

Research Symposium 5: Vulnerable Road Users (VRUs) and Inclusive Mobility
Paper I'd: 69

Identifying Dependency of Service Quality on Perceived Transit Accessibility – A Latent Variable Causal Analysis Approach

Presented by
Rohit Rathod (Research Scholar)

Co-authors
Darshan Gheewala, Pankaj Prajapati, Gaurang Joshi

Sardar Vallabhbhai National Institute of Technology, Surat, India



PRESENT SCENARIO



Urban Population and Mobility Needs

- Urban population has increased by 70% in last 50 years.



Source : [statista.com/statistics/271312/urbanization-in-India](https://www.statista.com/statistics/271312/urbanization-in-India)



Rapid motorization and personalized vehicle dominant travel to satisfy the increased demand

- Road congestion
- Travel delay
- Air pollution
- Accidents

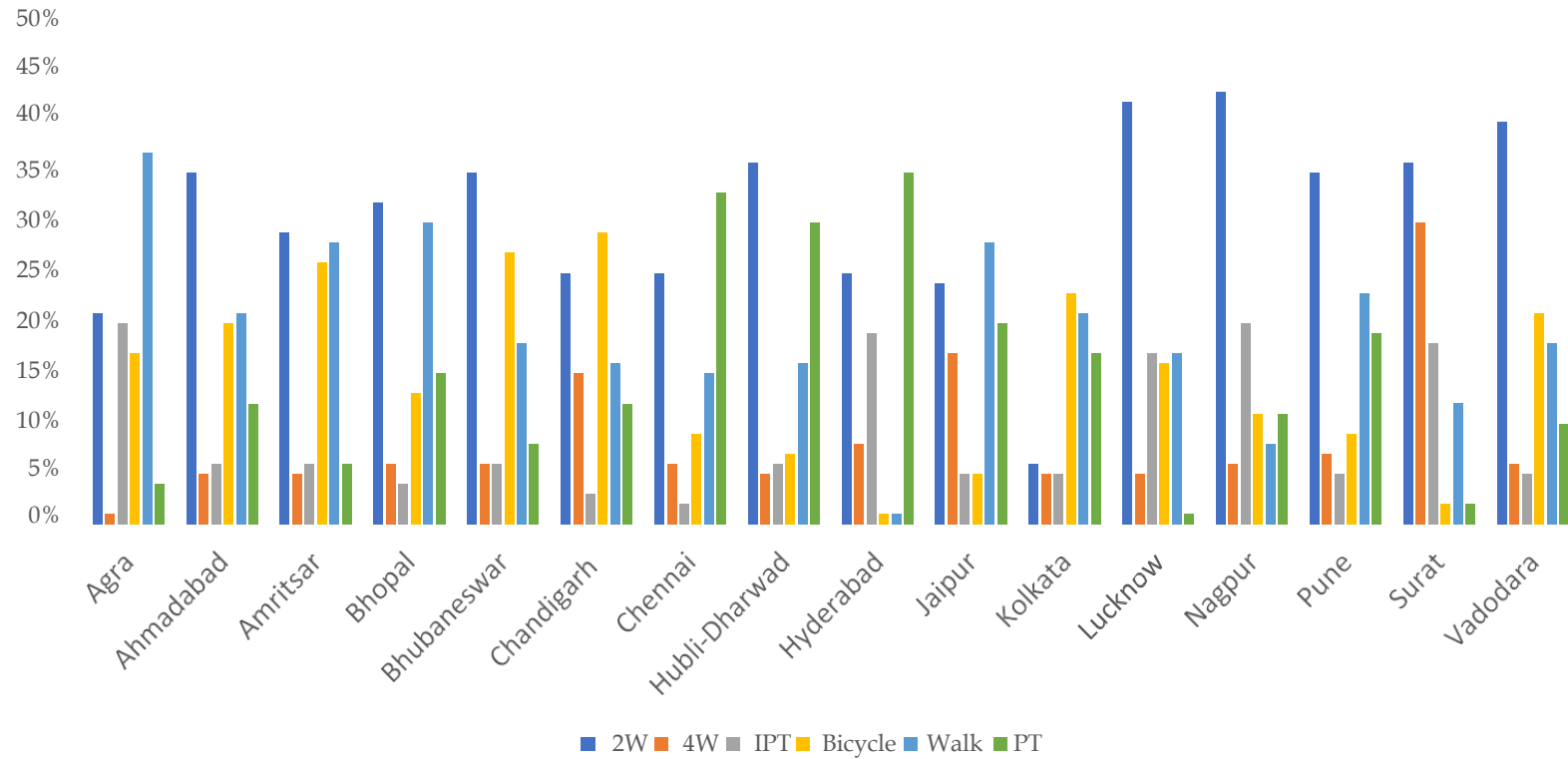


Available public transport facilities

- Unreliable, slow, unsafe,
- Uncomfortable, inadequate capacity
- Improper planning, managerial and financial issues



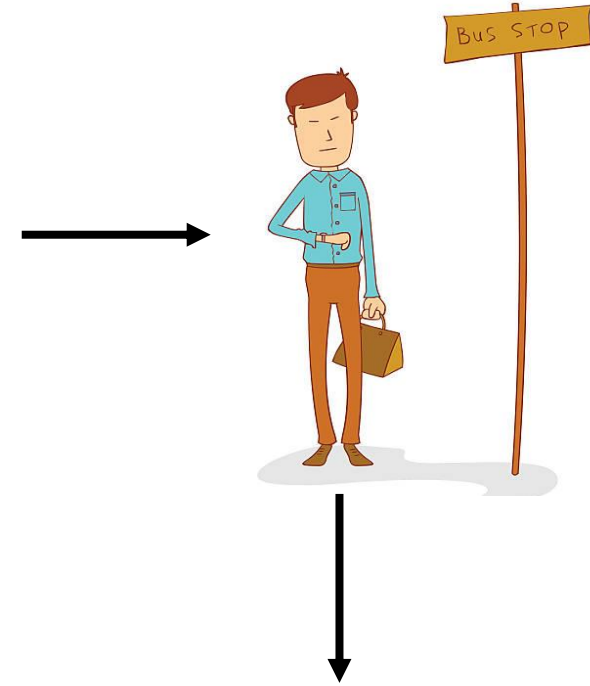
PRESENT SCENARIO



Vadodara City's Mode Share:

- 2W (Two-wheeler) Mode Share: 40%
- 4W (Four-wheeler) Mode Share: 5%
- Public Transport Mode Share: 7%

Current population (2.3 million)



- Congestion
- Pollution
- Parking Problems
- Increase in Travel Time
- Accident
- More expenditure on transportation services
- Social inequity

NEED OF STUDY

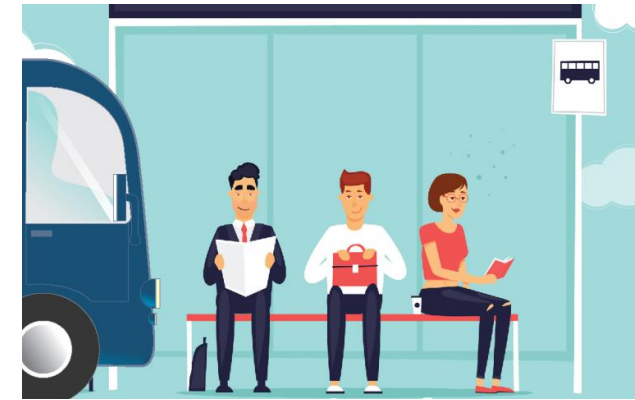
Who are the users of public buses and what are their expectation.

- Reliability
- Accessibility
- Affordability
- Safety/ Security
- Comfort and connectivity



What public bus organizers are lacking to provide to public bus users?

- Information and communicating
- Coverage area
- Infrastructure and facilities



Which aspects of public bus service is most crucial, and which is least important?

- Safety/ security
- Information and communication
- Comfort
- Accessibility/ Affordability



STUDY OBJECTIVES

- To evaluate the quality of the transit service with a maximum focus on the subjective (qualitative) aspect.
- To measure the level of satisfaction among transit service users.
- To investigate the relationship between perceived accessibility and various variables that impact the transit system.



LITERATURE REVIEW

Study	Transit mode and context	Attributes Analyzed	Key Attributes	Statistics Method
(Imam 2014)		Facilities, Cleanliness, Comfort, Convenience, Safety & Security, Availability	Safety, Comfort, Accessibility, and Timely performance	Linear regression and SEM
Islam et al., 2016	Bus service Dhaka city, Bangladesh	Sixteen attributes (Proximity from home, Structural condition, Service frequency, commuting periods (weekdays and weekends), Seat availability and Comfort, Accessibility, Proximity from workplace, Air ventilation, Female harassment, courtesy, Frequency, Cleanliness, Noise level, Route information).	Punctuality, Reliability, Service Frequency, Seat Availability, Commuting experience, Comfort, Structural condition.	Pattern Recognition Neural Network (PRNN), Generalized Regression Neural network (GRNN) and Probabilistic Neural Network (PNN)
Wong et al., 2017	Bus transit, Hongkong	Eight attributes (Ease of boarding and alighting, waiting time, Availability of seats, Attitude of drivers, Walking distance to bus stop, Condition of bus stop, Travel time and Temperature inside bus)	Seat availability, Condition of station, Driver's attitude, Ease of boarding and alighting,	Ordered logit model.

METHODOLOGY FLOWCHART

Investigation of Service Quality of Public Transit services in Vadodara, Gujarat

Method to Identified Key Variables Impacting Bus Transit Quality Service

Literature Review Using
SLR (Systematic
Literature Review)

Study area

Vadodara City Bus
Transit System

Primary Data Collection

- Travel Characteristic
- Demographic Characteristic
- Satisfaction Factor Questions
- Perceived Accessibility Questions

Data collection

Total **700** Samples were collected from
19 Different wards of Vadodara City

Data analysis

Exploratory Factor Analysis (EFA)

- Principal Component Analysis

Confirmatory Factor Analysis (CFA)


- Path Diagram Analysis
- Structural Equation Modelling


Measurement model
for service quality


Results and Discussion


Conclusion


STUDY AREA

- 

Vadodara has a well-developed and expanding bus service catering to residents and visitors. **Largest in India as per population**
- 

The city has a total of **61** bus routes covering approximately **603** kilometers. **Rapid Growth**
- 

The fleet comprises **169** buses, including **40** air-conditioned ones for a comfortable experience. **Rapid Growth**
- 

Popular routes like Deolali, Sayajipark, Bapod, Somatalav, GIDC, Tarsan, Mena, Sama, Bajwa, Bhayli, and Chansad experience high traffic due to key destinations. **Inadequate**
- 

The public bus system provides comprehensive coverage across the entire city. **Increase in**



Rapid Growth



Rapid Growth



Inadequate



Increase in

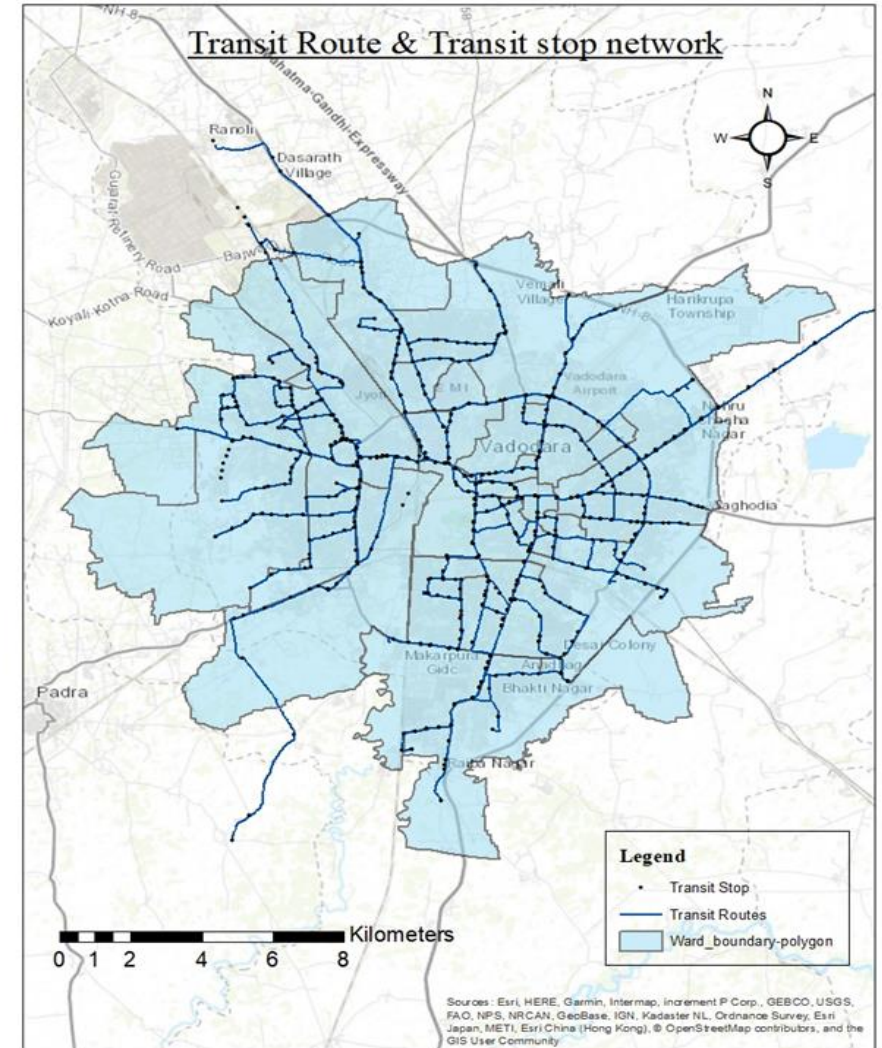


Figure : Public transit route map for Vadodara city.

Source: VSCDL transit portal and google map

VARIABLES AFFECTING TRANSIT SERVICE QUALITY

Satisfaction Parameters	Parameters	Satisfaction Parameters	Parameters	Satisfaction Parameters	Parameters
Accessibility	Access Distance	Comfort / Convenience	Crowding Level	Personnel / Customer Service	Staff Behaviour
	Access/ Egress Mode		Seat Comfort		Driver Behaviour
	Access Time		Ease in Boarding and Alighting		Customer Service Efficiency
	Egress Distance		Ease of Ticketing		Conductor Behaviour
	Egress Time		In-Vehicle Temperature		Driver Physical Appearance
Availability	Fare Collection Facilities		Waiting Area Crowding Level	Physical Condition	Staff Efficiency for Solving Problems
	Shelter Facilities at Stop		In-Vehicle Hand Hold/Grip Availability and Comfort		Staff Physical Appearance
	Facilities provided for elderly/ disabled		Level of Noise	Reliability	Quality of the vehicle
	Lighting at Stop		Waiting Area Seat Comfort	Route chateristics	Service Reliability
	Park-and-Ride Facilities		Comfort during journey		Spatial Coverage
	Storage Space in Vehicle		Level of Vibration	Saftey	Deviation from optimal route
	Efficiency Fare Collection Facilities		Tranfer Comfort		In-Vehicle Safety
	Handrails at Stop	Cost	Fare Structure Afforrdability		Safety at Stops
	Ticket Validation Processing Facilities	Frequency, Service Hours and Offered capacity	Service Frequency		Overall Safety
	Visibility of Handrails at Stop		Waiting Time		Safety Againts Accident
	Weather Protection at Stop		Service Hours		Safety in Access
	Availability of Wheelchair Space	Information	Information about schedule and route		Safety againts Crime in Vehicle
	Benches at Stop		Guidance Siganges at Stop		Provision of security alarm facilities
	Bicycle Storage in Vehicle		Information Availability on Board		Safe Driver
	Commercial Activities near/ at Stop		Map of Station Facilities		Safety when boarding and alighting
	Complementary Services Near/ At Stop		Advertisement of the Tranit System		The behaviour of other passengers
	Facilities for Disable People		Announcement at Stop	Time	Total Travel Time
Cleanliness	Clenliness in Vehicle		Clarity in Information		Bus speed is convenient
	Clenliness at Stop		Clarity in Information for Ticketing		Time Compared with Other Mode
	Clenliness in Vehicle (Outer Body)		Door Closing Announcement		Transfer Time

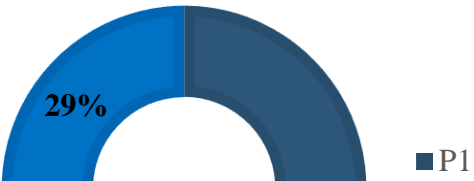
Point Likert scale Table

Service Quality Ratting				
1- Highly Unsatisfied	2- Unsatisfied	3- Moderate	4- Satisfied	5- Highly Satisfied

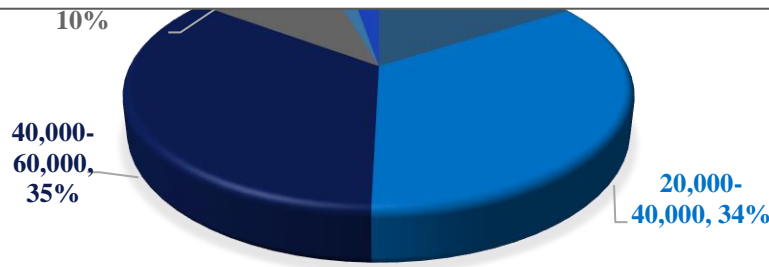
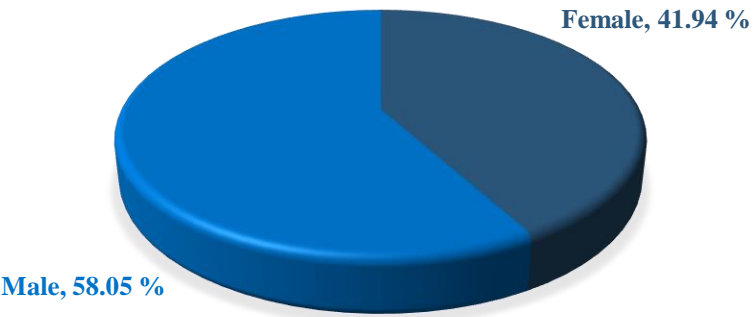
Perceived Accesibility Ratting				
1- Very Difficult	2- Difficult	3- Medium	4- Easy	5- Very Easy

DESCRIPTIVE DATA ANALYSIS

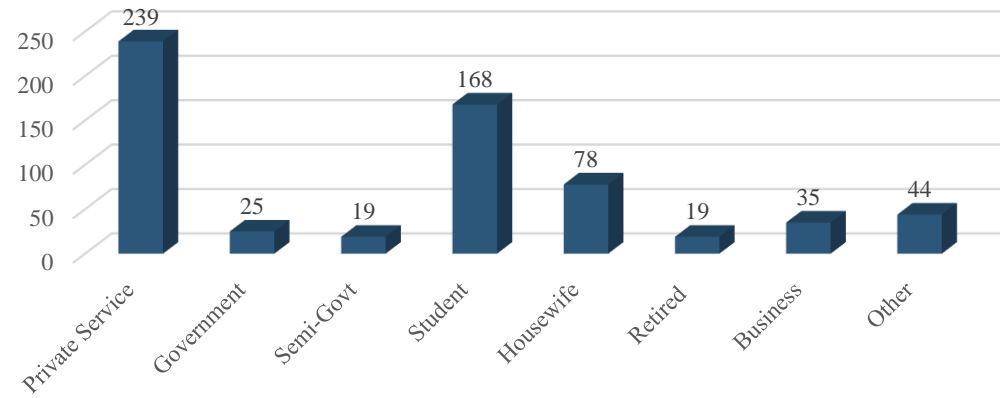
TYPE OF TRIP PATTERNS



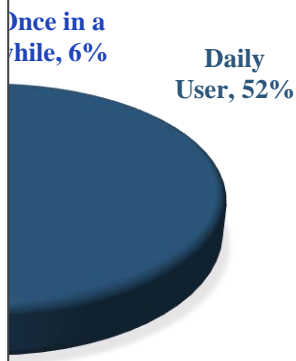
GENDER WISE DISTRIBUTION (%)



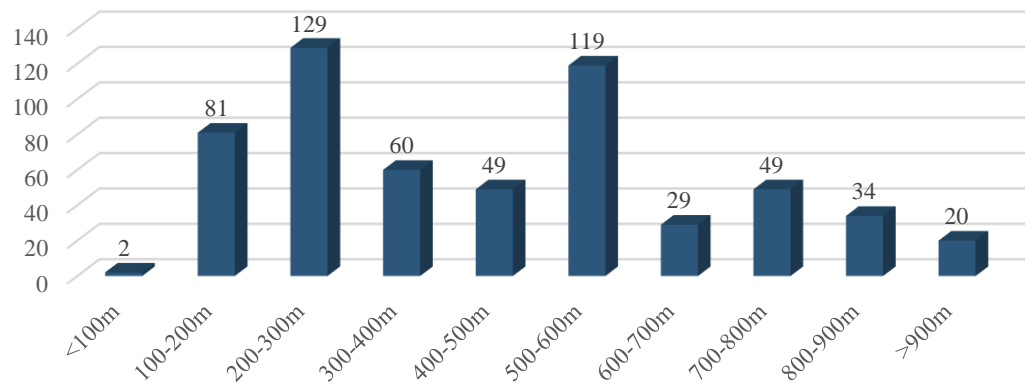
OCCUPATION TYPE



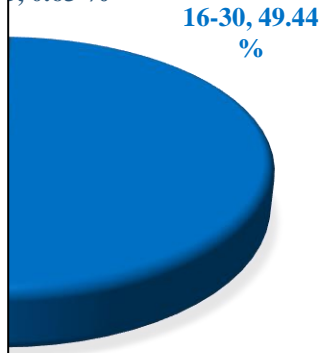
USING PUBLIC TRANSPORTATION IN (%)



WALK MODE USING BETWEEN ORIGIN TO ACCESS BUS STOP



UP (%)



DESCRIPTIVE DATA ANALYSIS

Indicators	Observed Variable	Mean	S.D	Indicators	Observed Variable	Mean	S.D
SF1	Rate the Walking distance to the bus stop.	3.31	0.984	SF12	Rate the in-bus (In-vehicle) real-time information system.	2.505	0.96
SF2	Rate the availability of shelter facilities and benches at bus stops during the journey.	2.502	1.037	SF14	Rate the availability of facilities for disabled and elder persons.	2.165	0.924
SF3	Rate the cleanliness of bus stops/stations.	2.766	1.068	SF15	Rate your perception of the travel time that the transit system takes to reach your destination.	3.343	0.844
SF4	Are you satisfied with the information availability of the bus schedule, route, and display system at stops?	2.517	1.048	SF17	Are you satisfied with the service frequency and service hours of the transit system?	2.811	0.927
SF5	Are you satisfied with the real-time information provided by the announcement and display system at the bus stops?	2.47	1.018	PAC01	Is it easy to do (daily) activities using public transport?	2.618	1.055
SF7	Rate the in-bus (In-vehicle) cleanliness of the bus.	3.353	0.811	PAC02	Are Access and egress distances convenient to perform your preferred activities using public transport?	2.568	1.002
SF8	Rate in-bus (In-vehicle) Crowding level.	2.335	1.014	PAC03	If public transport is your only mode of travel, would you be able to continue living the way you want?	2.213	0.959
SF9	Rate in-bus (In-vehicle) seat comfort.	3.348	0.785	PAC04	It is possible to do the activities at your preferred time of the day by using public transport.	2.188	0.945
SF10	Rate the level of comfort at boarding and alighting.	3.159	0.862	PAC05	Is the Frequency of the public transport buses adequate at your preferred time of the day to reach opportunity/activity?	2.205	0.989
SF11	How convenient and comfortable are the in-bus (In-vehicle) handholds/grips?	3.352	0.832	PAC06	Is it easy to reach your activities with available public transport information facilities? (Bus schedule, route, and display customer service at stop and in vehicle)	2.236	1.012

THANK YOU.....