Pandemic and its Impact on Public Transport: Case of Ahmedabad BRTS

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The Award of the Degree of

Master of Urban and Regional Planning

By

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CERTIFICATE

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The contents presented in this Thesis represent my original work and it has not been submitted for the award of any other Degree or Diploma anywhere else.

Parth Bhadreshkumar Vyas

This Thesis is submitted in partial fulfillment of the requirements for the
Degree of Master of Urban and Regional Planning
at the Department of Architecture
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The present work has been carried out under our supervision and
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ABSTRACT

It is historically observed that a city has major economic pillars upon which it survives. Apart from this transportation is such an aspect of the city which may be or might not be the driving factor of the city but transportation is definitely such a factor which affect a city on a greater level. It designs a city, helps a city to grow. It is one of the most effective ways of transportation in the city which helps a city to grow smoothly; in other words, it can make or break a city's equilibrium. In case of Ahmedabad AMTS and BRTS had conflicts in term of the users as a result both the bus services ran in a loss; Hence it needed a much awaited solution. Coming to the pandemic Covid-19 situations the bus services are completely shut down and with the growing fear of the virus infection the people use to prefer private means of transport or at least don't prefer to move through the bus; hence when a complete service is running as a failure and incurring losses it's better to bring a better solution to this or at the worst case scenarios, to stop the service at all.

This might bring some adverse problems to the city as bus services run at a loss specially in a city like Ahmedabad is quite a bit shocking. Hence apart from this a metro & bullet trains are also going to be incorporated in the city hence the sense to have 2 bus services seems of no sense currently specially after this pandemic.

DEDICATION

This thesis is dedicated by me to my parents.

Hansaben Vyas

&

Bhadreshkumar Vyas

The credit goes to my parents for whatever
I have learnt and achieved till date.
I am thankful to god for blessing me with such
loving parents.

I am also thankful to my guides for helping me in this thesis.

Mr. Gopal Shah

&

Dr. Jayant Kumar

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It was my dream to have my post-graduation done at Maharaja Sayajirao University & when I got an admission here, I was really happy to become a part of this institute. I am really thankful to all my faculties to teach me those things which I was never aware about.

I would like to show my gratitude to my primary guide Mr. Gopal Shah for helping me out in this thesis and teaching me & investing time in me for my growth. He taught me various ways to solve the problems and find out the hidden problems too and get solutions to those problems.

I would also like to extent my gratitude to my secondary guide Dr. Jayant Kumar for helping me out in this thesis. He used to keep a close watch on me and helped me to not get lost in to the topic and get to a conclusion and he helped me to find out some critical solution to various problems.

Lastly, I would like to be thankful to the whole MSU department and my colleagues for the time we spent learning in these 2 years course.

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ABBREVIATIONS

WHO	World Health Organization
Covid-19	Coronavirus Disease 2019
WCTRS	World Conference on Transport Research Society
MoUD	Ministry of Urban Development
ULB	Urban Local Bodies
AJL	Ahmedabad Janmarg Ltd
AMC	Ahmedabad Municipal Corporation
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
SPV	Special Purpose Vehicle
BRTS	Bus Rapid Transport System
AMTS	Ahmedabad Municipal Transport Service
MEGA	Metro link Express Gandhinagar Ahmedabad

CHAPTER 1 - INTRODUCTION

The global impact of the coronavirus has been reported in Wuhan, China in December 2019 resulting in a worldwide pandemic (declared by the World Health Organization on 11 March 2020) called Covid-19 disease rapidly spread everywhere the world. The spread of the Covid-19 outbreak has been shocking globally. This disease usually spread rapidly and affect an outsized number of individuals, disrupting daily activities of the bulk of the population. The pandemic has spread to everywhere within the world and its socio-economic impact shook every corner of the world. Several developed, developing countries, and India also enforced social distancing measures by imposing lockdown within the country. It was initially held for 3 weeks from 24 March to 14 April 2020 and extended to 17 May 2020. The govt also has to implement some strict laws and safety measures to prevent the spread of the disease, the consequences of the pandemic which are being faced by everywhere the world. The Covid-19 pandemic has significantly impacted everyone and almost every aspect of Society and life like air quality, water resources, environmental factor, urban design, smart cities, governance, truism, transport etc. The Covid-19 crisis will pose many new challenges to those aspects and should take time to adapt, which has become a new challenge for the people of the 21st century.

1.1 Transportation

Transportation is the movement of goods and persons from place to other place and the various means by which such movement is accomplished. In other words, to understand transportation the action of transport is defined as a particular movement of an organism or thing from a point A to a point B.

The types of transportation are as follows:

- Road transport, (including public transport)
- Railway transport,
- Water transport,
- Air transport,
- Pipeline transport

1.1.1 Public Transportation

Urbanization in India has increased from 17.3% in 1951 to 31.2% in 2011 and is expected to grow to 40% by 2031 (Ministry of Urban Development, 2012). This urban growth has been mainly due to people moving into cities for better life style and soico-economic opportunities. Growing rapid urbanization implies an increase the demand for public transportation services in cities.

Public transportation could be a sort of travel offered locally that allows more people to travel together along designated routes. Public transportation systems have options of transit like buses, light rail, and subways. These systems are available to the general public, may require a fare, and run at scheduled times. Public transport projects are mainly aimed at improving environmental quality, increasing accessibility for people, improving economic efficiency, reducing privet mode of vehicles and traffic congestion. Public transportation services play a very important role for those who are unable to drive, including those without access to non-public vehicles, children, individuals with disabilities, and older adults.

Principles of sustainability for public transport:

- Accessibility,
- Affordability,
- Connectivity,
- Land use planning,
- Holistic transportation,
- Planning with the environment

Public transportation is a very important contributing factor to urban sustainability and urban transport management. An efficient and effective transportation network that features conveyance helps reduce a city's per capita carbon footprint and makes cities more livable by simplifying travel and transportation needs and increasing accessibility. With of these facilities, public transportation plays a very important role and fulfills the needs.

1.1.2 Public Transport in the city

Generally, the urban local bodies operate public transport and some Indian cities have witnessed attempts to improve public transport via introduction of bus rapid transport systems (BRTS) and metro rail. BRTS service has been completed in many cities and in many cities projects are in several stages of implementation, a number of whom supported by the Jawaharlal Nehru National Urban Renewal Mission (JNNURM). When transport planning plays its role, it facilitates the common people in the city and also makes the city beautiful, so the transport planner plays a very important part in transport planning. The main purpose of planning is to satisfy the mandatory and necessary facilities which will lead to the development of the city. So transport planning is finished therewith with that in mind but sometimes the transport system planned by the transport planner also fails. Such an opportunity is feasible and also the forecasted ridership in some cities has also been proven wrong.

Public transport has the ability to attach or disconnect cities. Quality, well-designed transport systems are fast, comfortable, affordable, and most significantly, accessible. Access to safe and modern transport provides a viable alternative option of personal car ownership, which may be a major source of socioeconomic inequality and a significant contributor to global climate change in cities around the world. Moving from single occupancy private cars to high-capacity transport corridors would drastically cut emissions, eliminate traffic jam, better connect low-income communities better with their opportunities and resources.

1.2 Pandemic (Covid-19) and its Impact

Covid-19, which has spread everywhere the world, has affected many sectors of the society which has also led to changes within the practical life of citizens. The pandemic Covid-19 outbreak affects all segments of the population and is especially detrimental to members of these social groups within the most vulnerable situations, continues to affect populations, including people living in poverty situations, older persons, persons with disabilities, youth, and indigenous peoples.

Early evidence indicates that that the health and economic impacts of the Covid-19 are being borne disproportionately by poor people. As an example homeless people, because they will be unable to safely shelter in place, are highly exposed to the danger of the virus. People without access to running water, refugees, migrants, or displaced persons also stand to suffer disproportionately both from the pandemic and its aftermath whether due to limited movement, fewer employment opportunities, increased disorders in society etc.

The pandemic Covid-19 has rapidly affected our day to day life, businesses, disrupted the world trade and movements. Identification of the disease at an early stage is significant to regulate the spread of the virus because it very rapidly spreads from person to person. Most of the countries have over-involved their manufacturing of the products. Countless industries are disappearing. Half the world's 3.3 billion global workforce has lost its livelihood (World Health Organization). Workers within the informal economy are particularly vulnerable because most of the people lack social security and quality health care and productive assets have also been pack up. Without earn an income during a lockdown, many are unable to assist themselves and their families so it has decimated a lot of livelihoods in danger.

Covid-19 pandemic might also increase inequality, exclusion, discrimination and global unemployment within the medium and long term. Comprehensive, universal social protection systems, when in place play a way durable role in protecting workers and in reducing the prevalence of poverty, since they act as automatic stabilizers. That is, they supply basic income security in any respect times, thereby enhancing people's capacity to manage and overcome shocks. Governments are banning gatherings of individuals to the spread and break the graph.

These are a number of the areas that are impacted by the pandemic Covid-19, that cover planning area. The planning system of every area shown here also has an impact which the actual Authority is additionally facing financially. Planning plays awfully important role in any field because it could be a cornerstone for the event of each sector (Ayyoob Sharifi, Amir Reza Khavarian-Garmsir).

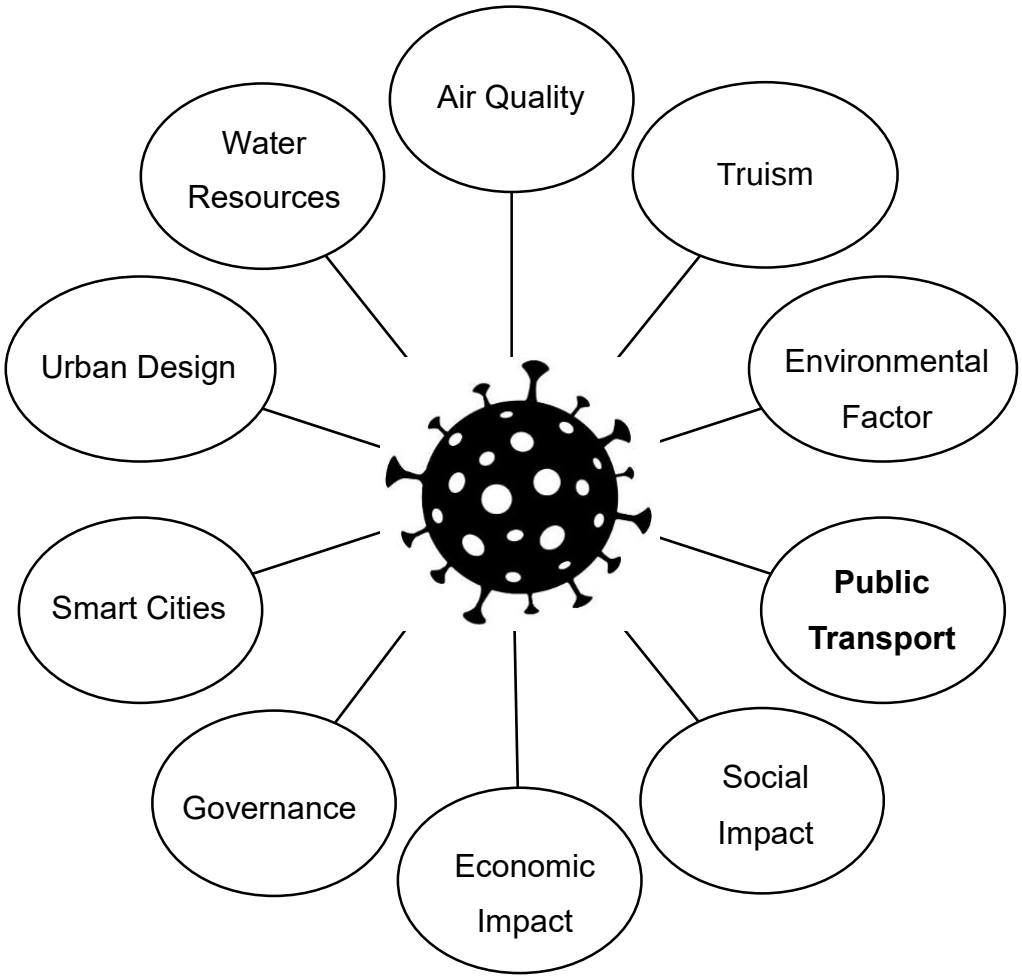


Figure 1-1: Impact of pandemic Covid-19

1.2.1 Public transport before (Covid-19)

Transportation is the backbone to the development of urban areas and plays extremely important roles in sustainable development. Public transportation is an integral a part of human life and society. People's personal preferences and freedom for the vehicle are expressed in increasing the ownership and use of non-public vehicles then, public transport becomes financially less viable, speeds reduce, congestion levels increase and therefore the transportation becomes a source of environmental problem and 70% of the world's urban population breathes unsafe air. Vehicles are major sources of urban pollution and gas emissions. Bus transit is a premier style of urban travel. A new paradigm in delivering bus services, becoming called as bus rapid transit, is being developed in cities. The problem of pollution, safety

and inefficiency have reached at an alarming level in most of the major cities so, there's an excellent must ensure clean, efficient, affordable, effective and safe public transportation system. These are a number of the issues related to public transport that the city is facing and making public transport facilities more efficient to minimize but, now the Covid-19 pandemic has created new problems that have affected all sectors and have had an instantaneous impact on conveyance.

1.2.2 Pandemic (Covid-19) and its impact on Public Transport

Transport played an important role in the spread of the Covid-19 disease so public transportation is unsafe and dangerous for humans while pandemic. Public transport services have been restricted and hit hard by Covid-19, bus services have almost ground to a halt, down by 98-99 percent during the pandemic. The outbreak has caused profound impact on the mobility of passengers and employees. Travel restrictions are implemented at a local level, state level, national level, or international travel based on the severity of the outbreak of the infectious disease on 23 January 2020 in China and thereafter it was implemented in other countries and people might avoid travelling in public transportation and shared mobility.

Public transportation increases the risk of acute respiratory infection and face social distancing challenges during this pandemic situation then it causes a giant impact on the local and national economies. Up to now social distancing and various control measures like closing schools, working from home, limiting large gatherings, avoiding public places, avoiding transit and travel restriction, etc. These control measures have an on the spot impact on travel patterns, as a result most of the persons are working from home or temporarily unemployed and plenty of people cancelled their non-mandatory travels. It’s expected that after the tip of the lockdown period, people will start their mandatory travel but the fear of coronavirus will change people’s daily commute frequency and travel psychology in terms of mode choice. Psychological effects on people have led to changes in the way people live and use the system. The impact on people has led to a change within the way people live so it’s can't be ignored within the future so necessary changes must be made keeping in mind.

The Transport sector, especially conveyance, has been impacted significantly by the pandemic. People may try and shift from public and shared transport services due to higher perceived risks, resulting in increased use of personal modes of travel. As Indian cities are struggling to reduce the dependence on private motor vehicles but, this crisis may further crumple to adverse outcomes created by high motorization rates. The pandemic has led to a marked transition in people's perceptions and behavior, which shall likely affect urban freight transport demand as furthermore. The Covid-19 pandemic has put the lives of the many on hold and prompted people to rethink their choices and behavior.

Changes in travel behavior can occur in the following areas depending on the adversity caused by the pandemic:

- Impact on the uses of various mode of transportation
  People are more dependent on a personal mode of transportation during the pre-lockdown.
- Mode shift during pre-lockdown and after the lockdown ends based upon income level
  Mode choice decision depends upon the individual income level of people.
- Impact on the uses of public transportation
  The reduction in the uses of public transport during this period because most of the people are in quarantine and avoiding unnecessary travel.
- Impact on the frequency of non-mandatory trips
  The reduction in non-mandatory travel that people are avoiding unnecessary travel because of fearing the risk of infection.
- Impacts on the average trip length
  People have also reduced the average daily travel distance.
- Perception about safest mode of transportation during the pandemic
  Personal transport is the safest as compared to public transport.
- Impact on the Future Travel Plan (truism)
  People are cancelling or changing their future travel plans people will not travel as they travel during the normal situation (Sanu Meena, 2020).

1.2.3 Travel with Social distancing during Pandemic (Covid-19)


Pandemic is permanent.


Social distancing is difficult in public transportation.


Few people can travel in one bus.


Public transportation is unsafe during pandemic.


Government's economy is decaling.


It is necessary to rethink about public transportation.

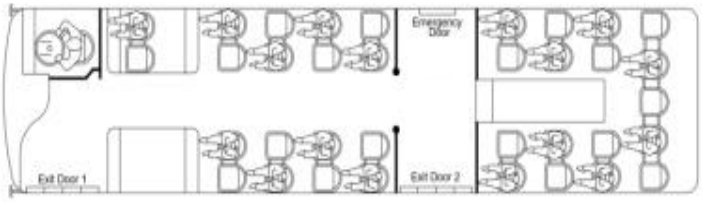


Figure 1-2: Travel with social distancing

- Bus carries three times the number of passengers which leads to overcrowding and increase in the economy of the government.

Figure 1-3: Travel before and after pandemic

overcrowding in public transportation

Public transportation with social distancing

1.2.4 Problems and impact after Pandemic (Covid-19)

The pandemic Covid-19 has hampered travel but also had a positive impact on the need and essential travel such as transportation contributed towards success of the frontline workers in reaching the needy ones in time and saving them and this is made possible by the reduction of unnecessary travel. Many lost jobs including in transportation and informal workers had to migrate back to their home regions. Work from home attributed to the new normal. The academic institutes have started online learning processes. commuters were advised to avoid non-mandatory travels during the lockdown, passenger demand dropped, and transportation operators incurred huge financial losses.

Here are some of the effects of the pandemic and it can also change the city's planning strategy and have a direct effect on public transport.

1 Migrant workers have lost their jobs
   - Migration has deceased because of unemployment
   - They will start home based industry
2 People will migrate to the villages
   - Rural economy will increase
   - People will turn towards agriculture
   - Organic farm will come in to existence
   - Health awareness increases
3 Town planning has been affected
   - The density of the city will be low
   - Villages and towns near the city will be developed because people will move in town which is closer to city
4 Effect on working behave
   - WFH concept has come into existence
   - The work place will be close to home
   - E-marketing has come into existence
   - Online meetings & E-court & Online education is essential

1.3 Impact on Road Transport

The various degrees of restrictions adopted to curb pandemic change peoples' lifestyles and affect their social interactions and economic conditions. This features a direct effect on their travel and outdoor activities (Deepti Muley and others,2020).

1.3.1 Impact on Mobility

The movement restrictions found to be effective in limiting the spread have directly affected mobility. During a pandemic, anxiety and fear of infection, which is especially influenced by social media, significantly reduce people's mobility and therefore the travel restrictions substantially decreased travel, especially for long-distance trips.

1.3.2 Impact on Traffic Conditions

The reduced movement of individuals will have a direct effect on the operating characteristics of traffic, like patterns, volumes, speeds, and level of service. Restricted measures have reduced morning and afternoon traffic, especially because of the actual fact that essential work can be done online, which has reduced trips and significantly reduced traffic. In California, the shelter-in-place order reduced the traffic volumes from 20% to 55% on highways compared to before the order was in place.

1.3.3 Impact on Traffic Safety

The changes in traffic conditions alter the traffic safety situation. They can improve traffic safety due to the availability of more space and lesser conflicts on the road or worsen the situation as the presence of a lesser number of vehicles can trigger unsafe driving behaviors and untimely the result is that road traffic crashes were reduced significantly due to lockdown in cities. Around 10,000 road fatalities were in an exceedingly month at the value of 200 loss of lives because of COVID-19 and California experienced a significantly lower daily number of collisions in 22 days of shelter-in-place order compared to the worth before the restrictions (Deepti Muley and others,2020).

1.3.4 Impact on Traffic Behavior

The preventive measures will affect the way people undertake their travel, including limiting the amount of trips to changing modes of travel and destinations. It absolutely was speculated that because of Covid-19, people would reduce their travel, and would favor active modes or cars over transport, which might put additional pressure on available road infrastructure. This might reduce traffic volumes and affect people's well-being.

1.3.5 Benefits and drawbacks

The occurrence of infectious diseases affects travel and outdoor activities significantly. People reduced outdoor activities and related travel due to fear of contracting the disease and also to follow the govt orders as a result, a major drop in mobility across many cities around the world, particularly because of Covid-19 (Deepti Muley and others,2020).

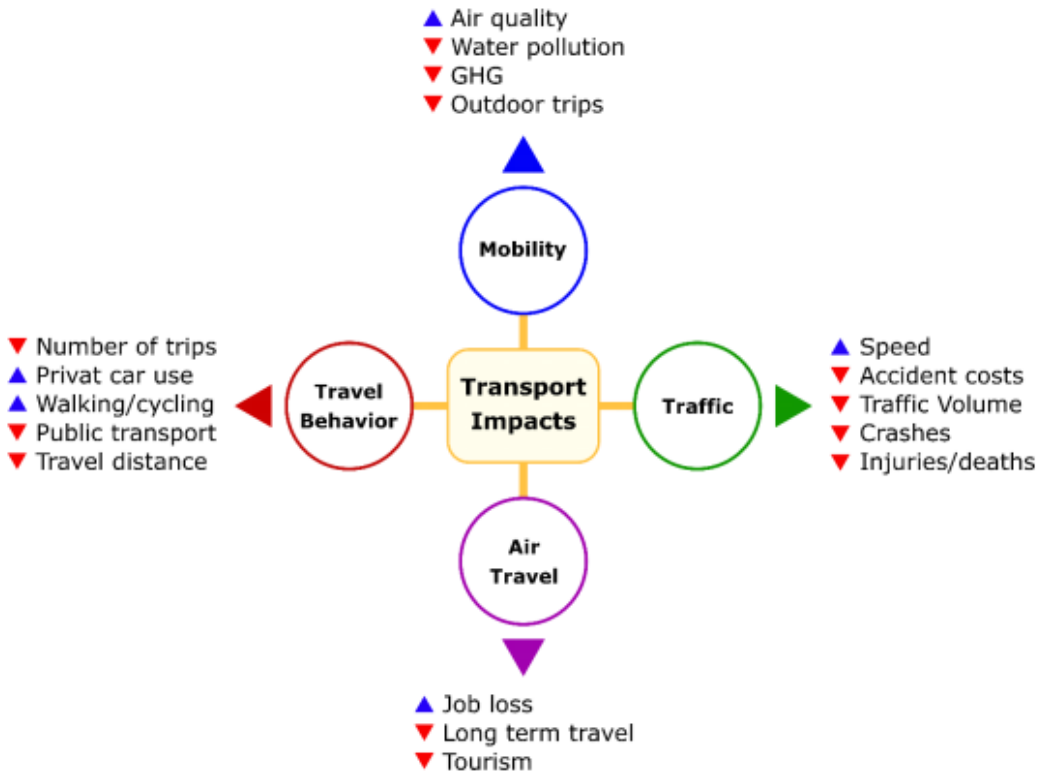


Figure 1-4: Transport impacts of occurrence of infectious diseases

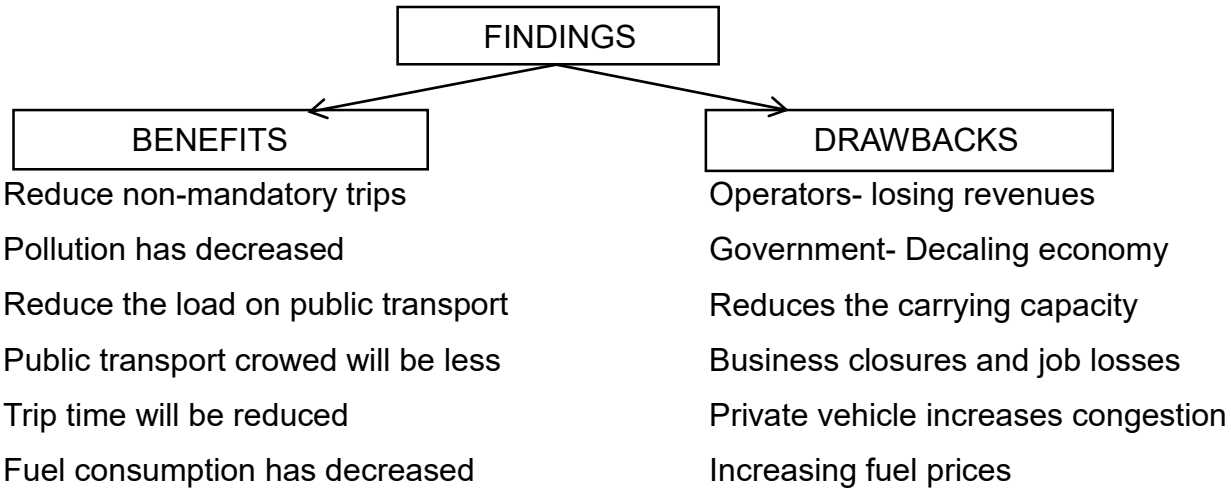


Figure 1-5: Observation

1.4 Impact on the Environment

Transport being one of the major contributors to air pollution, the impact of reduced trips on environment needs to be quantified. Generally, $PM_{2.5}$, CO, NO_2, O_3 and PM_{10} are the partials of air quality were reduced significantly and consequently the ozone level was improved in different parts of the world because of pandemic. Further, the reduction in CO, and $PM_{2.5}$ was partially mediated by reduced mobility due to travel bans, while the reduction in NO_2 and PM_{10} were completely mediated (Purnima Dasgupta, Kavitha Srikanth, 2020).

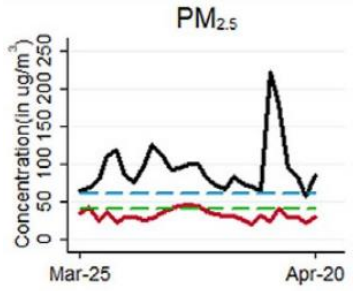


Figure 1-6: Air particle $PM_{2.5}$

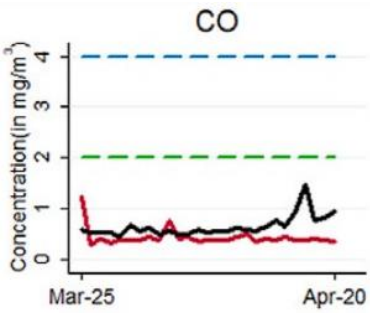


Figure 1-7: Air particle CO

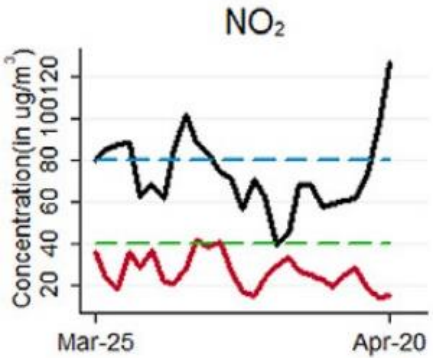


Figure 1-8: Air particle NO_2

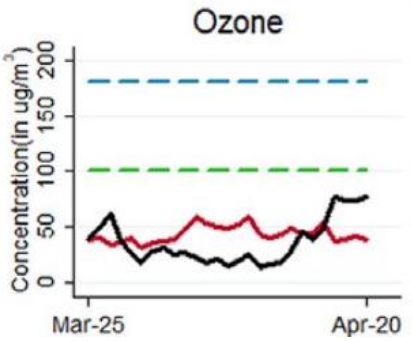


Figure 1-9: Air particle O_3 (Ozone)

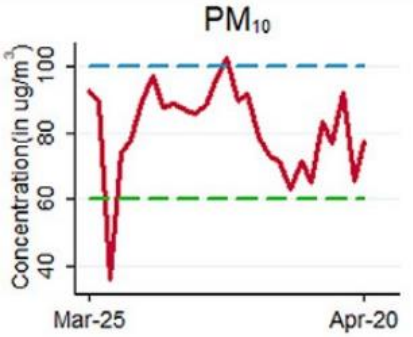
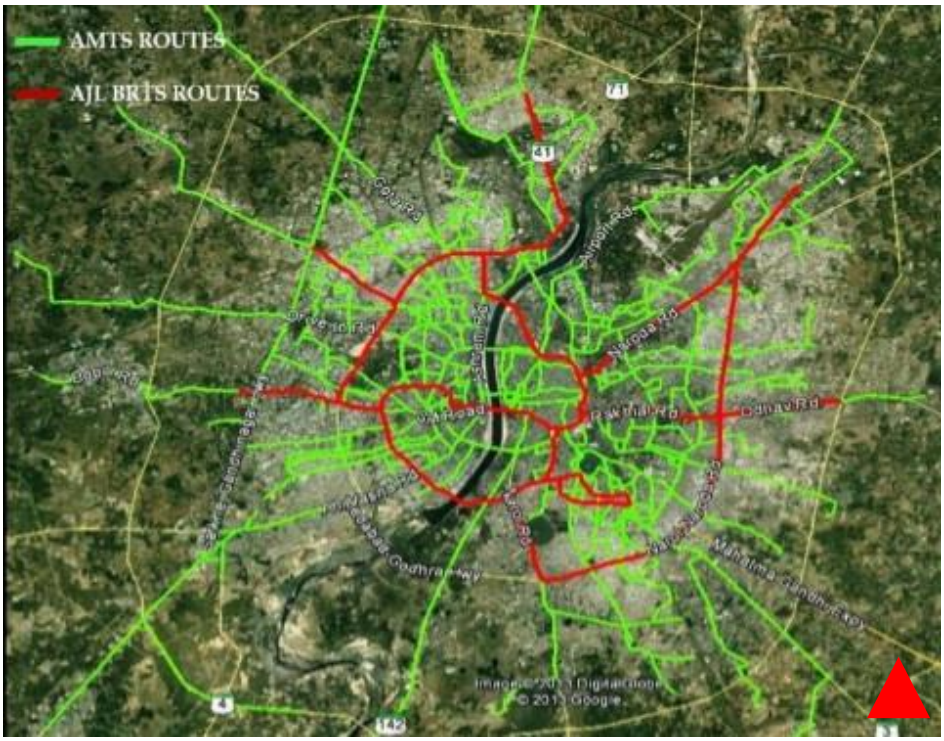


Figure 1-10: Air particle PM_{10}

1.5 Thesis Framework

1.5.1 Study Area



Map 1-1: AMTS and BRTS routes

(Source: google.com/images/)

The city of Ahmedabad was founded in AD 1411 as a walled city on the eastern bank of the river Sabarmati. It's the commercial capital of Gujarat is now the seventh largest metropolis in India and therefore the largest within the state with a population of 5.58 million in 2011. Its population is probably going to rise to 11 Million by 2035 and probably going to extend from the current 440 sq. Kms 1000 sq. Kms by 2035.

Ahmedabad city has two major transport systems: The Ahmedabad Municipal Transport Service (AMTS), a public-service corporation running in mixed traffic and also the Bus public transit System (BRTS), which is operated by Ahmedabad Janmarg Ltd (AJL), which runs on dedicate corridors (except junctions and some other sections). Both AMTS and BRTS are wholly-owned subsidiaries of the Ahmedabad Municipal Corporation (AMC), which has an around of about 465 km2 under its jurisdiction.

Map 1-2: METRO rail system routes

(Source: google.com/images/)

East-West Corridor North-South Corridor

The development of metro rail system is in many cities of India and now, the metro rail system is being developed in Ahmedabad city with the main objective of reducing the growing traffic congestion on the road, low use of private vehicles, carbon reduction and attracting the people towards public transport. The third public transport system in Ahmedabad metro rail system which called the Metro link Express Gandhinagar Ahmedabad (MEGA) has been proposed and is within the advanced stages of planning. The proposed metro alignment provides north-south connectivity in Ahmedabad city from Visat to APMC running along the Ashram road on most of the sections. The opposite corridor Thaltej to Vastral provides east to west connectivity and passes through important nodes of Kalupur, Ashram road, Thaltej and Industrial areas on the east of Ahmedabad. There are basically three transport services in Ahmedabad city but BRTS service has been taken for study.

1.5.2 Need for the study

- Travel has restricted and public transport system has become unfavorable for the people. It is very important for urban centers to have a safe and secure public transport network.
- It is the biggest challenge in the public transport, to implement social distancing where public transport modes are always crowded and infrequent.
- Because of India's high-density urban agglomerations and its vast numbers of low- and middle-income urban families for whom public transport often provides a lifeline. This is a good time to build upon the lessons of this crisis and rethink the new normal.

1.5.3 Why it should be done?

- Enhancing the safety of bus transport will be the most pressing issue.
- Buses will not be able to operate for very long without support, funding untimely results in to liquidity.

1.5.4 Research question

- Can public transportation continue after pandemic and what alternative solutions we can think towards public transportation?

1.5.5 Vision

- To rethink about public transportation.

1.5.6 Aim

- Rethinking of the mode of public transportation present facilities in after pandemic.

1.5.7 Objectives

To study the Detail Project Report of BRTS.

- Achieved from Ahmedabad BRTS Phase-1 & Ahmedabad BRTS Phase-2.

To study the occupancy of PT especially BRTS during and after pandemic.

- Derived from BRTS study literature.

To understand psychological impact of human towards PT.

- People's perception about to PT will be derived from survey.
- What people are thinking for their convenience and safety.
- Willingness towards Online education & Online marketing.

To understand psychological impact of human towards PT.

- Will depend on data collection and analysis.

1.5.8 Scope of work

- From research, it can be identified that public transport in Ahmedabad city is affected due to Covid-19 pandemic.
- Different types of pandemic effects and impacts on public transport can be understood from research.
- Cities having BRTS & public transport can have such research related to pandemic & their effects.
- Town planning and development planning will be done keeping in view this type of situation.

1.5.9 Limitations

- This study has been done only on the public transport system of Ahmedabad city keeping in view the current situation of the city.

CHAPTER 2 - LITERATURE REVIEW

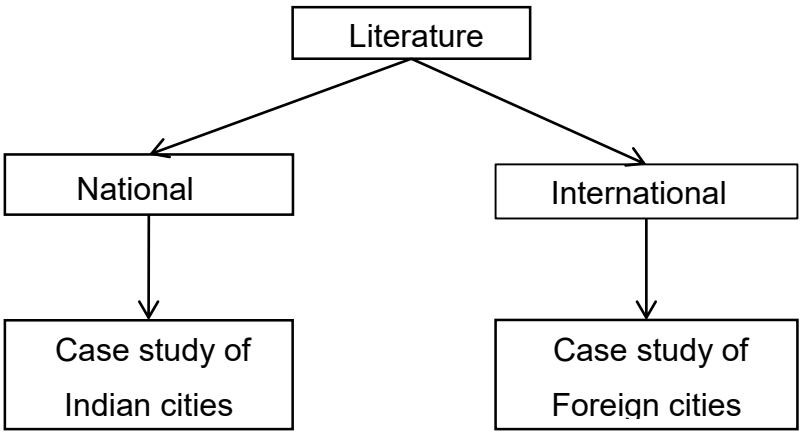


Figure 2-1: Literature

About half the world's population lives in cities, which provides cities a turn towards development. The growing population within the city is because of migration because of various reasons and therefore the cities are developing with the required facilities which sometimes need to face some adversities. One among the important facilities of cities is conveyance which is greatly affected during the pandemic Covid-19 lockdown due to travel restriction, out migration, people's perception and hygiene requirements. The history of infectious diseases affecting human lives dates back to several centuries, for instance, Black Death within the 14th Century. In 1918, the Spanish Flu, an influenza pandemic, affected every person within the world (around 500 million), causing deaths of 10% infected people (around 50 million) worldwide. The emergence of the pandemic isn't the primary event of the 21st century but such pandemics have also arisen within the past and its effects are felt within the society and within the useful sectors (Deepti Muley and others,2020).

The chronological history of major health emergencies in the 21st century.

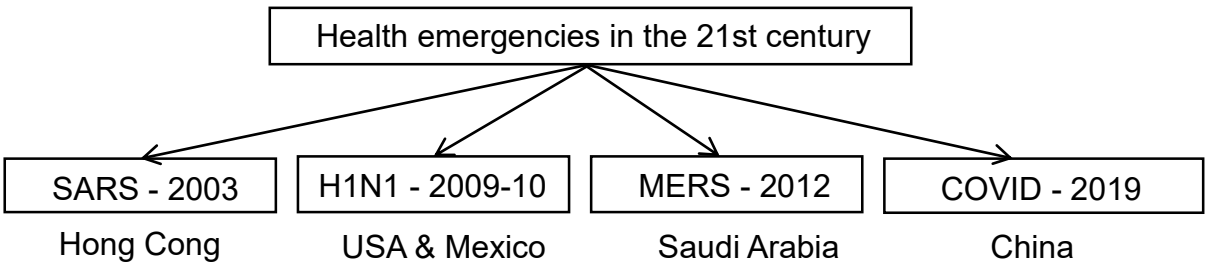


Figure 2-2: Chronology of major health emergencies in the 21st century

SARS, the first pandemic within the 21st century, was identified on 26 February 2003 in Hong Kong spread rapidly, leading to 8422 infections round the world with almost 11% mortality. After this, in April 2009 residents of the USA and Mexico experienced a pestilence of a replacement strain of virus called Influenza A. During the first year, H1N1 caused the death of 151,700–575,400 people worldwide. Subsequently, on 10 August 2010, the world Health Organization announced an end to the worldwide pandemic of 2009 H1N1 influenza. In 2012, the epidemic MERS appeared in Saudi Arabia. Recently, Covid-19 was first detected in China in 2019, it's affected 213 countries within the world (Deepti Muley and others,2020).

During the past pandemics, along with safety measures to prevent the spread of the disease, people travel less and public transport was also stopped to prevent the spread of the disease. Public transport has been used as the crisis has passed and the pandemic has eased, but the use of public transport depends on the extent of the impact of the pandemic and how much the pandemic has spread and how much the situation has improved then before. The effects of all the pandemics in the past seem less but the lessons didn’t learn from the situation in the past that such a situation will happen in the future as the impact diminishes. The effects of the Covid-19 pandemic are far greater than the past pandemics and has created a very critical situation that is responsible for changing every aspect of human life and society. Many necessities of life and society have been restricted to prevent the spread of infection, resulting in clutter and discomfort, but it is essential for safety measures. One of these is the city's public transport system, which was shut down due to the direct impact of the pandemic on public transport and the question arise that the presence of a public transport service in the future as people travel less and ultimately ridership has fallen in public transport. As this is a new experience for the people, the perception of the people has also changed, computerized works have started to be done from the concept of work from home which has reduced the ridership and also reduced the traffic congestion of the city and the attraction towards public transport has decreased. Ultimately the results showed that without travel restrictions, the spread of Covid-19 could have accelerated significantly in cities therefore transportation was restricted to reduce the risk of infection, improve the situation and the safety of the public.

The mandatory control procedures, strict restrictions and lockdowns imposed the spread of the disease affected the whole transport system and the sudden impact significantly declined passenger numbers in the public transportation. Even closed spaces in the public transportation is often challenging for daily commute during and after the pandemic. services have started on the basis of some policy rules but still raises the question of future planning for the Transport Authority.

Studies revels that the quarantine measures modified people's trip purposes and work remained as the only important purpose in Spain. Public transport observed the highest drop, 93%, amongst all modes due to confinement measures. The movement restrictions experienced different changes for various modes, the share of private cars increased from 43% to 65%, while the share of public transport reduced from 43% to 18%. The mode shares by cycling 4% was doubled compared to 2018. The analysis of the Netherland's Mobility Panel data showed that the lock down affected people's travel behavior and activities temporarily, with about 80% of respondents reducing their outdoor activities. Further, compared to 2019, 55% fewer trips were undertaken and the travel distance was reduced by 68%. Additionally, travel by walking or cycling increased and people preferred private cars and rejected public transport. After the lock down, about 20% of people were expected to walk or cycle more and travel less. The occurrence of infectious diseases affects travel and outdoor activities significantly. People reduced outdoor activities and related travel due to fear of contracting the disease and also to follow the government orders. As a result, a significant drop in mobility was observed across many cities, due to Covid-19. The traffic patterns changed with lower peak traffic volumes and reduced congestion levels across cities. The drastic drop in traffic volume led to marginally increased travel speeds on some highways. On a positive side, the number of crashes, fatalities, and injuries due to crashes reduced significantly for all modes of transport. In addition, lower material losses were reported due to traffic crashes compared to before the occurrence of diseases or a similar time the previous year. The road traffic crashes were reduced significantly due to lockdown in India. Around 10,000 road fatalities were avoided in a month at the cost of 200 loss of lives due to Covid-19 (Deepti Muley and others,2020). Similar notable changes have also taken place in the cities of India.

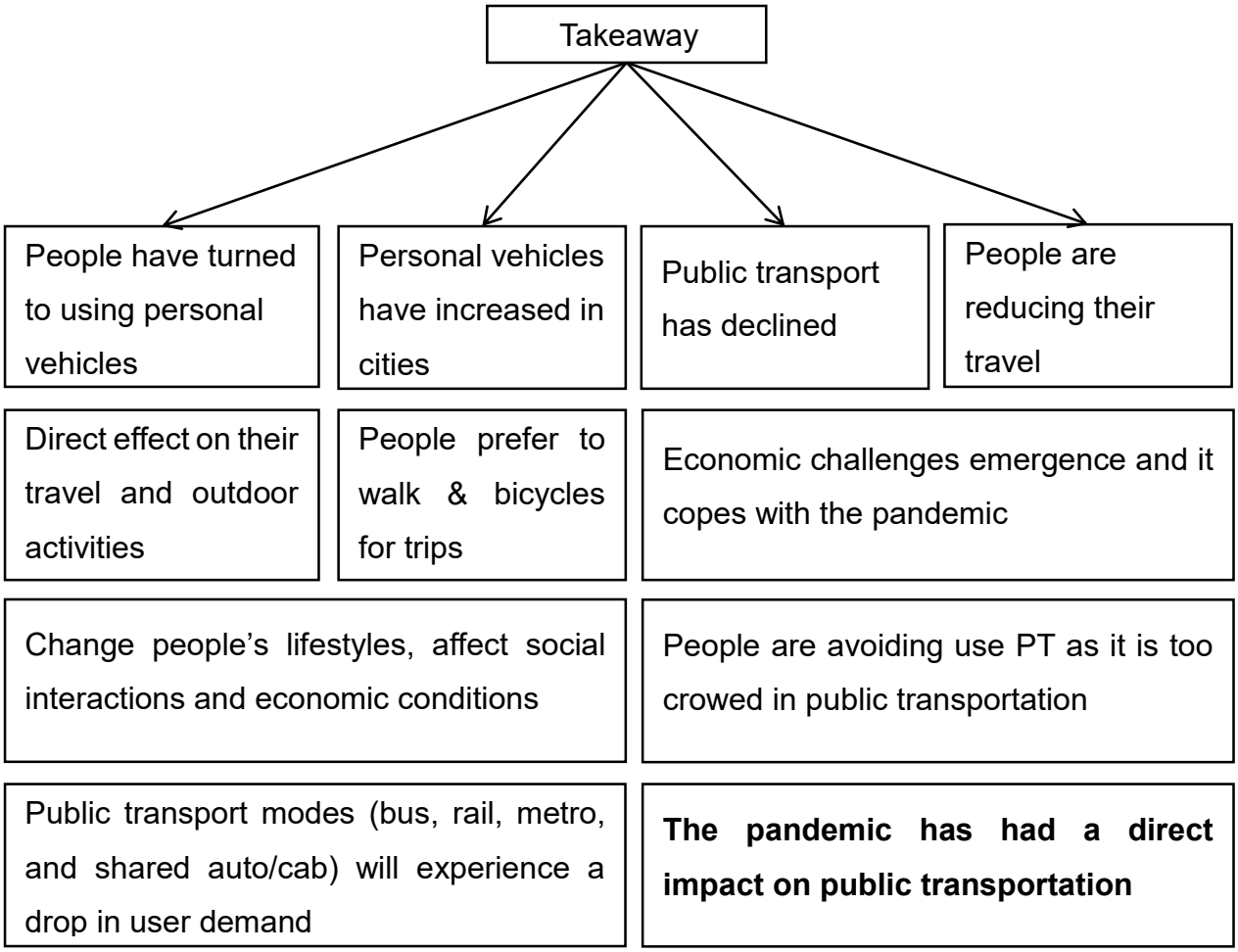
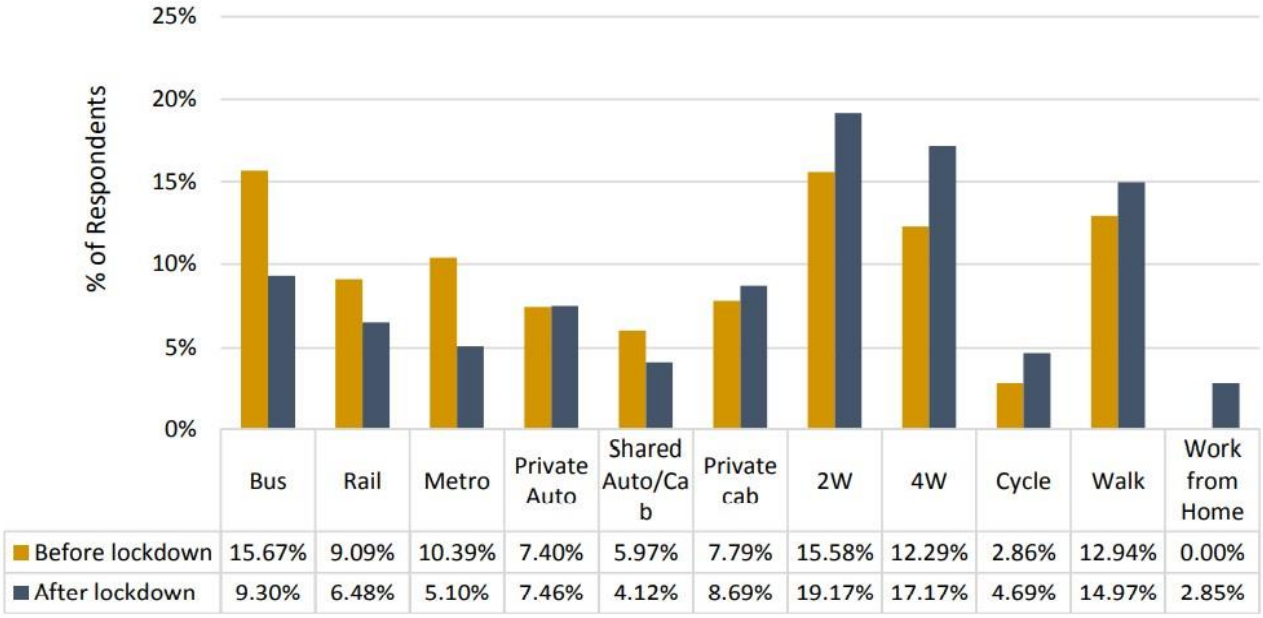


Figure 2-3: Takeaway derived from literature

2.1 Case of Indian cities

The pandemic has had a major impact on the general public transport sector all around the world and therefore the use of transport has declined as per the case which is additionally seen within the cities of India. To understand the impact of the pandemic, the impact on the general public transport of some cities has been shown so the transport situation of all the cities may be known and necessary observation and enhancements are often made. Generally, situation before and after the lockdown has been studied so the changes in all modes of transport may be closely observed and therefore the changes made will be known. The changes in both transport and non-public transport modes are covered so the longer term situation may be known from the changes made relative to each other.



	Bus	Rail	Metro	Private Auto	Shared Auto/Cab	Private cab	2W	4W	Cycle	Walk	Work from Home
Before lockdown	15.67%	9.09%	10.39%	7.40%	5.97%	7.79%	15.58%	12.29%	2.86%	12.94%	0.00%
After lockdown	9.30%	6.48%	5.10%	7.46%	4.12%	8.69%	19.17%	17.17%	4.69%	14.97%	2.85%

Figure 2-4: Impact of Covid-19 on Mode Share

The impact of some Indian cities has been studied as follows Ahmedabad, Bengaluru, Chennai, Delhi, Hyderabad, Kolkata, Mumbai, Pune. The new physical distancing advice of maintaining a 2-meter distance between individuals seems to have reduced levels of public transport users' trust in the operators. 67% of the respondents suggest that safety from Covid-19 is the most important criteria while travelling. The general public transport modes (bus, rail, metro, and shared auto/cab) will experience a drop in user demand. Simultaneously, the private modes are likely to become the preferred and popular mode of travel, with results indicating that the 2-wheeler mode share will likely increase from 15.6% to 19.2% and 4-Wheelers from 12.3% to 17.2%. Non-motorized modes also are anticipated to witness an increase. It's interesting to note that 3% of the respondents indicated that they are likely to work from home and will not be making any regular trips in figure 2-4. Therefore, it is probable that the pandemic will significantly alter the mode choice and travel patterns in cities. Working from home is expected to be widely accepted and adopted, and improved virtual infrastructure in cities may further reduce the need for travel. Public transport users suggested that they'd still not favor to use public transport. This can be due to the perceived high risk of contamination on public transport so, the belief that maintaining physical distancing when using public transport would be difficult (Ramit Raunak & others, 2020).

2.2 Case of Foreign cities

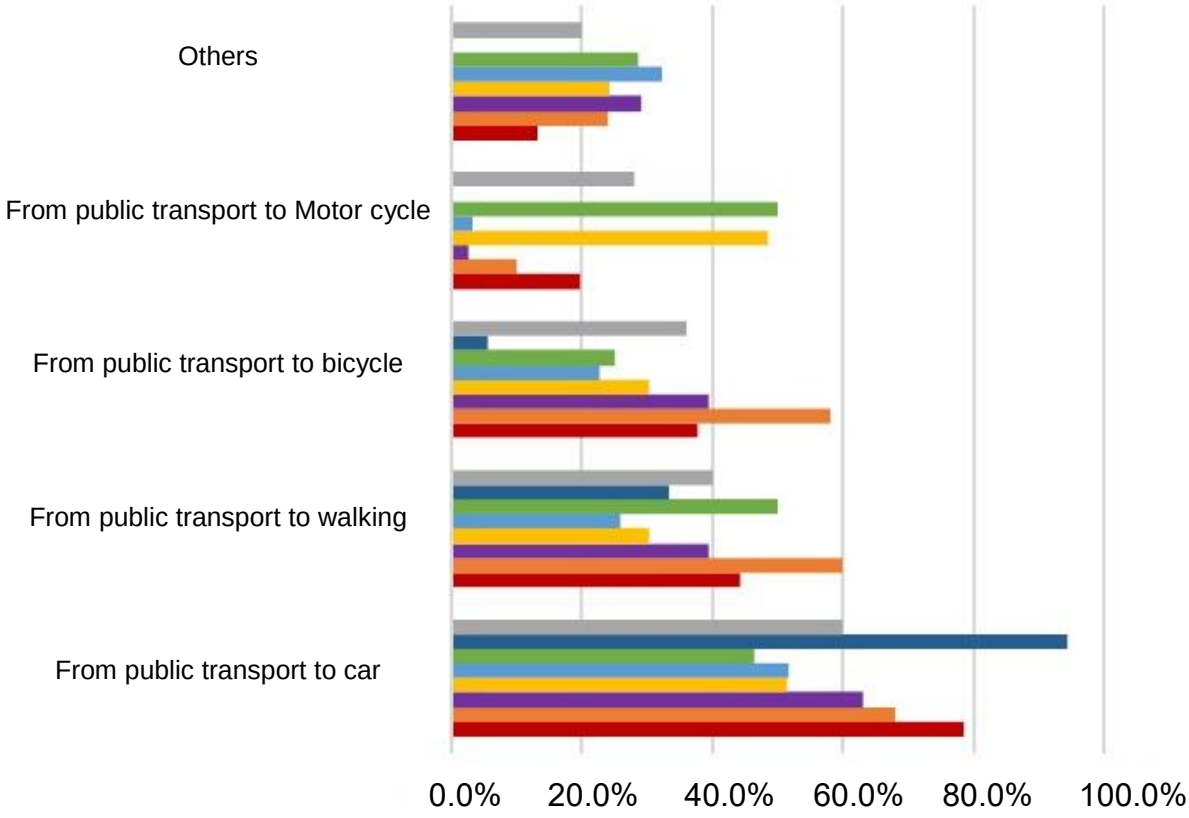


Figure 2-5: Modal shifts during Covid-19

This world-wide survey was initiated by the Chair and Co-chairs of the WCTRS (World Conference on Transport Research Society) Covid-19 task force. The WCTRS could be a platform for the exchange of ideas among transport researchers, managers, policy makers, and educators from everywhere the globe, from a perspective which is multi-modal, multi-disciplinary, and multi-sectoral. It's observed from figure 2-5 that obviously, an outsized share of modal shift from public transport to other modes was observed by supported experts'. The most important shift to car 64.8%, followed by walking 42.3%, bicycle 35.6%, and motorcycle 19.7%. Among the 22.5% of other answers are about the decline of all trips because of lockdown and other restrictions.

Thus, while transport should be further improved, the present crisis should be thought to be an opportunity to significantly increase the share of walking and bicycle. As seen in figure 2-5, the shift from transport to car in Asian nation and China is most remarkable. In contrast, European people show a more environmentally sustainable and healthy travel style, i.e., shift from conveyance to walking and bicycle. In India and other Asian countries, the shift from transport to motorcycle is way over other countries/regions. India shows the second largest shift from conveyance to walking, following Europe (Junyi Zhang and Yoshitsugu Hayashi, 2020).

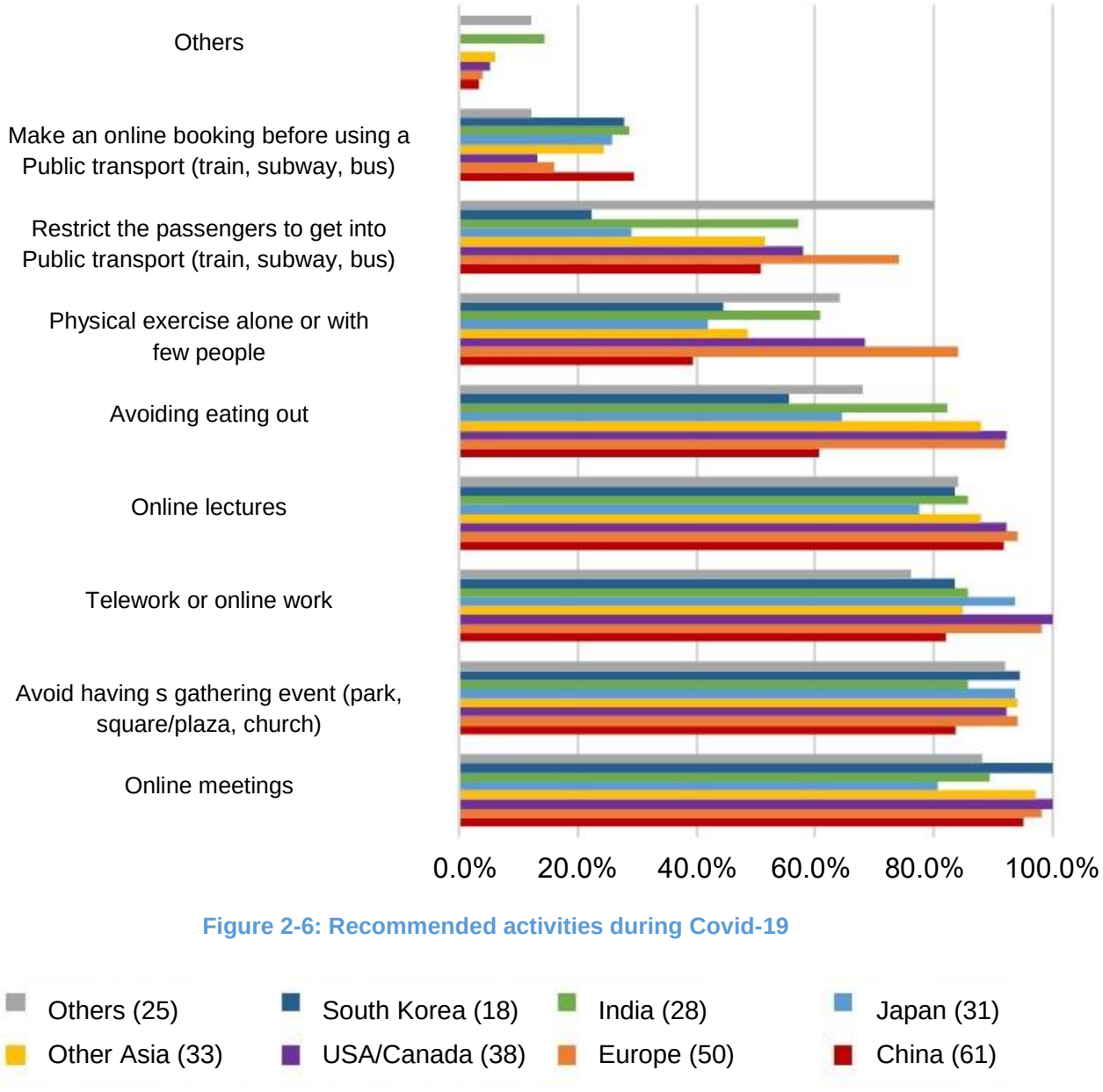


Figure 2-6: Recommended activities during Covid-19

As per figure 2-6, the foremost recommended activities during Covid-19 pandemic are online meetings in 94.0% of cities/towns, avoiding gatherings 90.5%, telework or online work 88.7%, online lectures 88.4%, and avoiding eating out 76.4%. Importantly, in 54.6% of cities/towns, it's recommended to limit passengers on train, subway, bus, and in 22.2% of cities/towns, it's recommended to create an internet booking before employing a transport mode (e.g., train, subway, bus). These measures are useful for keeping physical distance in people when using transport, and it's therefore important to deploy and implement such kind of measures in additional cities.

Observing differences across countries in figure 2-6 “other countries” have the biggest share of restricting the quantity of passengers to board conveyance vehicles, followed by Europe. Considering the effectiveness as a physical distancing measure, transport demand control should be promoted however, as an example, it's not popular in Japan, which was still facing an increasing number of Covid-19 infections and deaths. Another feature is the share recommending exercise alone or with few people is that the highest in Europe. Many facilities are closed like schools 64.1%, offices 46.5%, factories 44.7%, and stores 34.2%, while restrictions are put on people who can make a trip 40.1% and on trip frequency 15.1%. In 17.6% of cities/towns, no physical exercise or walking dogs outside houses/apartments is allowed, while medical emergencies 56.3%, medical retrieval 50.7%, and shopping of daily necessities 55.3% are allowed. As for country comparisons, South korea, Japan and China had much lower shares of restricted activities, while the shares in Usa/Canada, Europe, India, other Asian countries, and other countries are extremely high.

Now, figure 2-7 shows differences across countries with changes in lifestyles based on the shares of “fully agree” and “agree”, that the car dependence will become more the popular share in the USA, followed by India. In India online shopping and working is to become more preferred, but also show the highest share who believe that society will become more isolated due to the progress of online activities and with developing smart technologies. Online shopping will become more popular in South Korea and the popularity of online shopping in Europe and USA/Canada as well as Japan is evaluated to be lower than that in other countries. Working hours will become longer

in India and other Asian countries and the top three countries with the highest statement of that “infection risk level of a job will determine job choices of people” are Japan, India and other Asian countries. These everyday lifestyles have changed due to the pandemic and will continue to connect with people in the future (Junyi Zhang and Yoshitsugu Hayashi, 2020).

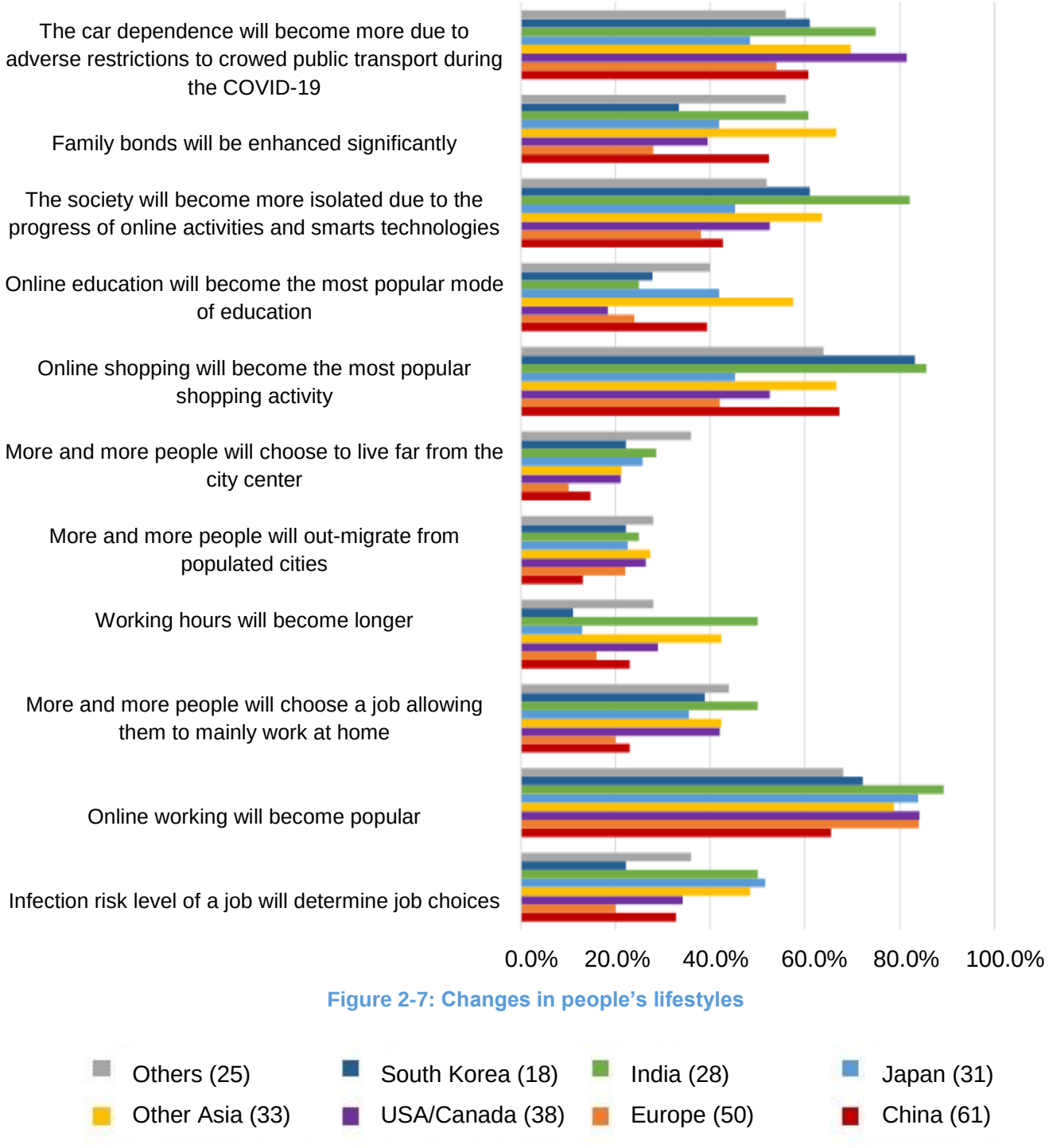


Figure 2-7: Changes in people’s lifestyles

CHAPTER 3 - RESEARCH METHODOLOGY

3.1 Methodology

The objective of this study is to understand the impact of Covid-19 on travel pattern of Ahmedabad city by comparing the mode choice behavior and frequency of various purposes of trips before the outbreak, during the outbreak or pre-lockdown and after the lock down or post-lock down period and impacts of pandemic Covid-19 on mode choice of people, public transport conveyance in AMTS and BRTS, ridership by people, and vehicular ownership. Additionally, this study discusses the essential needs of public transport within the city of Ahmedabad and describes the current situation of public transport so as to achieve right perception about this situation and make favorable decisions for the longer term.

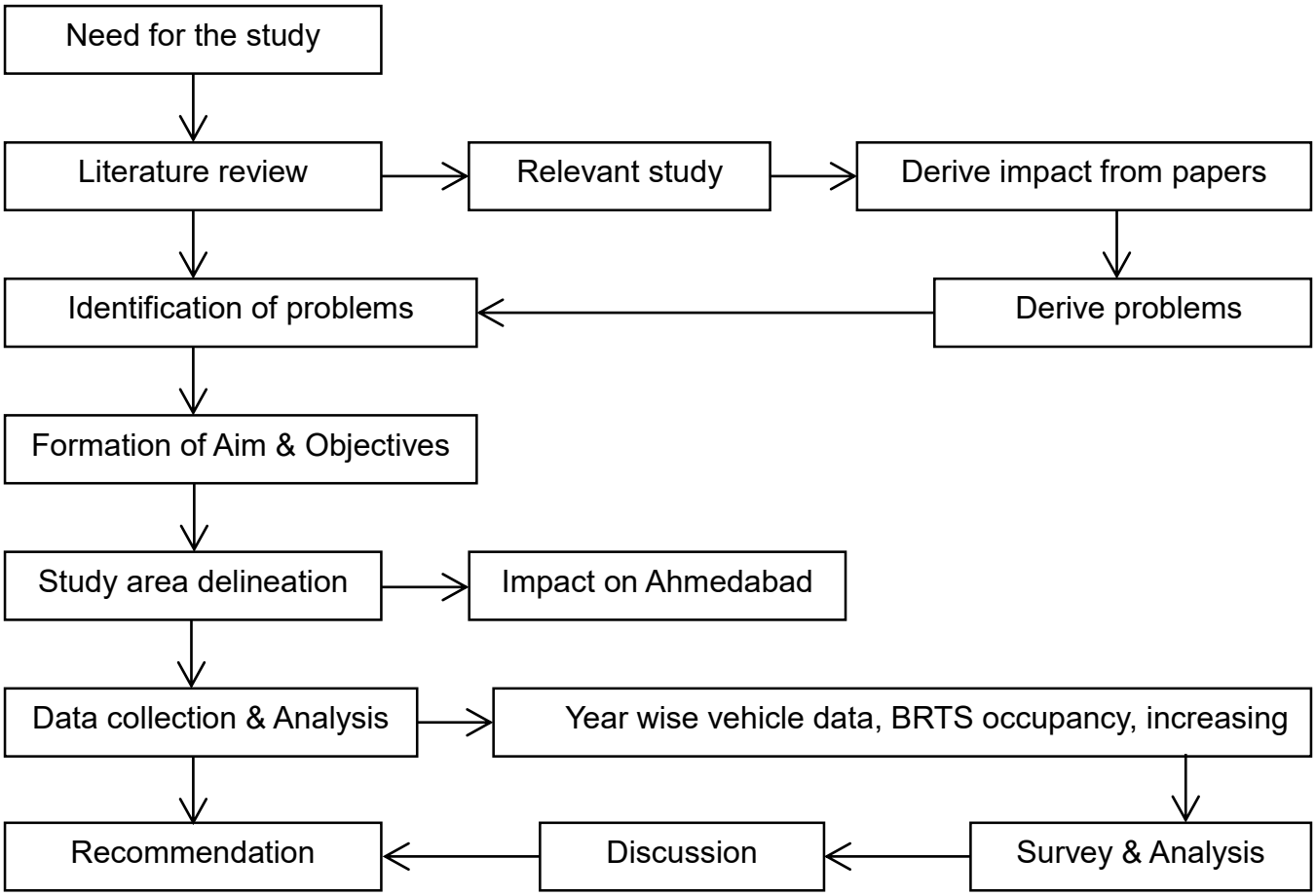
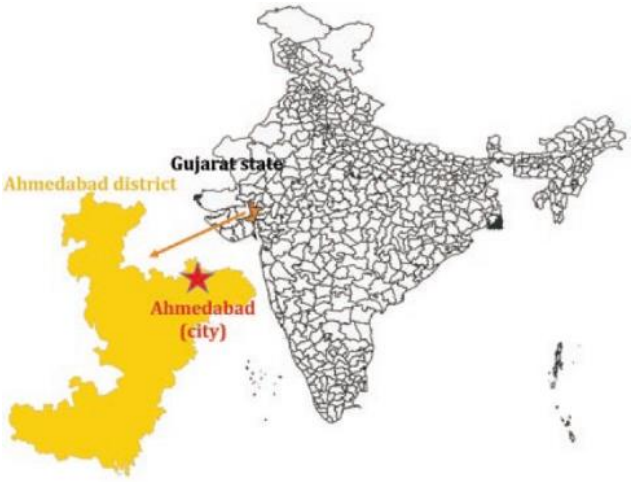
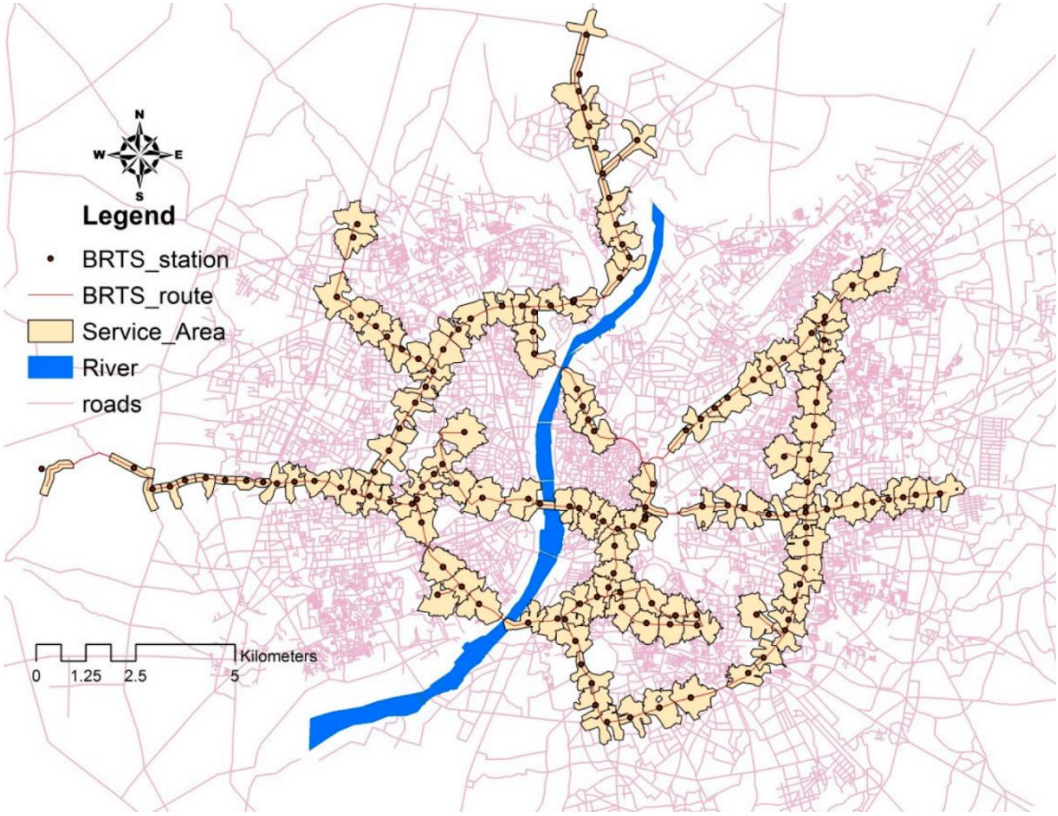


Figure 3-1: Methodology

3.2 Case of Ahmedabad BRTS



Map 3-1: Ahmedabad District



Map 3-2 Ahmedabad Janmarg BRTS

(Source: google.com/images/)

The BRTS system is operated and managed by Ahmedabad Janmarg Limited (AJL), a Special Purpose Vehicle (SPV) incorporated under AMC.

3.3 Data collection and analysis

3.3.1 Ridership in AMTS & BRTS

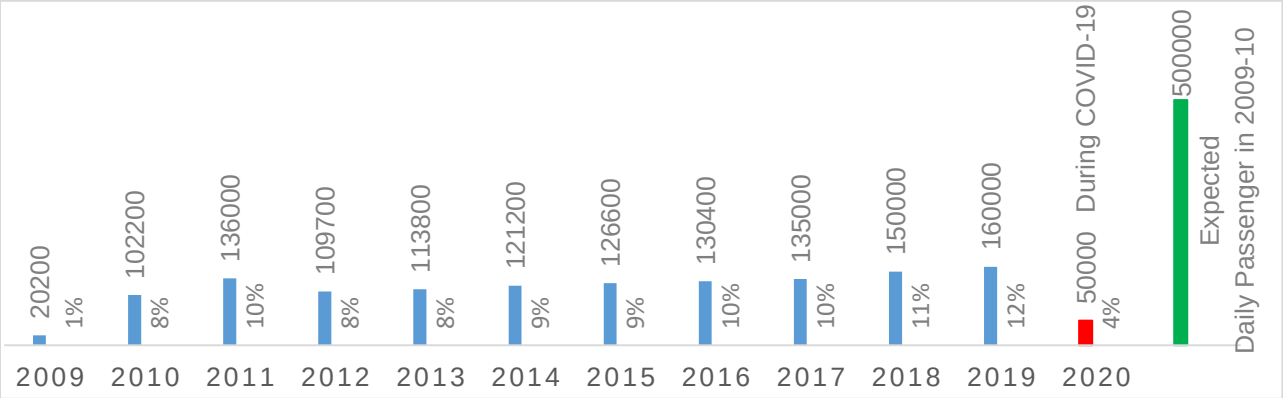


Figure 3-2: Average daily passengers in BRTS

The BRT system (Bus Rapid Transit System) in Ahmedabad city was started in the year 2009 which is known as “Janmarg” and in the year 2009-10 the average daily passenger was expected to be 500000 but by 2019 it has failed to reach up to 500000 passengers even during a decade. Figure 3-2 explains by 2019 there are only 160000 daily commuters traveling in the BRTS. (Shalini Sinha, April 2019)

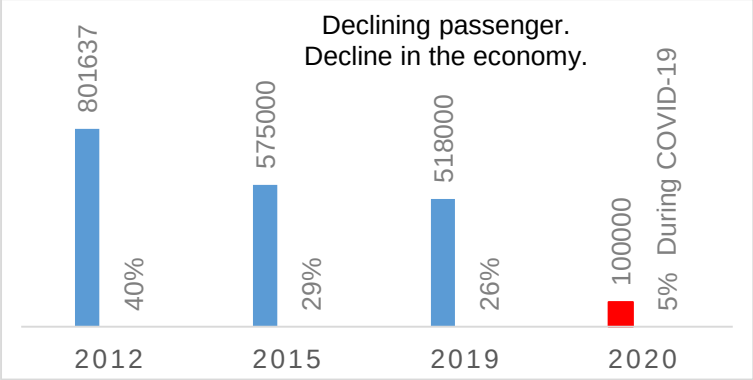


Figure 3-3: Average daily passengers in AMTS

(Source: https://portfolio.cept.ac.in/2021/Ravi Sharma)

Ahmedabad started its Municipal Transport service (AMTS) in 1947, which is now one of the oldest urban transport organizations in the country and it had been started with 112 buses. The decline in average daily commuters in the AMTS transport service from 2012 to 2019 means that personal vehicles are on the increase and therefore the public transport system is failing to attract people.

In 2012, the number of daily passengers in AMTS transport it was average 800000 but after the development of BRTS system, both the transport systems are running at a loss and the loss of passengers has also led to financial loss. The situation in the year 2020 is due to the pandemic Covid-19 but by 2019 there has been a significant decline in daily commuters which indicates the failure of public transport system in Ahmedabad city. It means that the reason for the decline in passengers in public transport is the development of the BRTS system. Now due to the pandemic the number of passengers in both the transport systems has come down to 100000 in AMTS and 50000 in BRTS respectively. The pandemic has a long-term impact on society and public transport so it could have an impact in the future that could reduce the number of passengers from the current number. Such a situation would reduce the existence and necessity of public transport as people would avoid traveling in public transport and also reduce unnecessary trips which would reduce the number of passengers in public transport.

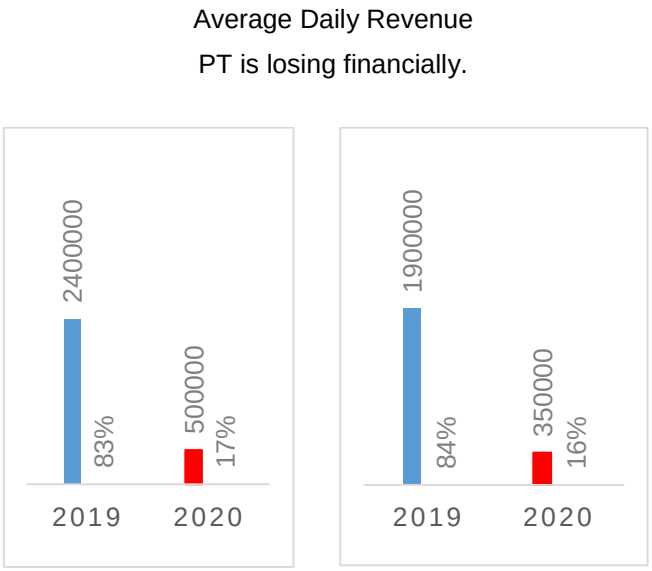


Figure 3-4: Average daily revenue before and after pandemic in AMTS & BRTS

Both AMTS and BRTS have shown daily revenue of the transport system till year of 2019 which is 2400000 and 1900000 respectively which has come down to 500000 and 350000 due to low number of passengers and this effect is due to the pandemic Covid-19 but the pandemic will still reduce the number of passengers in public transport which will cause financial loss on both the transports in the future.

According to the analysis, after the development of BRTS in Ahmedabad, the number of passengers of both public transport system AMTS and BRTS has significantly decreased. The number of daily passengers of both AMTS and BRTS in the year 2019 is 518000 and 160,000 respectively which is less than the average passenger of AMTS in 2012 which is 801637. This means that as the public transport system develops, the number of daily commuter's decreases.

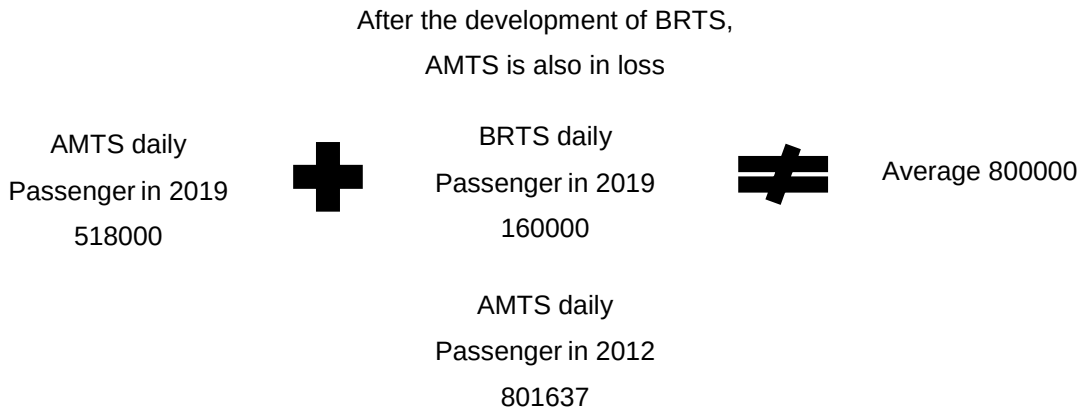


Figure 3-5: Analysis of average daily passengers in AMTS & BRTS

The development of public transport in the city is meant to reduce road traffic, reduce traffic congestion and reduce accidents but the use of public transport is decreasing day by day and the number of passengers is decreasing and it proves that public transport has failed in Ahmedabad and BRTS has been unable to fulfill its objectives.

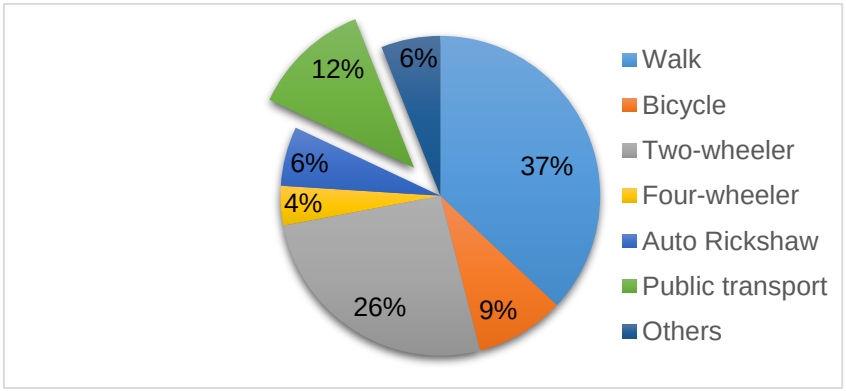


Figure 3-6: Mode share 2011

As per the year 2011, 12% of the people in Ahmedabad city use public transport which will see a decreased in the future.

What could be the reason for the decline of daily commuters?

- The decline in public transport is not due to the pandemic but also the declining number of passengers in AMTS before the year 2020 and the BRTS has been unable to fulfill its objectives.

- There should be a detailed market survey for commuters, I had researched various things regarding this but I could not find market survey related to public transport before established or introduced new public transport system BRTS.

- Survey is much needed for finding out the requirements of any new transportation system. It should have a focus group of daily commuters.

This may be the reasons

- **Fare**
  BRTS fare is 1.5 times higher than the AMTS.

- **Distance**
  People have to travel separately to reach the BRTS stand.
  To travel in BRTS, people have to go to BRTS stand using transport mode like auto rickshaw

- **Place**
  BRTS may not be available where people want to travel.
  People have the option of a company bus to reach their destination.
  People travel easily with the buses provided by some companies so they do not need public transport and do not even have to wait for the bus.

- **Individual rise in income**
  Perhaps the rise in income of individual may have encourage them to purchase their own vehicles.

3.3.2 Vehicle ownership

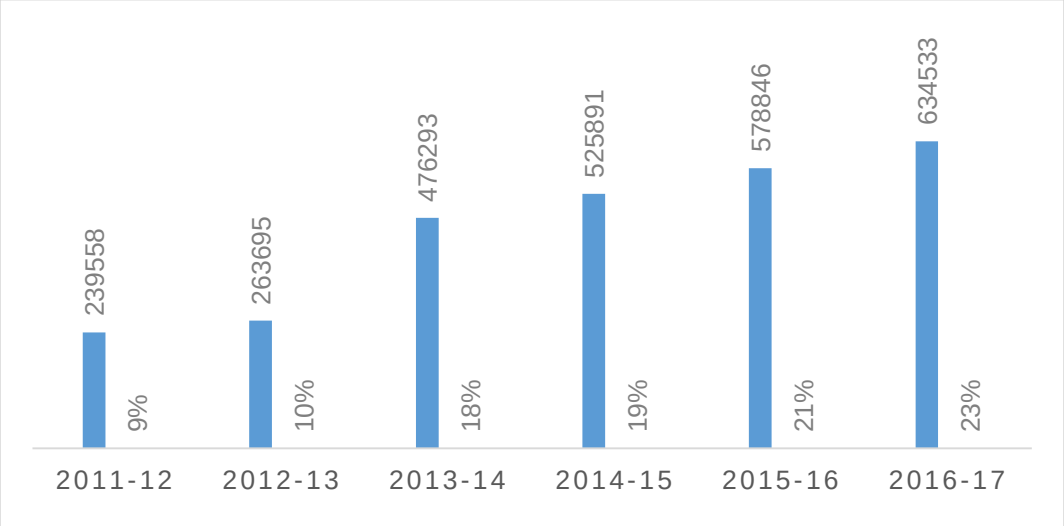


Figure 3-7: Year wise growth of four wheelers in Ahmedabad city

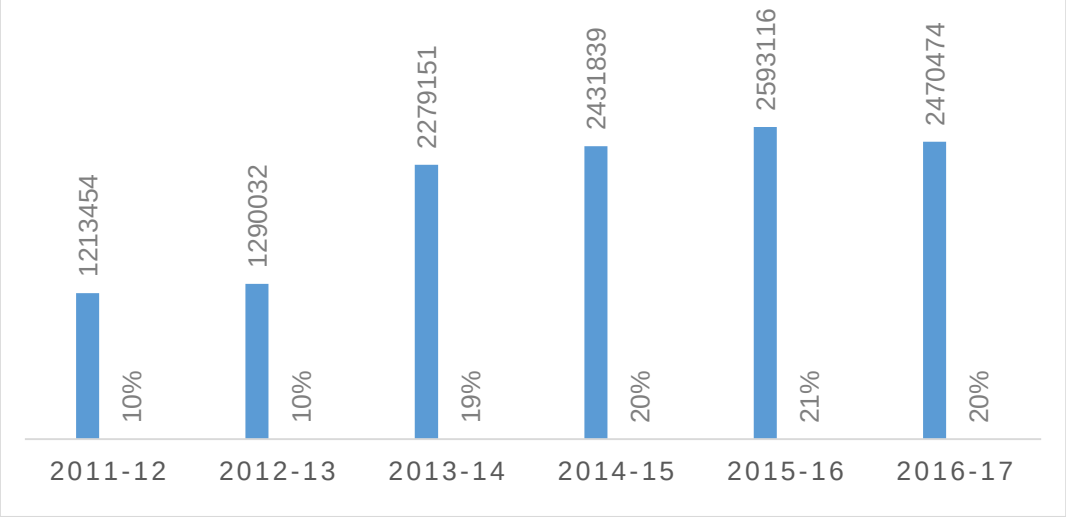


Figure 3-8: Year wise growth of two wheelers in Ahmedabad city

(Source: Road transport year book 2006-17)

Despite having 2 public transport systems in Ahmedabad city AMTS and BRTS, the number of personal vehicles two wheelers and four wheelers are increasing day by day which reduces the use of public transport and proves the failure of public transport in the city. An increase in the number of vehicles two wheelers and four wheelers have been shown from the year 2011-12 to the year 2016-17 which has increased two to three times in the year 2016-17 as compared to the year 2011-12.

3.3.3 Metro forecast

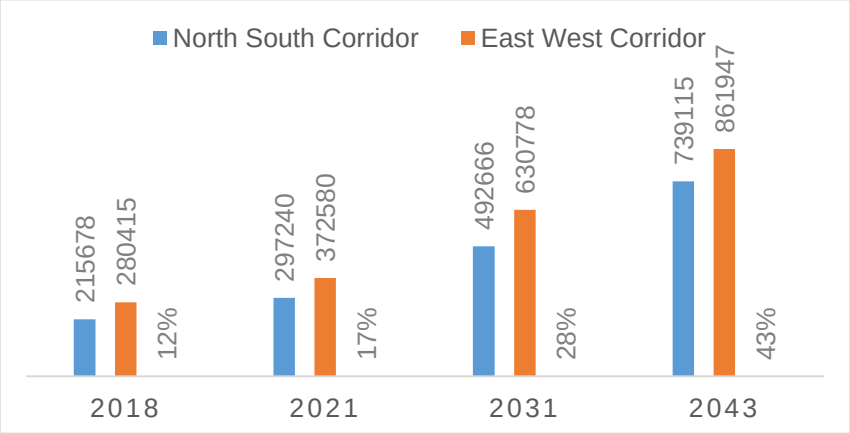


Figure 3-9: Forecast daily ridership in metro

(Source: Dpr for Ahmedabad metro rail project, 2015)

Metro Rail, the third mode of public transport in the city of Ahmedabad, is being developed and daily commuters have been forecast from 2018 to 2043. This forecast has been proven wrong due to the pandemic Covid-19 and the metro will also be affected by the pandemic with this low number of passengers. The impact of the pandemic is a sudden situation but even though both the city's AMTS and BRTS transport systems are experiencing a decline in daily passengers, if the metro is being developed in the city, the metro will also fail as passengers will not travel in the metro like AMTS and BRTS. The population of the city is increasing with 8.3 M (2021) even in the absence of pandemic, although public transport is declining in user's demand and the third mode of public transport metro is developing in city, so this development seems unsuitable.

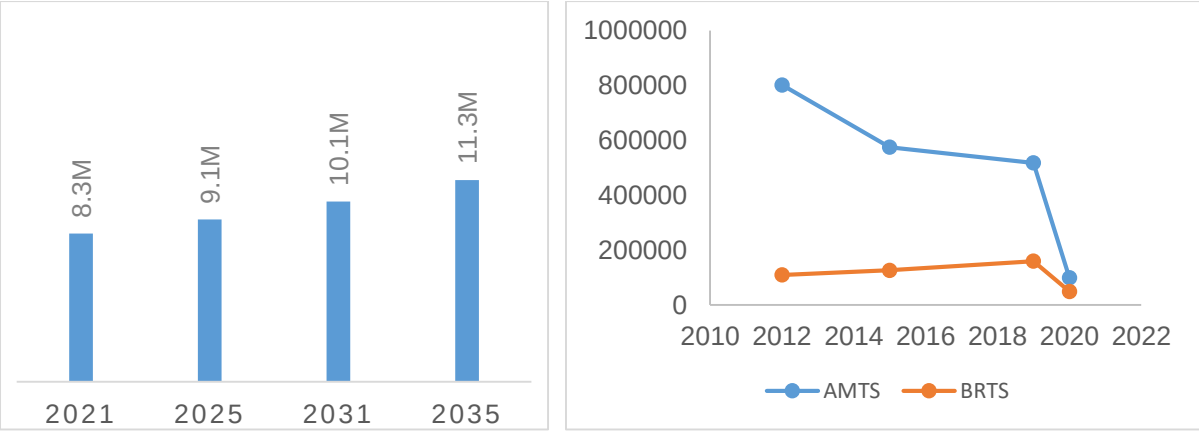


Figure 3-10: Population projection of Ahmedabad city and decaling public transport

3.3.4 In migration and out migration

Migration is a part of urbanization and in developed cities migration takes place but pandemic have caused out migration.

Migration from other state	695000
For work and employment	445000
business	91043
Education	25471
Marriage	437000
Moved after birth	164000
Moved with house holds	584000

Table 3-1: In migration in Ahmedabad city

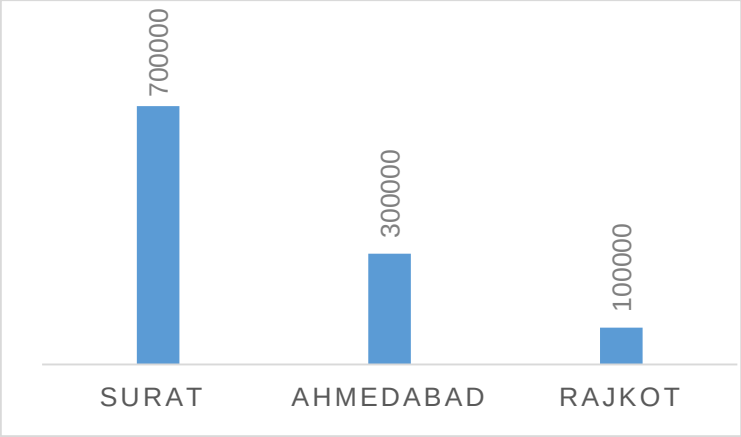


Figure 3-11: Out migration during Covid-19 from city

(Source: https://timesofindia.indiatimes.com)

- 14.97 lakh migrant workers returned to their home states from Gujarat.
- Highest number of laborers left from Surat, Ahmedabad & Rajkot.
- Migrant workers faced income loss, food shortage and uncertain future and other difficulties.
- More people may migrate depending on the situation.
- This will reduce the rush and impact on public transport.

3.3.5 Registered vehicles

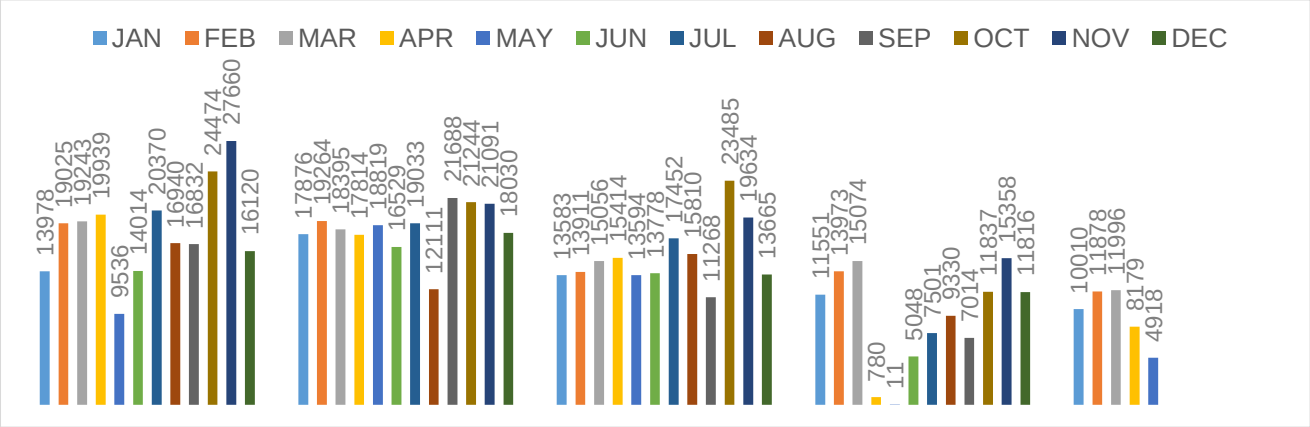


Figure 3-12: Total registered numbers of two wheelers in Ahmedabad city

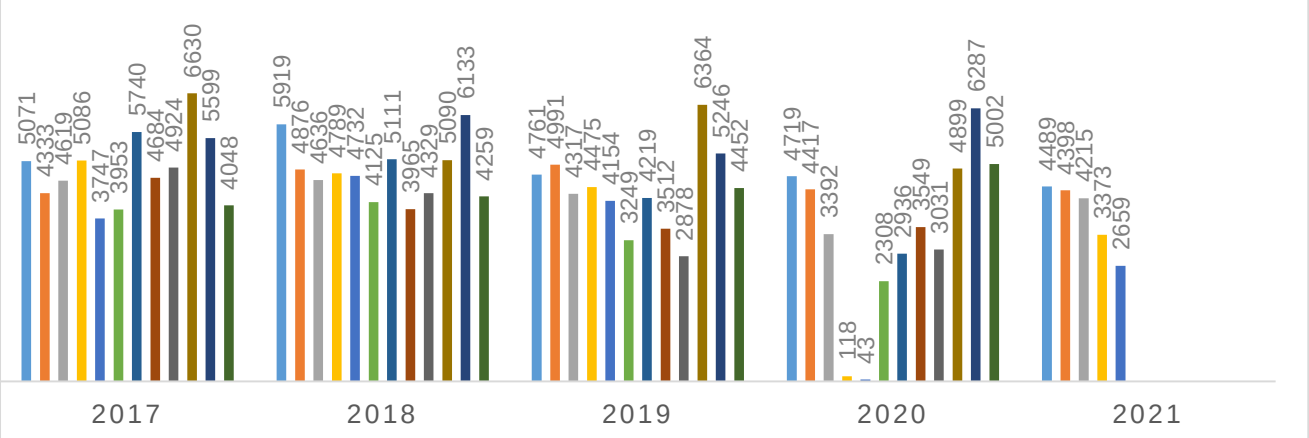


Figure 3-13: Total registered numbers of four wheelers in Ahmedabad city

(Source: https://vahan.parivahan.gov.in)

There has always been an increase in the number of private vehicles in developing cities which efforts have been made to reduce on the basis of public transport but still private vehicles have increased. The number of two wheeler and four wheeler vehicles registered in Ahmedabad city from the year 2017 to May 2021 is in which the number of vehicles has decreased during the year 2021 as compared to other years due to the impact of the pandemic Covid-19. The city's public transport has failed to reduce the number of private vehicles but the reduced number of vehicles has led to many benefits like reduction in traffic, decreased road accidents, Improving the pollution etc.

This significant reduction proves that people have reduced trips due to the epidemic which has also reduced travel by private vehicles so even in public transport people will travel less and for that reason, public transport has declined. This kind of effect has changed travel behavior this has never made before but, it has reduced unnecessary travel by people, reduced private vehicles on road, reduced travel distances, people are moving for concept of work from home and it has reduced petrol and diesel consumption so now people will travel less in public transport due to factors

3.3.6 Survey and analysis

Overall, mobility in India has been significantly impacted by the lockdown imposed as a result of the pandemic. Even during the 'unlocking' stages, public transport has witnessed reduced ridership and travel demand. To capture the perception of people are in city an online survey was conducted through social media platforms during March and April 2021. The form was divided into different sections which has included age, gender, marital status, profession, household income, and household and individual vehicular ownership and another section was about to focused on capturing the impact of the pandemic Covid-19 on travel behavior, which includes stated mode preference after lockdown, reasons for change in travel behavior and willingness to buy new vehicles. The purpose of this survey was to assess the general trend towards the change in travel behavior during lockdown and in the unlock phase and an additional limitation of the survey was that it was not able to reach out to respondents who are without access to internet and social media. A total of 580 people from the city responded who live near or far from the BRTS station from which the perception of the people towards the public transport of a city can be known.

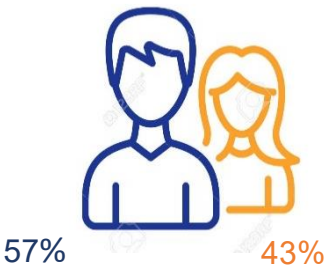


Figure 3-14: Respondents

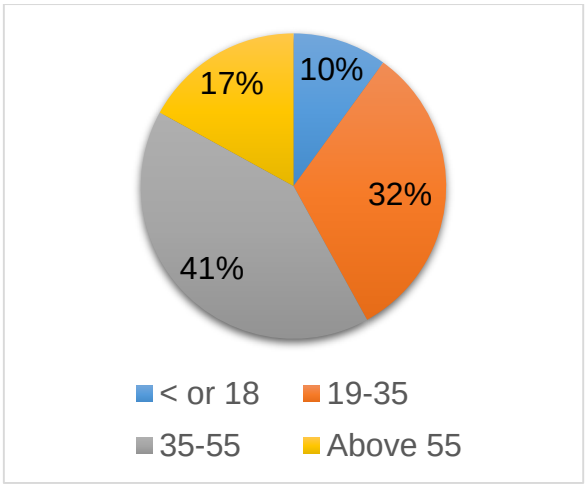


Figure 3-15: Marital Status

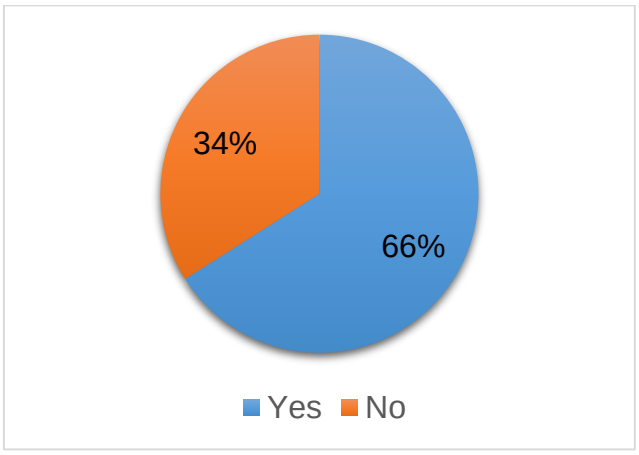


Figure 3-16: Age

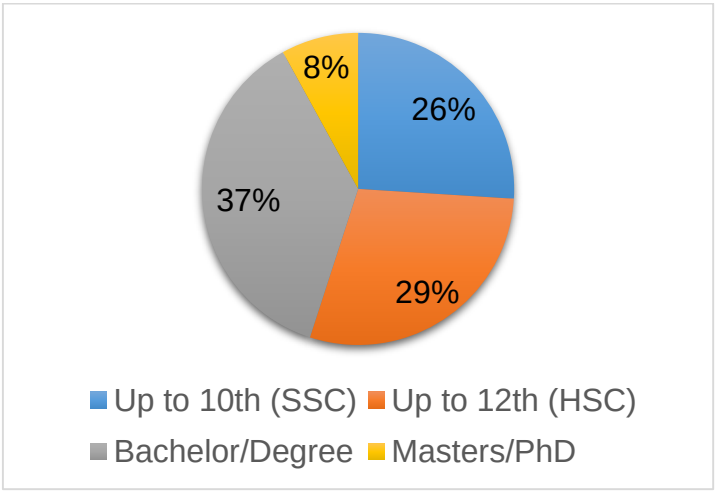


Figure 3-17: Education Qualification

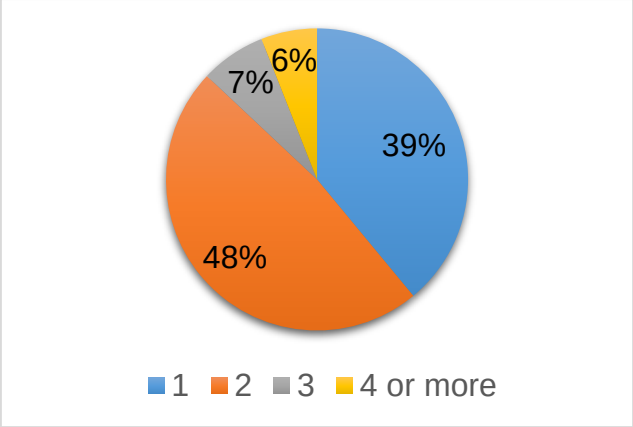


Figure 3-18: Total number of earning family members

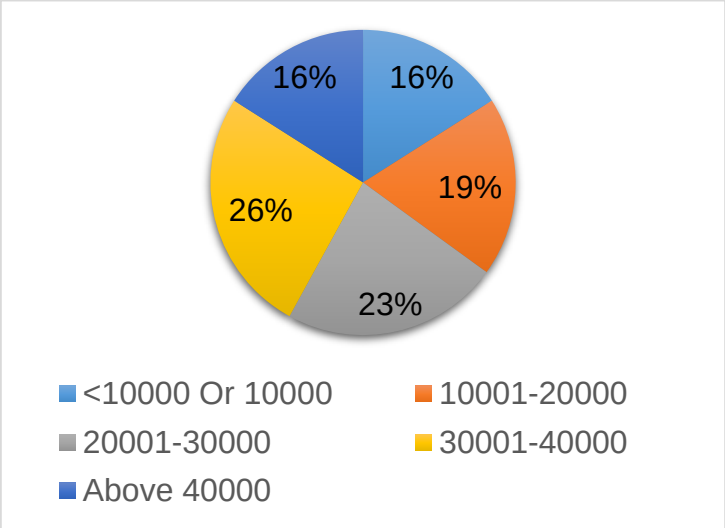


Figure 3-19: Average monthly Income (INR)

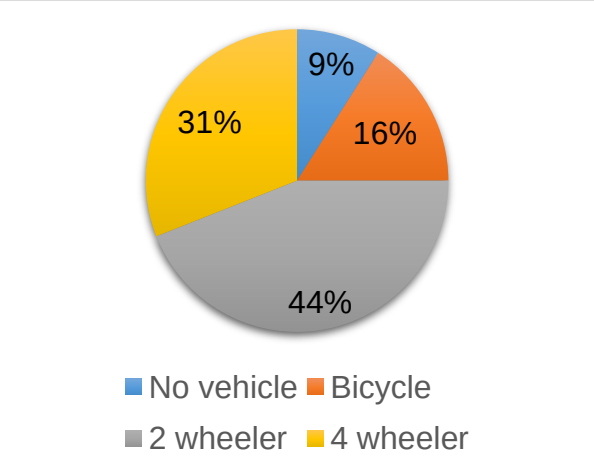


Figure 3-20: Vehicle occupation

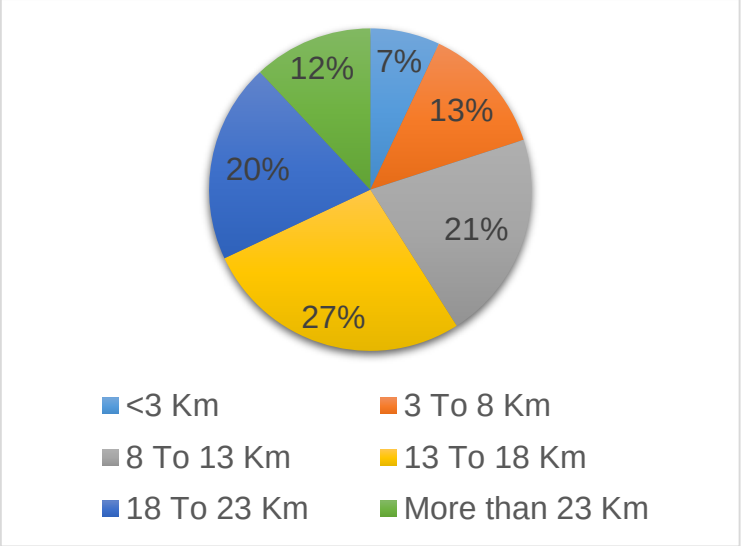


Figure 3-21: Distance between your place of residence to place of work

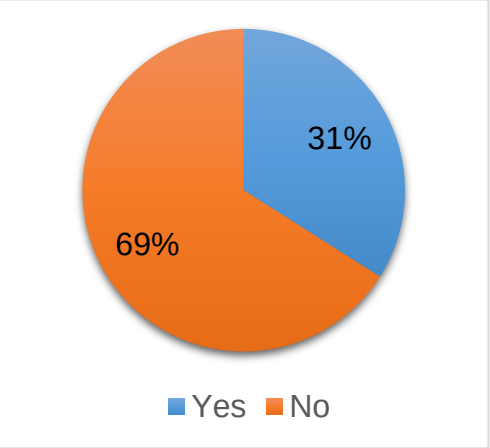


Figure 3-22: Did you travel on public transport before Covid-19?

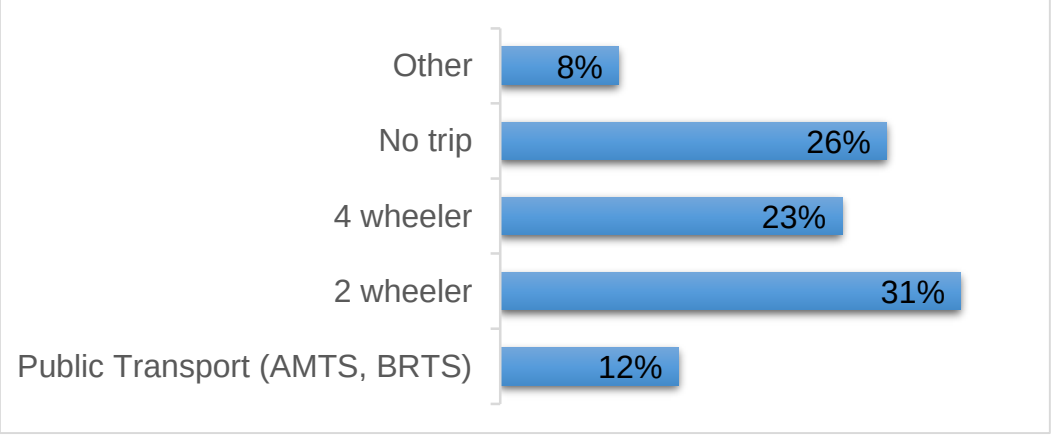


Figure 3-23: Travel mode during Covid-19

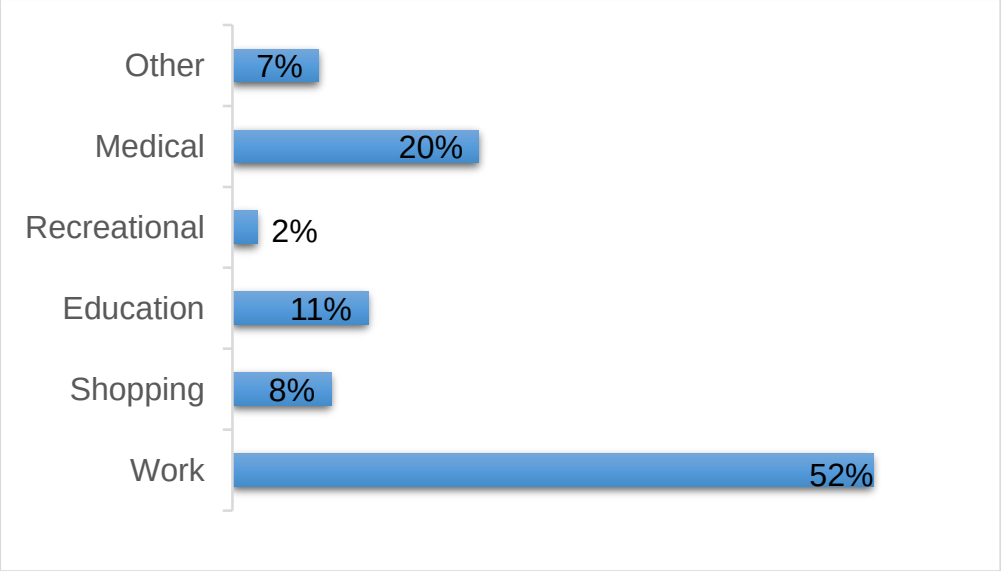


Figure 3-24: Travel purpose during Covid-19

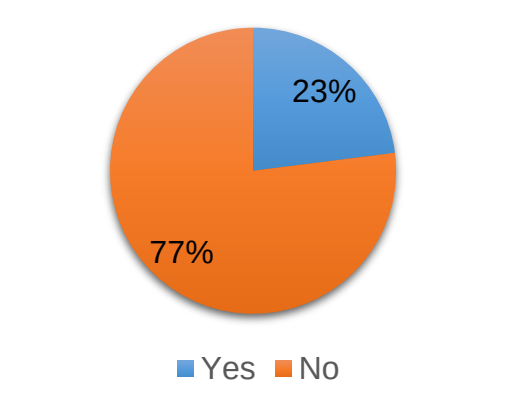


Figure 3-25: Is social distancing maintain in public transport?

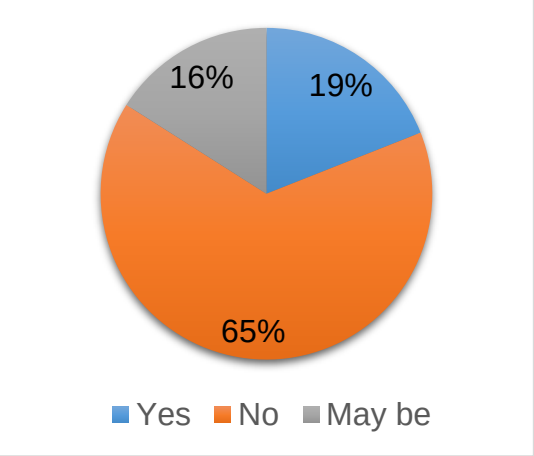


Figure 3-26: Would you prefer to travel by public transport after Covid-19?

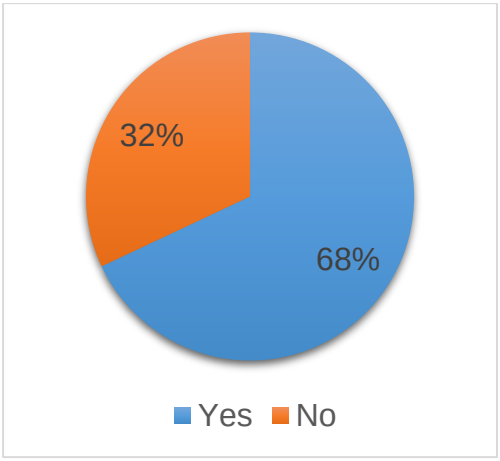


Figure 3-27: Do you feel uncomfortable on public transport?

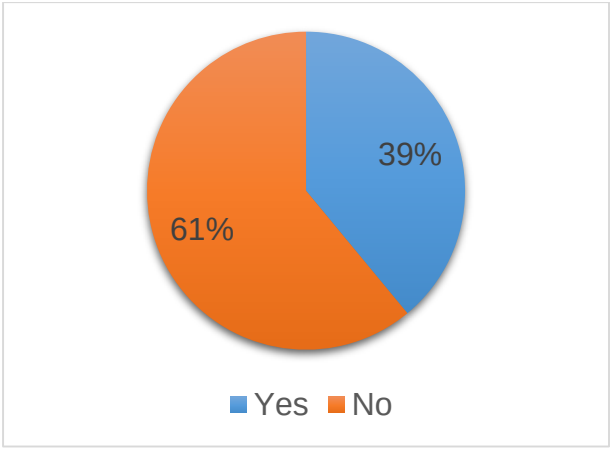


Figure 3-28: Prefer concept of work from home?

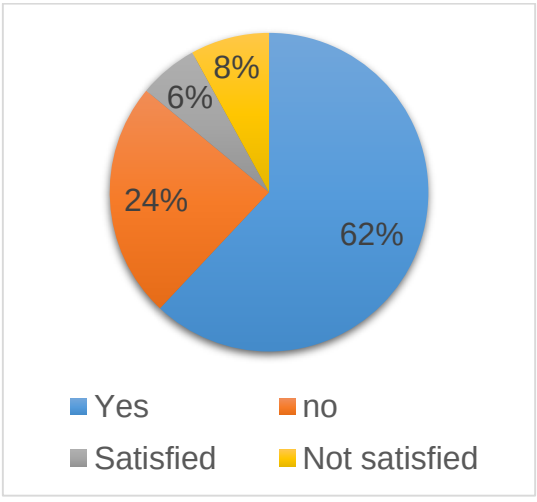


Figure 3-29: Prefer to shop online during or after Covid-19

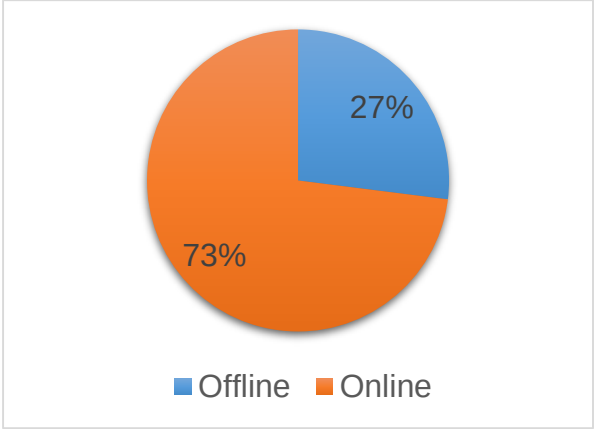


Figure 3-30: Study preference during & after Covid-19

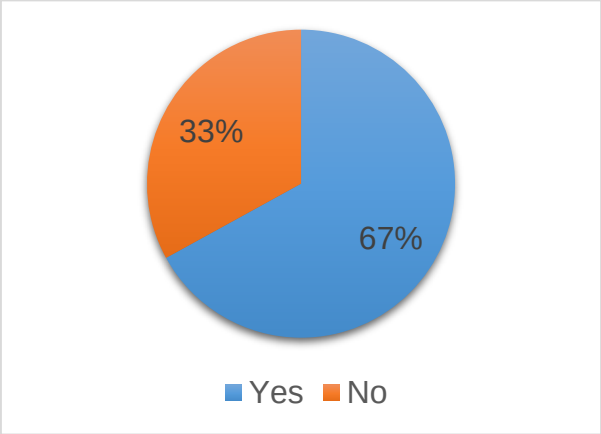


Figure 3-31: Would you prefer to buy a private vehicle during Covid-19?

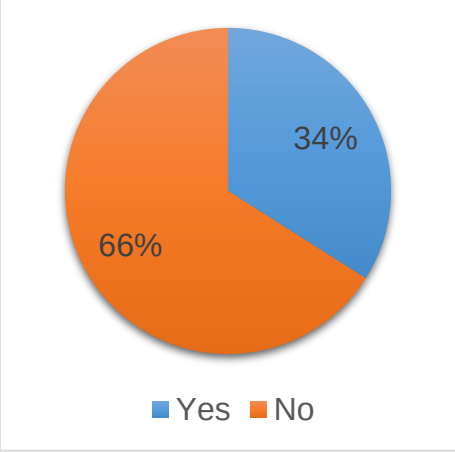


Figure 3-32: Prefer cycling

The sample distribution by gender reveals responses from 43% females and 57% males. Samples collected have the proportional distribution of low, medium and high-income groups of people in city. Maximum 41% of the respondents belong to the age group of 35-55 years, followed by 32% in the age group of 19-35 years, 17% in the age more than 55 years and rest 18% belong to the age less than18 years. Overall, 9% of the respondents do not own any vehicles, 9% only cycle, 44% own only a 2-wheeler, 31% only a 4-wheeler. In this way the behavior of the people during and after pandemic situation, what the various modes of transport they use for safety in the future and these all changes in the people that can be estimated from all the given figures with questions have shown here with present of answers. Now after this pandemic situation, it is interesting to observe the uses of public transport by people and various mode shifts during the outbreak of Covid-19 and after the lockdown.

CHAPTER 4 - RESULTS AND DISCUSSION

It is clear that social distancing will continue to be the norm and public transport in city means that such social distancing will pose a significant changes and challenge. As from the responses public transport is likely to be negatively impacted and there is also a possibility of increased vehicular ownership after lockdown and this shift away from public transport to private modes will lead to increased demands of road space. This requires that some decision to be made for the city's public transport system and must be considered.

Analyses of survey results revealed serious impacts of Covid-19 on public transport, according to a survey conducted here, there are 69% people do not travel in the city's public transport system AMTS and BRTS remaining 31% people travel in the public transport system as per the pre-pandemic situation so these percentage of people who travel in public transport is also possible to decrease. Now maximum 77% people have the opinion about, that norm which social distancing is not maintained while traveling on public transport (e.g. Bus, metro) so according to this survey, there is a possibility that 77% people will travel less in public transport during and after pandemic. 65% of people will not travel in public transport even after pandemic, 19% people need public transport to travel and 16% people may or may not travel. It is observed that people are more dependent on a personal mode of transportation during outbreak Covid-19 which has two wheelers 31%, four wheelers 23%, people who don’t travel 26% and 12% people depended on public transport. Most people travel only for their professional work which is 52% while other types of travel are less such as shopping 8%, education 11%, medical 20% recreational 2% and other 7%. The work-from-home concept came into existence at this during and after pandemic time so, 39% people would work with concept of work-from-home and 61% people could not, ultimately travel would be reduced by 39% according to this survey. Now that education and shopping have become more popular and preferred online, 73% of students will study online and 62% people will be comfortable with shopping online. People shifting from shared mobility to private vehicles (car and two-wheeler) may be because they feel safe in their own vehicles compare to sitting over in shared vehicles (public transport)

that carry several other passengers in a day so, 67% of people are ready to buy their own private vehicle during and after pandemic. The ultimate result is that due to the pandemic Covid-19 situation people travel less, stop moving to crowded places like public transport so the cost of public transport will increase in future and its use by people will decrease day by day.

limited to 50% of passenger's occupancy and no standing passengers.

Average daily commuters 160000 & Total fleet size 260 was in 2019 Instead of 500000 daily commuters which was expected by BRTS in year 2009-10. The decline of public transport is not only due to the pandemic Covid-19 but also the BRTS is failed to reach the expected passengers and also the decline in passengers in AMTS after the development of BRTS.

AMTS daily passenger in year 2019 - 518000

&

BRTS daily passenger in year 2019 - 160000

With 50% passenger's occupancy AMTS will carry less than 259000 passengers and BRTS will carry less than 80000 passengers which is only 6% people of the population of Ahmedabad able to travel by public transport.

Now the situation is such that from 2011 to 2021, the population has increased by 35% and public transport occupancy has decreased to 6% in Ahmedabad city. Despite of having two public transport these all statistics suggest that there is no need for three different modes of public transport for such a short commuters and private lanes have been allotted for BRTS but non-public transport travels in those lanes and the police have to be on standby to stop it so what is the need of private lane for BRTS.

CHAPTER 5 - CONCLUSION

The impact of the pandemic Covid-19 on the city's public transport and the impact on people's personal lifestyles has led to new changes and challenges which also raise questions about the city's development. The daily commuters have not been analyzed before to introduce new public transport system in the city that's why development results tend to be unnecessary and inappropriate. What can be the impact on the ridership of AMTS during the projection of BRTS has not been considered, so BRTS has broken the passengers in AMTS also. It is not necessary to develop or introduce a new public transport system for the convenience of the people but it is necessary to strengthen the existing public transport system. Now the situation is such that as private vehicles increase and public transport decreases, there is a need for proper planning for the future. People's income levels will play a significant role in the selection of mode after and during pandemic therefore it is expected that the low-Income category group and those don't have any option of travel they will use public transport for their daily commute. The public transport operator should provide proper sanitation and diagnostic measures and ensure that everyone is properly cleaned and inspected and need for e-ticketing and automated system or card sweeping has increased. ultimately it seems inappropriate to have three different modes of public transport in the city for the declining number of commuters.

5.1 Recommendations

Recommendation 1

- The third mode of public transport is Metro in Ahmedabad.
- Metro is being developed so it may be an alternative option to attract people to public transport but according to statistics, commuters in Metro may also be reduced and there may be financial loss, so its development needs to be considered, need to think about it and it should not be developed.

Recommendation 2

- Both BRTS and AMTS public transport systems are in deficit and utilities are declining.
- If BRTS is not able to satisfied and fulfill own objectives, if BRTS is not viable and not profitable then we can think about complete stoppage of BRTS and BRTS should be complete demolished. The land can be widened and it has occupied ocean of road so it can increase the width of the road and with 4 lane road in the city we can occupy and give more way to more vehicular traffic.
- Strengthen the existing AMTS public transport system in the city so that there is no need to introduce a new system.

APPENDIX I - SURVEY FORM

1. Name of Respondent: _____

2. Gender

   ○ Male ○ Female

3. Marital status

   ○ Yes

   ○ No

4. Age:

   ○ < or 18 ○ 35-55

   ○ 19-35 ○ Above 55

5. Education Qualification:

   ○ Up to 10th (SSC) ○ Bachelor/Degree

   ○ Up to 12th (HSC) ○ Masters/PhD

6. Total number of earning family members

   ○ 1 ○ 3

   ○ 2 ○ or More

7. Average Income (INR)

   ○ <10000 Or 10000 ○ 30001-40000

   ○ 10001-20000 ○ Above 40000

   ○ 20001-30000

8. Vehicle occupation

- ○ No vehicle
- ○ Bicycle
- ○ 2 wheeler
- ○ 4 wheeler

9. Did you travel on public transport before Covid-19?

- ○ Yes
- ○ No

10. Is social Distancing maintaining in public transport?

- ○ Yes
- ○ No

11. Which vehicle would you choose to travel during the Covid-19?

- ○ Public Transport (AMTS, BRTS)
- ○ 2 wheeler
- ○ 4 wheeler
- ○ No trip
- ○ Other

12. Would you prefer to travel by public transport after Covid-19?

- ○ Yes
- ○ No
- ○ May be

13. For what purpose do you travel during Covid-19?

- ○ Work
- ○ Education
- ○ Medical
- ○ Shopping
- ○ Recreational
- ○ Other

14. Can the work you are involved in be done from the concept of work from home?

- ○ Yes
- ○ No

15. What is distance between your place of residence to place of work?

- ○ <3 Km
- ○ 3 To 8 Km
- ○ 8 To 13 Km
- ○ 13 To 18 Km
- ○ 18 To 23 Km
- ○ More than 23 Km

16. Would you prefer to shop online during or after covid-19?

- ○ Yes
- ○ No
- ○ Satisfied
- ○ Not satisfied

17. How will you teach your children during Covid-19?

- ○ Online
- ○ Offline

18. Do you feel uncomfortable on public transport?

- ○ Yes
- ○ No

19. If you do not have a vehicle, would you prefer to buy a private vehicle during Covid-19?

- ○ Yes
- ○ No

REFERENCES

Alejandro Tirachini, O. C. (2020). COVID-19 and Public Transportation: Current Assessment, Prospects, and Research Needs. *Journal of Public Transportation* , 22.

Darshini Mahadevia, R. J. (2013). Ahmedabad's BRT System A Sustainable Urban Transport Panacea? *REVIEW OF URBAN AFFAIRS*, 10.

Deepti Muley, M. S. (2020). Role of Transport during Outbreak of Infectious Diseases: Evidence from the Past. 22.

Dipanju Buragohain, M. B. (2020). COVID-19 PANDEMIC AND THE SUBSEQUENT EFFECT ON PUBLIC TRANPORT IN ASIA. *UNITED NATIONS CENTRE FOR REGIONAL DEVELOPMENT* , 22.

Dr. Akanksha Jaiswal, D. C. (2020). Unlocking the COVID-19 Lockdown: Work from Home and Its Impact on Employees. 27.

Dr. Meenakshi Kaushik, N. G. (2020). The Impact of Pandemic COVID -19 in Workplace. *European Journal of Business and Management* , 11.

Junyi Zhang, Y. H. (2020). Impacts of COVID-19 on the transport sector and measures as well as recommendations of policies and future research: Analyses based on a world-wide expert survey. 36.

Lee Stadtlander, A. S. (2020). Home as Workplace: A Qualitative Case Study of Online Faculty Using Photovoice . *Journal of Educational Research and Practice* , 15.

Palak Thakur, P. M. (2020). IMPACT OF COVID-19 ON URBAN MOBILITY IN INDIA: EVIDENCE FROM A PERCEPTION STUDY. *The Energy and Resources Institute (TERI)* , 30.

Ramit Raunak, N. S. (2020). Impact of Covid-19 on Urban Mobility in Indian Cities. *Transport and Communications Bulletin for Asia and the Pacific* , 15.

Rani, D. S. (2020). Changes and challenges in work from home culture . *International Journal of Home Science 2020; 6(3): 315-319* , 6.

SanuMeena. (2020). Impact of novel Coronavirus (COVID-19) pandemic on travel pattern: A case study of India. *INDIAN JOURNAL OF SCIENCE AND TECHNOLOGY*, 12.

Sarah Alonzi, A. L. (2020). The Psychological Impact of Preexisting Mental and Physical Health Conditions During the COVID-19 Pandemic. *American Psychological Association*, 3.

Sinha, S. (2019). BRT GOVERNANCE AND CHALLENGES – A CASE OF INDIAN CITIES. 33.

Subhadeep Mukherjee, D. S. (2020). People's Perception about Quarantine and its Impact on Occupational Stress: Community-Based Online Survey Following Covid-19 Outbreak in India . *International Journal of Disaster Recovery and Business Continuity* , 12.

Vinay, A. J. (2020). Impact of coronavirus pandemic on the Indian education sector: perspectives of teachers on online teaching and assessments .22.

https://vahan.parivahan.gov.in

https://timesofindia.indiatimes.com/city/ahmedabad/15l-migrant-workers-left-during-lockdown-study/articleshow/77044207.cms

https://portfolio.cept.ac.in/2021/Ravi Sharma

https://www.business-standard.com/article/economy-policy/ahmedabad-brts-rolls-out-successfully-109102600026