



USERS' PERCEPTION ON INTEGRATED PUBLIC TRANSPORT SYSTEMS

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INTRODUCTION

Need of the study

- Cities with **independent operations** of various public transport modes.
- The **decline in public transport efficiencies** reduces passenger ridership, and result in shift to private modes.
- Cities are now looking to **promoting public and non-motorised** forms of transport as alternatives.
- The services have to be **affordable, efficient and attractive** to incentivize mode shift.
- To overcome the challenges, '**Integrated multimodal transport planning**' is the approach to planning that incorporates all modes of transport

Case studies

Ahmedabad (Independent operations)	Surat (Integrated system)
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Overview of Public transport integration

"Transportation integration allows for seamless movement throughout a transportation network facilitated by a unified system of modes, fares, schedules, and payment systems made possible by coordination and collaboration among the region's stakeholders in pursuit of social, environmental, and economic gains"

- Sriraj, P. S. et. al. (2017)

Types of Public Transport Integration



Benefits of Integration

Saves travel time	More transfers
Reduces travel cost	Use of different PT modes

INTRODUCTION

Aim

“To identify public transit users’ perception on two different public transport systems”

Objectives

1. To determine the factors affecting the users’ travel mode choice and travel pattern.
2. To analyze users’ perceptions on various travel attributes resulting from different levels of integration in Ahmedabad and Surat.

Analytical Framework

Perception analysis of PT users

Socio-demographic characteristics

Travel characteristics

Factors affecting travel mode choice and travel pattern

Importance Rating

Analyzing the attributes affecting satisfaction of PT users

Factor Analysis and SEM

Research questions:

- 1) Is integration a major factor which affects public transit users’ mode choice and travel pattern?
- 2) Can integration be used as a tool to increase passenger ridership?

Taking into consideration the components of integration and literature review, the **mode choice factors** were grouped into the following:

(1) Cost (2) Accessibility (3) Travel time (4) Reliability (5) Frequency (6) Safety/ security

CITY OVERVIEW

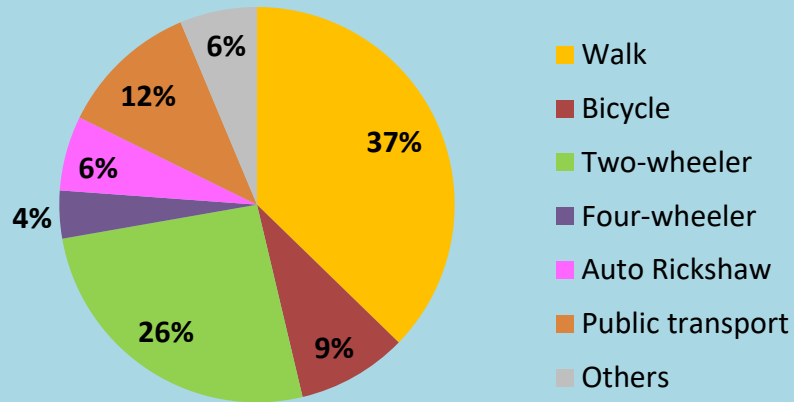
Ahmedabad

Population: **55.7 lakh** (Census of India, 2011)

Average trip length: **6 km**

PT trip length: **9.5 km**

Mode share



Public Transport service	AMTS	BRTS
Operator	AMC	AJL
Network length	549 km	89 kms
No. of Routes	187 nos.	12 nos.
Peak hr. headway	26-34 mins	3-5 mins
Network coverage	92%	19%

Public Transport Network



Legend

— AMTS — BRTS — AMC Boundary Waterbody

Source: CEPT student research work, 2016; Divyanka Dhok, CEPT student, batch 2017-19

CITY OVERVIEW

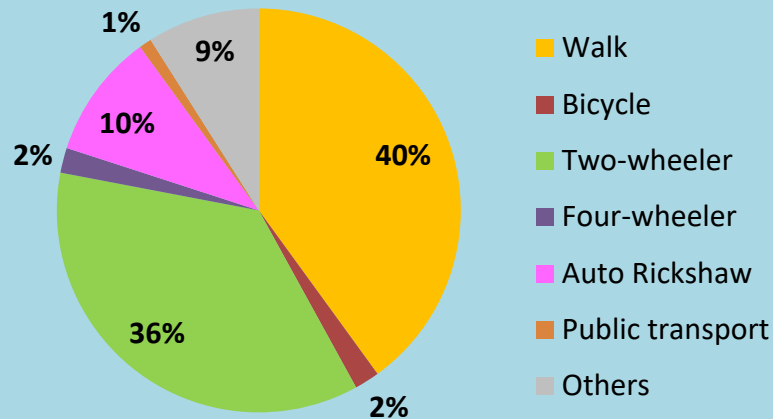
Surat

Population: **44.6 lakh** (Census of India, 2011)

Average trip length: **5 km**

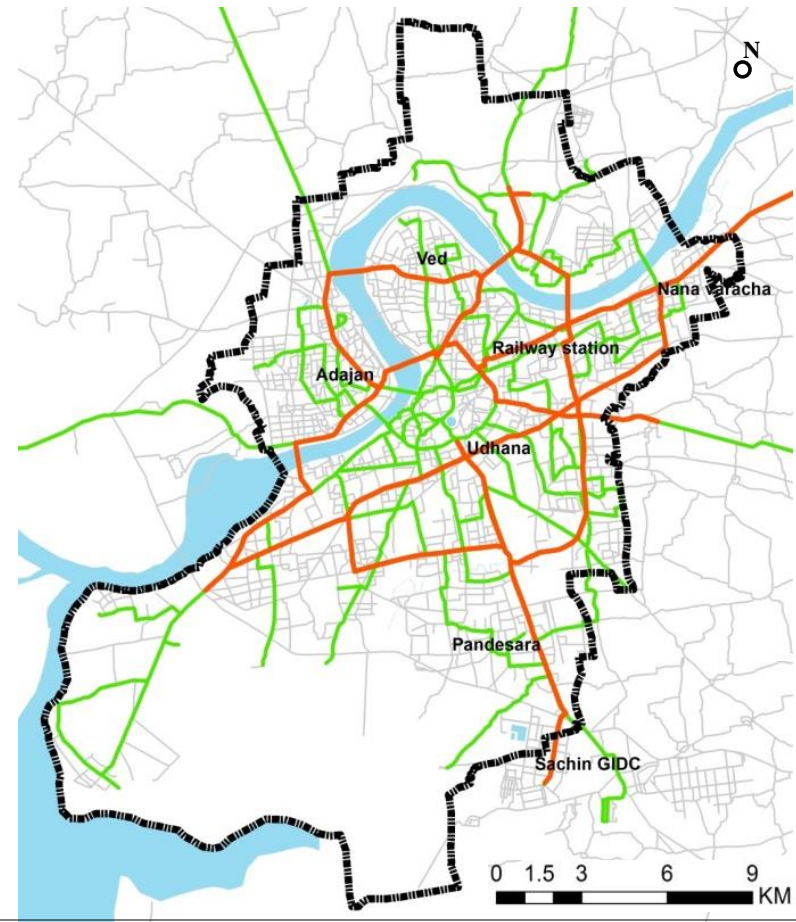
PT trip length: **10 km**

Mode share



Public Transport service	City Bus	BRTS
Operator	Sitilink Ltd.	Sitilink Ltd.
Network length	272 km	102 kms
No. of Routes	30 nos.	9 nos.
Peak hr. headway	15-20 mins	5-8 mins
Network coverage	83%	37%

Public Transport Network



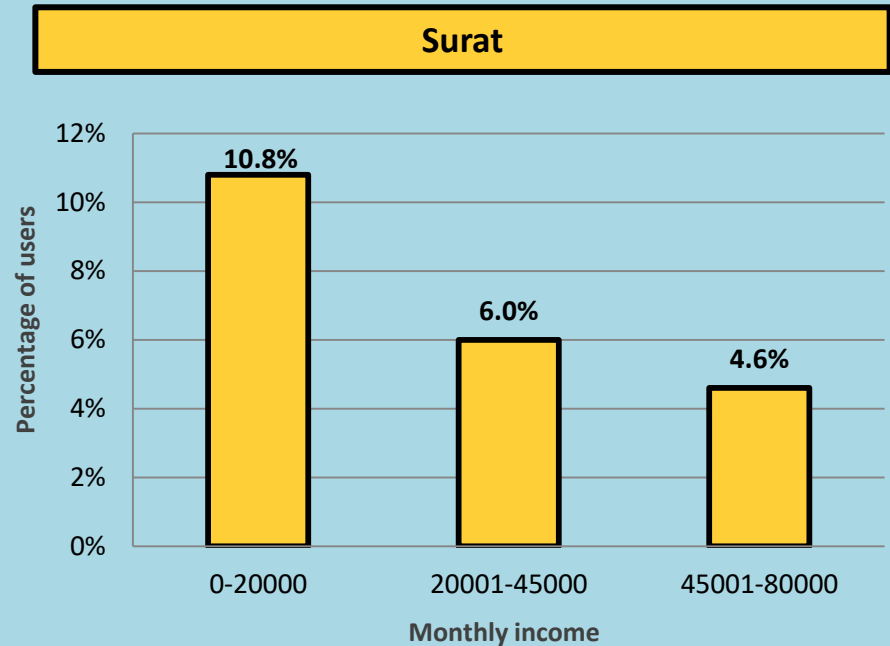
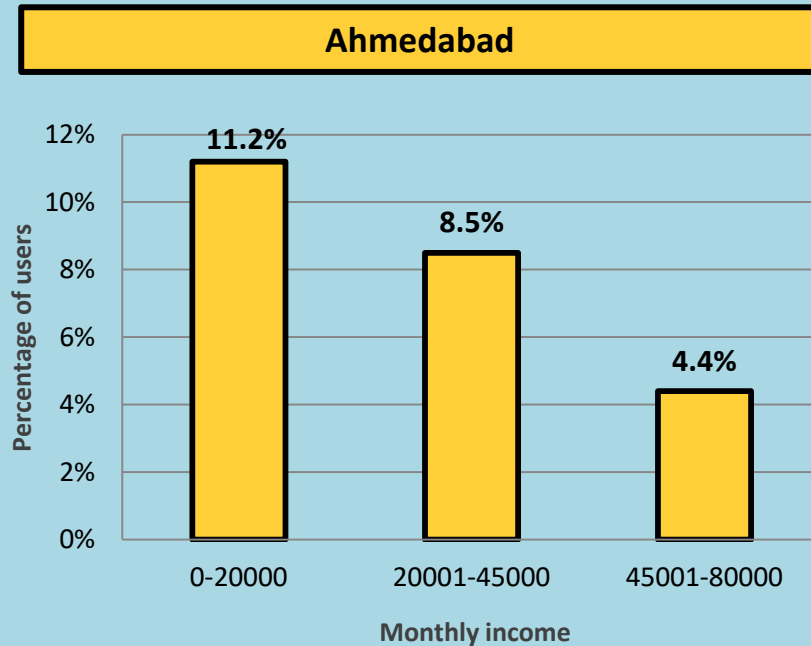
Legend

— City bus — BRTS - - SMC Boundary Waterbody

Source: COE-UT, Ahmedabad

TRAVEL CHARACTERISTICS

% HH income spent on PT

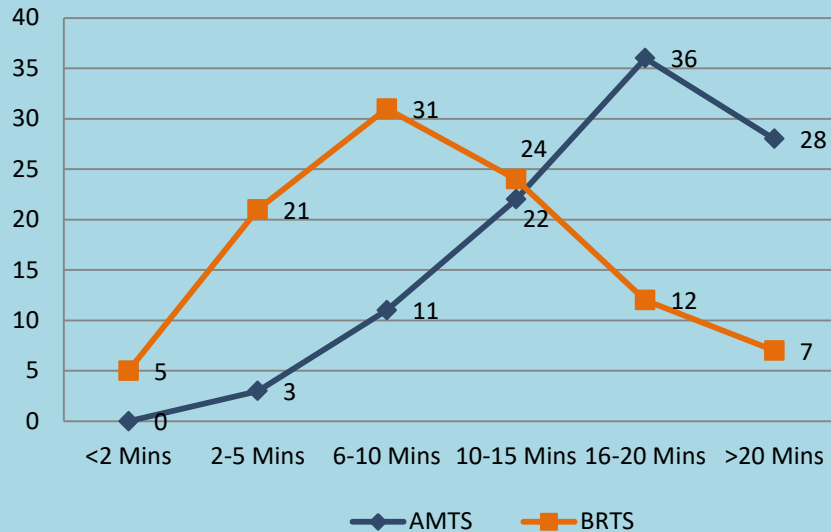


- Those earning below 20,000 spend 11.2% of their monthly expenditure on public transport compared to 8.5% by those who earn Rs20001-45000.
- While in Surat, it is 10.8% and 6% for those who earn below Rs.20,000 and those between Rs. 20001-45000. respectively. A decrease in public transport expenditure was observed in Surat where fare is integrated.

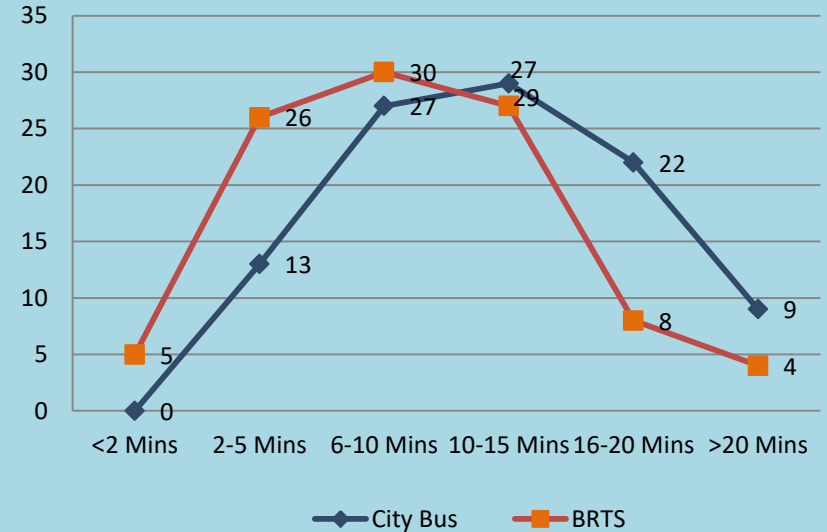
TRAVEL CHARACTERISTICS

Waiting Time

Ahmedabad



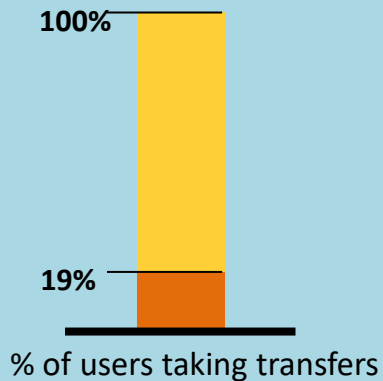
Surat



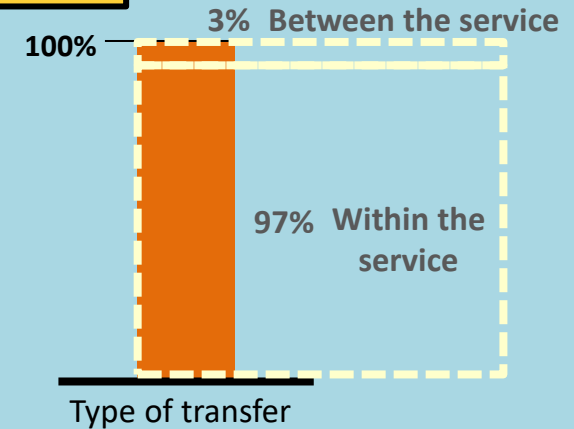
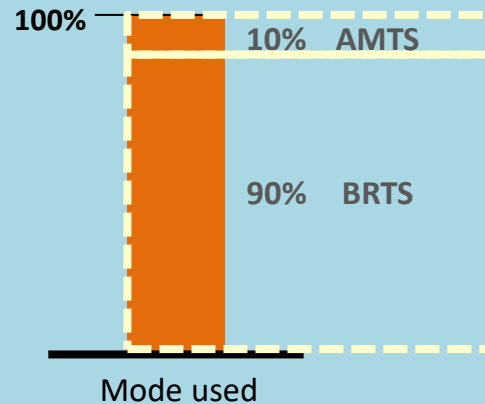
- Only 14% of the AMTS users have waiting time up to 10 mins. Around 64% of the AMTS users have waiting time of more than 15 mins and in case of transfer it increases even more. (Due to transfer penalty, people prefer using direct services)
- While 57% of the BRTS users have waiting time up to 10 mins.
- Around 69% of the city bus users have waiting time of up to 15 mins . (As fares are integrated, people use alternative routes if they don't get direct route bus)
- While 88% of the BRTS users have waiting time up to 15 mins.

TRAVEL CHARACTERISTICS

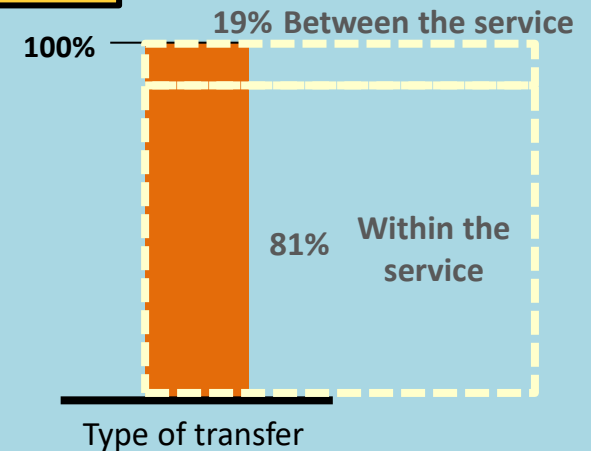
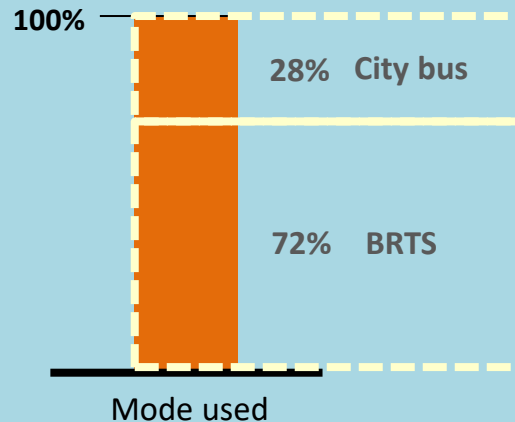
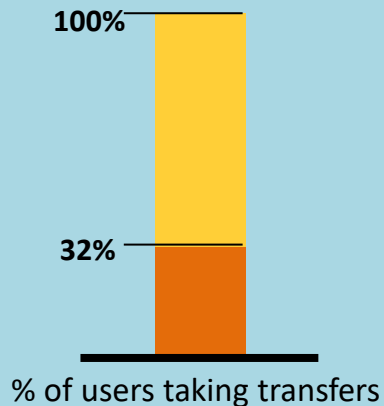
Transfer



Ahmedabad



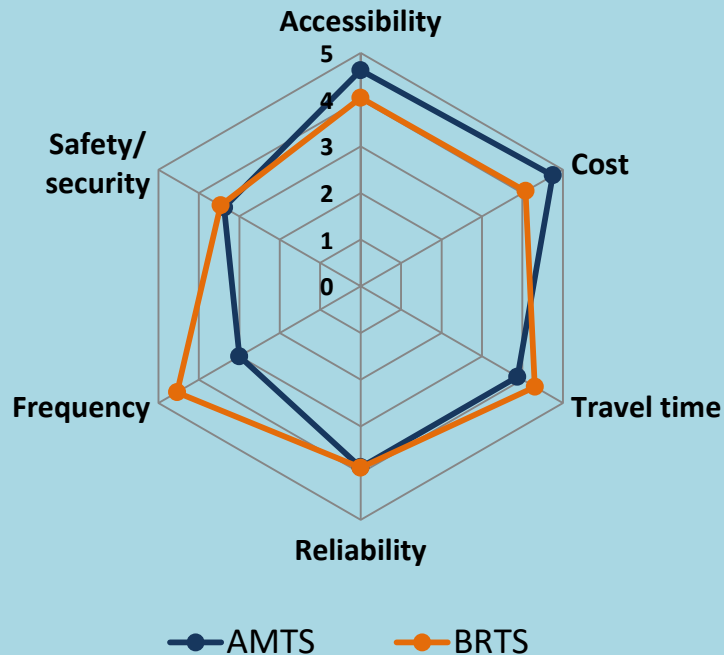
Surat



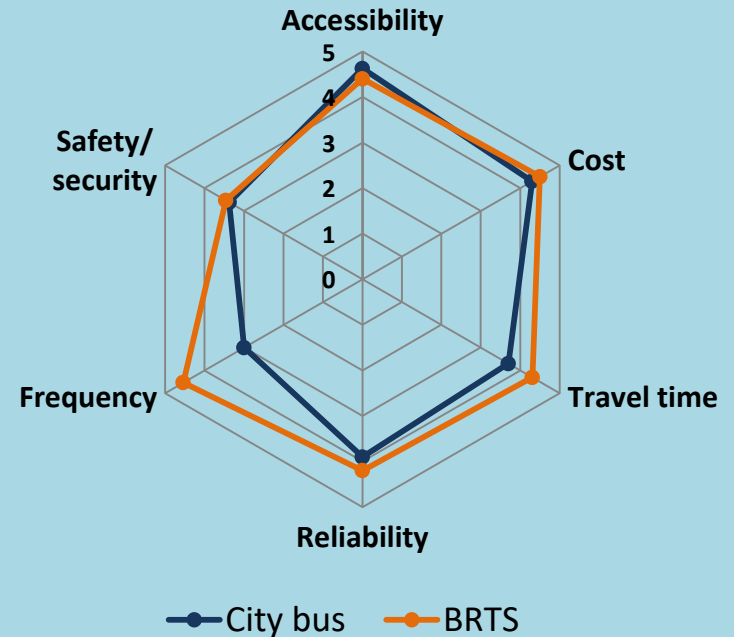
- In Ahmedabad, 19% of the users do transfers; out of which only 3% of users make transfers between the services. In Surat, 32% of the users do transfers; out of which 19% of users make transfers between the services.

FACTORS AFFECTING TRAVEL MODE CHOICE

Ahmedabad



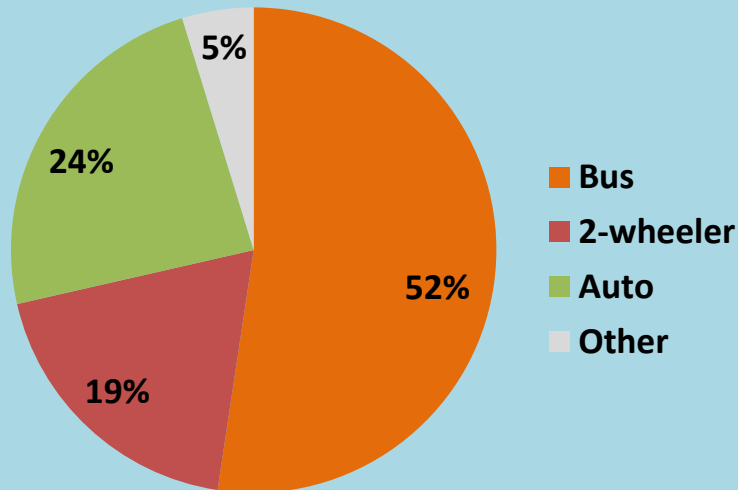
Surat



- A significant difference was seen between the PT services in both the cities for frequency of the service. The importance of frequency is higher for BRTS users of both the cities.
- A major difference is not observed between accessibility and cost for the PT users of Surat, as it has the system with integrated fares. Thus there is no difference in fares of both the PT services, which makes it flexible for the people to choose between different services.

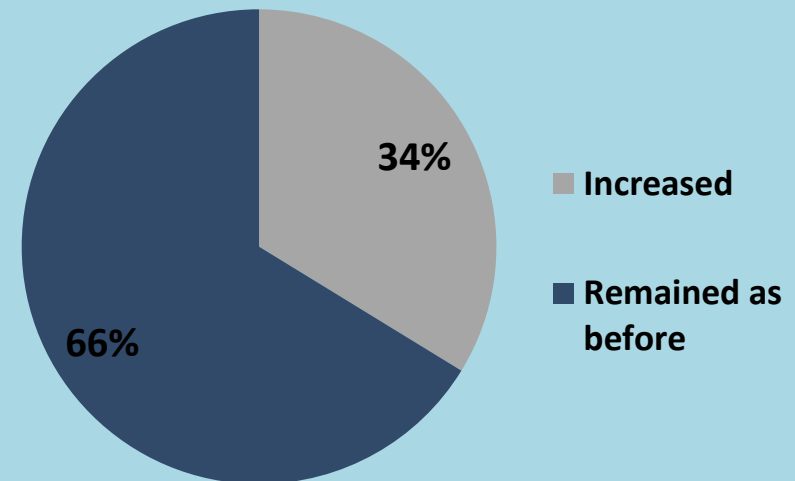
IMPACT OF SERVICE INTEGRATION

Mode used before service integration in Surat



52% of the current passengers were the one who used bus for their daily trips. Although there are users who have changed their travel mode to bus after fare integration. Out of the total users, **19%** of the current public transport users were using two-wheeler for their daily trips, while **24%** of them were preferring auto for their daily trips.

Change in no. of PT trips after service integration



Also integration had a positive impact on number of public transport trips, as **34%** of the users had reported an increase in number of trips after service integration.

RESULTS OF STATISTICAL MODEL

FACTOR ANALYSIS

STRUCTURAL EQUATION MODELING

ANALYSIS - COMPARISON BETWEEN PT SERVICES

Normalised Component Values

Components	Ahmedabad		Surat	
	AMTS	BRTS	City bus	BRTS
Amenities	0.19	0.10	0.23	0.13
Information	0.18	0.14	0.22	0.14
Fare	0.07	0.15	0.05	0.10
Reliability	0.18	-	-	-
Integration of services	0.15	0.24	-	-
Accessibility	0.07	0.14	0.10	0.22
Comfort	-	0.10	-	0.25
Waiting time	0.17	0.15	0.24	0.17
Safety	-	-	0.15	-

Amenities and Information

- Significance of amenities and information is higher for AMTS users.
- In both the cities due to lack of adequate amenities and information (i.e. waiting-sitting spaces, lighting facilities, signboards, maps and information on routes/services) significance of amenities for AMTS users and City bus users is almost twice compared to BRTS users.

Fare

- From the fare structure it was observed that up to distance of 6 kms, the fare for both the services are almost same with similar stages. But after 7 kms in all stages, BRTS has Rs. 6-7 higher than AMTS. Therefore increases significance of fare in BRTS users twice compare to AMTS users.
- While significance of fare for Surat is less compared to Ahmedabad.

ANALYSIS - COMPARISON BETWEEN PT SERVICES

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Reliability	0.18	-	-	-
Integration of services	0.15	0.24	-	-
Accessibility	0.07	0.14	0.10	0.22
Comfort	-	0.10	-	0.25
Waiting time	0.17	0.15	0.24	0.17
Safety	-	-	0.15	-

Reliability and Accessibility

- For BRTS users significance of accessibility is high as the network coverage is high.
- While in case of AMTS users significance of reliability is high due to higher waiting time and non availability of information on bus arrival.

Integration of services

- The significance of integration is high as currently there is no integration between the AMTS and BRTS services.

Waiting time

- Through study it was observed that 60% of the city bus users waited for more than 10 mins, while around 31% waited for more than 15 mins. Also the average peak headway varies from 15 to 20 mins, hence significance of waiting time is high for AMTS and city bus users compared to BRTS.
- Service integration has bring flexibility to choose between different PT modes, results in reduced waiting time, but still for maximum users waiting time is major concern

ANALYSIS - COMPARISON BETWEEN PT SERVICES

Normalised Component Values

Components	Ahmedabad				Surat			
	Male	Female	Daily	Occasional	Male	Female	Daily	Occasional
Fare integration	0.19	0.15	0.25	0.16	0.09	-	0.08	-
Amenities	0.27	0.09	0.12	0.13	0.34	-	0.15	0.20
Information	-	-	0.12	0.30	-	-	-	0.27
Fare	0.16	-	0.16	0.10	0.11	0.11	0.10	0.06
Reliability	0.27	0.10	-	-	0.34	0.19	0.23	0.20
Integration of services	-	-	-	-	-	0.18	0.26	0.11
Accessibility	0.11	-	0.18	0.13	0.12	-	0.26	0.16
Comfort	-	0.24	-	-	-	-	-	-
Waiting time	-	0.17	0.18	0.18	-	0.25	0.19	-
Safety	-	0.24	-	-	-	0.27	-	-

- **Fare integration** is significant for almost all users groups (i.e. male, female, daily and occasional) in Ahmedabad.
- For male users, the significance of **fare integration** is higher than female users in Ahmedabad.
- For male users the significance of **amenities and reliability** is 3 times higher than female users, whereas, for female users the significance of **comfort and safety** is higher than male.
- In Surat also, the significance of **amenities and reliability** is high for male users.
- Significance of **information** for occasional users is almost twice than daily users.

CONCLUSION

- In Surat, 32% users are taking **transfers** out of which 19% of the users are transferring between the services.
- In Surat, the difference between the **waiting time** of city bus and BRTS is less than Ahmedabad (where waiting time AMTS is twice than BRTS).
- The integrated fare system in Surat resulted in decrease in **PT expenditure** of the users.
- Ahmedabad have two different PT services which operate independently, thus the mode choice factors different for two different PT users. While in Surat, the factors affecting mode choice does not differ much, as the two services are working as one system.

Is integration a major factor which affects public transit users' mode choice and travel pattern?

- In Surat mode shift was observed by almost half of the PT users.
- Also a significant change in number of trips was seen in Surat, as 34% of the users experienced an increase in number of trips.

Can integration be used as a tool to increase passenger ridership?

CONCLUSION

- The components which are significant for users groups are:
 - (1) Amenities
 - (2) Waiting time
 - (3) Information
 - (4) Integration

THANK YOU

REFERENCES

1. Astrid, D. W., Joachim, H., Frédéric, D., Michel, H., & Cathy, M. (2013). Linking modal choice to motility: A comprehensive review. *Transportation Research Part A*.
2. Cirianni, F., Crisalli, U., & Iannò, D. (2009). Intermodality and fare integration for public transport in metropolitan areas.
3. Delhi Metro Rail Corporation Ltd. (2015). *Detailed Project Report for Ahmedabad Metro Rail Project (Phase - I)*.
4. India, G. o. (2011). Census of India.
5. Jadeja, R. (2018). Public Transport Route Rationalization and its performance analysis: A case study of Surat. Ahmedabad: CEPT University.
6. Sinha, S. (2017). Service Quality in Public Transport: Understanding user and non-user perspectives. Ahmedabad: CEPT University.
7. Sriraj, P. S., Paul, M., Jake, R., Adam, B., & Margarita, B. (2017). Integration of transportation for improved mobility. Urban Transportation Center and University of Illinois at Chicago.
8. Talagala, P. D., & Kalukottege, C. J. (2014). Factors affecting to public transport ridership: A case of Capital Colombo.
9. Litman, T. (2018). *Understanding Transport Demands and Elasticities*. Victoria Transport Policy Institute.