the chart and AMTS is in the 3rd quadrant of the chart.

This clearly indicates that commuters' perception about AMTS needs significant improvement in terms of the core aspects of the public transport services as well as the comfort and convenience aspect involved in using the services. Administrators of AMTS services need to reposition their services on both the key factors as expected by the commuters.

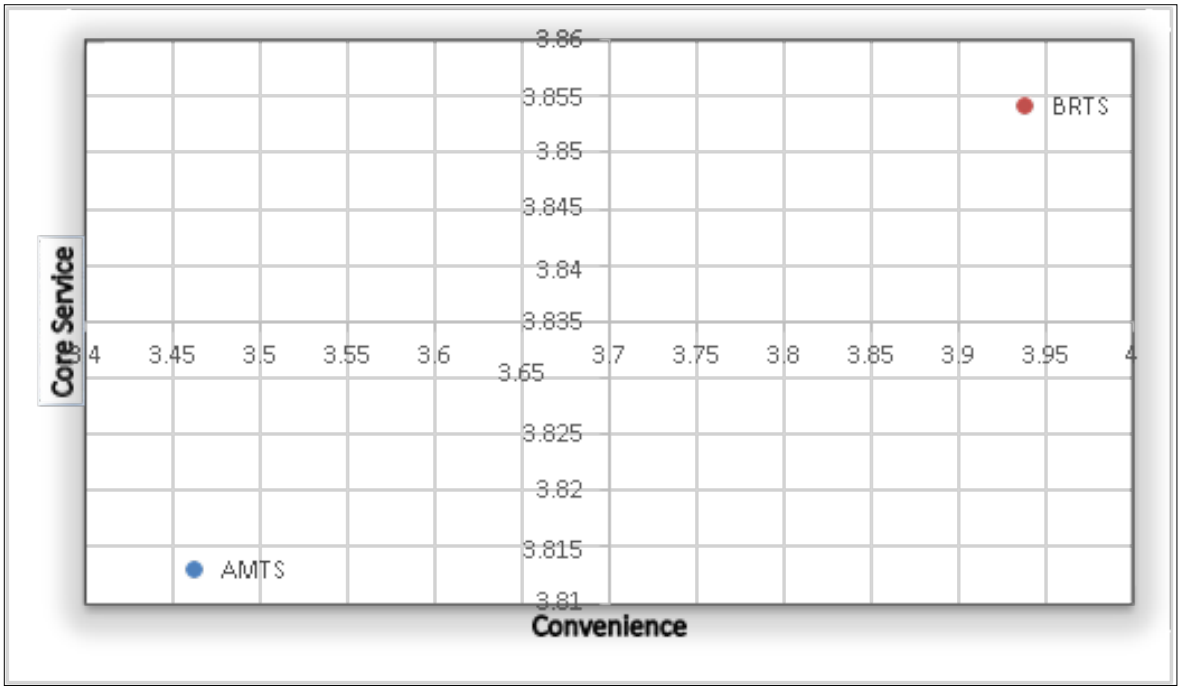

Fig 1: Perceptual Mapping – Mean Score

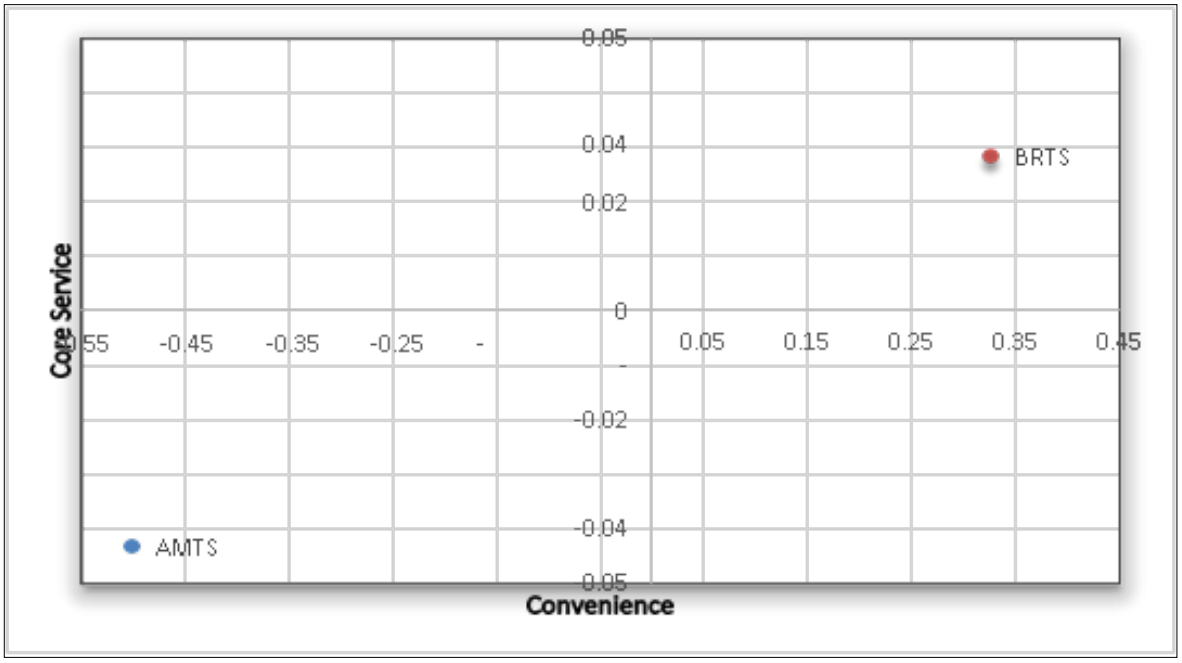

Fig 2: Perceptual Mapping – Z Score

Discussion and theoretical implications

Perceptual mapping technique was used to compare AMTS and BRTS - the two public bus services provided by government in Ahmedabad city on two dimensions – Core Services and Convenience. These two dimensions were derived from 16 original variables related to performance of public transport services using factor analysis. The perceptual mapping indicated that BRTS scored more on both the dimensions as compared to AMTS. Commuters' perception about AMTS needs significant improvement in terms of the core aspects of the public transport services as well as the comfort and convenience aspect involved in using the services. Administrators of AMTS services need to improve and reposition their services on both the key factors as expected by the commuters.

Perception regarding public transport is an important aspect which has been studied in the current study. The researchers have tried to understand the perception of commuters towards two different public transport services in Ahmedabad city, using perceptual mapping tool. The earlier literature has mentioned the image of public transport as an important variable which commuters consider while using the service. Not a lot of past literature has focused on the viewpoint of non-commuters. The researchers however believe that to reduce congestion in urban cities, it is imperative to reduce the ownership of private vehicles and increase the reliance on public

Limitations and Future Research

The current research mainly focused on the individual commuters and found out their preference for AMTS/BRTS. The opinion of other entities like the administrative bodies as well as policy decision makers for public transport was not taken into consideration. Further research can be carried out with a broader conceptual framework where the impact of urban congestion can be assessed on individual, economy as well as the society.

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