

Evaluation of Indore BRT: Passengers' Perception of Services and Improvement Opportunities

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ABSTRACT

In the whole world the Bus Rapid Transit Systems are gaining popularity since is low investment option in comparison to the rail transit but has facilities tending to the rail transit. In India, under Jawaharlal Nehru National Urban Renewal Mission Scheme many of the cities have opted for the system. One of the main aims of the mission was to provide safe and quality transport system and hence the Bus Rapid Transit Systems were encouraged. Indore Bus Rapid Transit System has been working since May, 2013 and has been successfully operating to serve as a rapid dedicated corridor for bus passengers. There have been public interest litigations which include demanding scrapping the system and running the buses in mixed vehicle lanes. The system in Indore has 11.4 km straight corridor along an old highway transecting the city. The present study aims at evaluating the performance of the system based on the perception of services and improvement opportunities. A questionnaire was prepared and opinion of 368 passengers was collected and analyzed. It was found that on majority of the questions, the passengers have shown satisfaction and have overwhelmingly appreciated the system. However, there are certain points which require proper attention and if such corrections are made it will improve the performance of the system.

Keywords

Bus Rapid Transit System, Speed, Reliability, Comfort, Safety

INTRODUCTION

Population explosion in the cities of India is one of the major environmental challenges of our time. Major reason of the population explosion is not biologic but indiscriminate migration of rural population. India is experiencing the menace of swollen cities with least amenities. Larger cities have larger transportation demands in terms of traffic volumes and the travel

distances. The demand is met either by an increased vehicular population owing to private vehicle ownership or by increasing the public transit facilities. The former mode is on a rampant trend in India. This is heading to traffic congestions, environmental pollution and energy security issues in urban areas of India. In India personal ownership of vehicles is a status symbol and progress of an individual is assessed by the size of the vehicle a person owns. The open market economy and the easy credit schemes have added fire to the trend of personal motorization. This is an unsustainable trend. It is widely recognised that attempts to address unsustainable patterns of travel involve a detailed understanding of travel behaviour and the reasons for choosing one mode of transport over another. The arguments for car use, including convenience, speed, comfort and individual freedom, are well known (Anable, 2004).

The latter mode that is the public transportation (or transit) is more sustainable if it is planned, designed and operated to cover a larger area and larger population. According to Litman (2012), "Public Transit (also called *public transportation* and *mass transit*) includes various services that provide mobility to the general public in shared vehicles, including shuttle vans, local and intercity buses, and passenger rail." Laying the stress on the increased safety of an individual, Litman (2013) states, "Public transportation is a very safe mode of travel, and total per capita traffic casualties tend to decline as public transit ridership increases in a community." In Indian context the public transit in most of the Tier II cities are dominated by Para-Transit mode of transport and the buses. It is necessary to promote measures that can reduce private transport dependence and increase public transport use. This is not an easy task because there is an underlying resistance of people to move from private to public transport (STIMULUS, 1999).

There is a difference in the rail transit and bus transit in a sense that the rail transit has a fixed corridor and unobstructed movement but the buses normally share the

roads which have mixed traffic conditions. Rail transport and its modern form is a fast mode but requires huge initial investments. The vehicles of public transportation especially the buses face tremendous impedance in moving on the city roads. This leaves the bus operated public transport a slow moving transport system and more and more people develop an aversion for the use of public transport. According to Deng and Nelson (2013), "Bus services are often criticized for the slow operational speed and infrequent, inconvenient and unreliable service. As a rubber tyre system, the BRT system needs to overcome the negative perception of bus services through effective marketing, branding and the modern design of buses and stations." Bus Rapid Transit System (BRTS) is a concept in which the buses are plied on a dedicated corridor. BRT has been defined by the Transit Cooperative Research Programs "a rapid mode of transportation that can provide the quality of rail transit and the flexibility of buses" (BRT Reference Guide). ITDP (2007) has more elaborate definition, "*Bus Rapid Transit (BRT) is a high-quality bus-based transit system that delivers fast, comfortable, and cost-effective services at metro-level capacities. It does this through the provision of dedicated lanes, with busways and iconic stations typically aligned to the centre of the road, off-board fare collection, and fast and frequent operations and excellence in marketing and customer services.*"

In India, under JNNURM Scheme many of the cities have opted for development of a BRT system. One of the main aims of the JNNURM was to provide safe and quality transport system and BRT system was encouraged. A detail on aspects of BRT systems in India are found in the report by UNEP (2013). The Janmarg system in Ahmedabad demonstrates how fast a BRT system can become the backbone of a city's transport network. What began as a 12.5 km pilot corridor in 2009 is expected to span 88 km by 2013, providing connectivity across the city' (ITDP, 2011). In Indore a BRTS system (closed type) has been executed for a length of 11.5 km on east while National Highway No. 3 connecting Mumbai and Agra. The BRT system is laid between Niranjapur in north to Rajeev Gandhi Chouraha is south of Indore city in the year 2013. More details and the features of the Indore BRT system are presented in following text. Presently there are other cities in India which either have a BRT system or have been proposed. The cities are Pune, Bhopal, Rajkot, Chennai etc.

The evaluation of BRT system is an important aspect as regards the improvements of the system are concerned. Many researchers and agencies have evaluated the BRT

systems worldwide. A study by Hidalgo and Pai (2010) the Delhi BRT Corridor has been carried out for the lessons learnt and recommendations. They mention, 'One of the initial projects in India, the Delhi Bus Corridor, has been controversial: media outlets highlighted problems for the general traffic and safety, while user surveys showed improved perception by bus users, bicyclists and pedestrians. The discussion of the benefits and problems of the corridor has been mostly based in perceptions and prejudices.' Gautam Raj et al. (2013) carried out a traffic simulation study on VSSIM Software to evaluate the Delhi BRT Corridor to assess the speed, travel time, delay and capacity. DEng and Nelson (2013) evaluated Beijing BRT and concluded that it is one of the key measures for promoting sustainable mobility. Hidalgo et al. (2013) evaluated the Bogota Mass Transit System which has BRT as a major component on the issues of cost-benefit analysis including monetary valuation of direct impacts on travel time and travel cost and externalities, such as improved road safety and air quality, impacts on crime, land values, employment and tax revenue etc. They conclude that though the system has improved on all these points but further improvement in the services are required. Gandhi et al. (2013) compare two designs of BRT System viz., the open system and the closed system to establish the usefulness of the BRT system. Their results show that bus operational speeds in open systems are approximately 25% less than those in closed systems however, the passenger speed is more in open system for a shorter journey. Nelson has presented the performance and benefits of the BRT System. Present study is also aimed at evaluation of Indore BRT according to Passengers' Perception of services. The details of the study and the findings are presented in following paragraphs.

BRTS INDORE

Indore a two tier city in central India with population 2.3 million having rapidly growing urban area, growing traffic congestion and air pollution, also growing accidents. Looking to these problems Indore BRTS Project was started in the Yr. 2013 with road length of 11.5 km from Niranjapur to Rajeev Gandhi Intersection with the objective of integrated model public transport which was fast comfortable safe reliable and eco friendly. It is closed type of BRT with 20 median stations and 1 kerb station. The buses are called i-Bus. The bus stations are featured with enclosed premises which incorporate sliding screen doors, staffed ticket booths, information booths and displays, bus arrival information displays, limited seating provisions, Wi-Fi facilities etc. Platforms are level with the bus floors for quick and easy boarding, accessible for

disabled passengers and children with minimum delay. Ticketing is done off board and checking is done in the buses. 34 i-Buses with ridership of 45,000 passengers/day at an average is running successfully with frequency of 4 minutes, so the waiting time and overcrowding of passengers is reduced significantly. Indore BRT system has high capacity, high quality, air-conditioned buses with capacity to carry 80 passengers at a time. The buses are having separate seating arrangements for ladies and gents also separate exit for females. In the beginning the buses were carrying an average of 2,046 passengers per day but now the number of passengers have increased up to 45000 passengers per day .Also now the waiting time for bus passenger has reduced up to 3 minutes from 10 minutes at the beginning and now there is 26% increase in journey speed (Source: Indore BRTS Wikipedia and information from AICTSL office)

THE PROBLEM

In a recent decision a BRT system running in Delhi has been insistently planned to be scrapped. Litigations are filed in the various courts and the present government in Delhi is also thinking of scrapping the present BRT corridor. Indore BRT is also facing lots of litigations on various issues and aspects of its implementation. The main reason for all such litigations seems to be bias for the personal motorization by the rich and affluent citizens who

incidentally are intellectuals also. These citizens have either not understood the woes of a common person staying in a large city and spending much time in slow moving public transport which is devoid of many facilities. These intellectual citizens have an eye on additional right of the way that will be available once the BRT system is scrapped. Though, BRT systems occupy a substantial share of right of the way of any road the passenger carrying capacity is much more and the speed of the BRT buses is quite competitive with that of the personal vehicles. If operated with proper systems such as smart ticketing, inclusive planning etc. The BRT can be proven to be a boon for a city's transportation system in terms of reduced congestion and low carbon emissions. The present study is aimed at an evaluation based on the public opinion about the BRT System and its operation.

MATERIALS AND METHODS

Present study is based on a survey carried out amongst the users of BRT to gain a feed back of the system and its operation. In all 800 people were surveyed. The feedback from the survey has been discussed and at the end a conclusion has been drawn. In all 368 passengers were surveyed. The feedback collected is prepared in the form of results shown in following paragraph. The sample questionnaire was prepared and was consider in the present study. The feedback form is presented in Table 1.

Table 1: Feedback Form

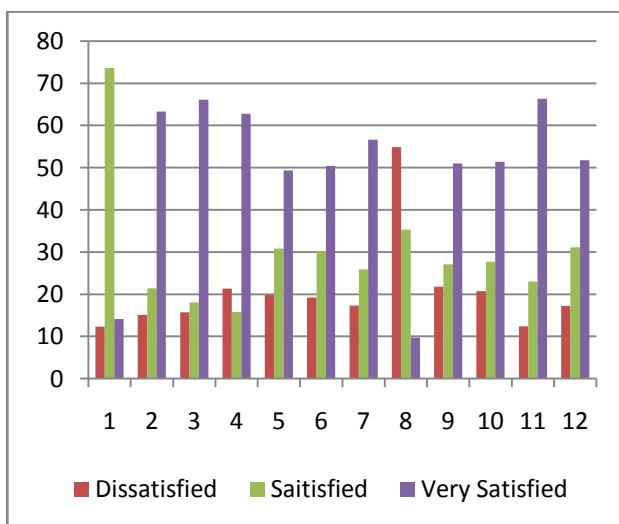
DATE:	NAME & ADDRESS	
ORIGIN:-		
DESTINATION:-	NEAREST BUS STOP	
1	Speed	Very Satisfied/ Satisfied / Dissatisfied
2	Reliability	Very Satisfied/ Satisfied / Dissatisfied
3	Safety	Very Satisfied/ Satisfied / Dissatisfied
4	Convenience	Very Satisfied/ Satisfied / Dissatisfied
5	Frequency	Very Satisfied/ Satisfied / Dissatisfied
6	Comfort	Very Satisfied/ Satisfied / Dissatisfied
7	Cleanliness	Very satisfied /satisfied /Dissatisfied
8	Pedestrian crossing	Very Satisfied/ Satisfied / Dissatisfied
9	Width of foot path	Very Satisfied/ Satisfied / Dissatisfied
10	Over loading problem in I buses	Very Satisfied/ Satisfied / Dissatisfied
11	I- bus is having reasonable fare	Very Satisfied/ Satisfied / Dissatisfied
12.	Overall Satisfaction	Very Satisfied/ Satisfied / Dissatisfied
13.	Other Vehicular Restriction on BRT Lane	Yes/ No
14	Flyover, Subway, Escalator, Foot Over Bridge are needed	Yes / No
15	conveyance from home to BRTS bus stop	by auto / by public transport / by others
16	conveyance from BRTS stop to your destination	by auto / by public transport / by others
17	Parking should be provided on BRTS lane	Yes / No

RESULTS AND DISCUSSIONS

The evaluation results of the first 12 questions in the questionnaire are indicated in Table 2 and in Figure 1 in terms of percentage. The questions had a reply in three major categories viz. Not Satisfied, Satisfied and Very Satisfied. In the following lines the survey results and the discussion about the parameter is presented.

Table 2: Results of the Feedback Survey

S. No.	Parameter	Not satisfied	Satisfied	Very satisfied
1	Speed	12.3	73.6	14.1
2	Reliability	15.1	21.4	63.3
3	Safety	15.7	18.1	66.1
4	Convenience	21.3	15.8	62.8
5	Frequency	19.8	30.8	49.3
6	Comfort	19.2	30.2	50.4
7	Cleanliness	17.3	25.9	56.6
8	Pedestrian crossing	54.9	35.3	9.7
9	Width of foot path	21.8	27.1	51.02
10	Over loading problem in I buses	20.7	27.7	51.4
11	I- bus is having reasonable fare	12.4	23.03	66.3
12	Overall Satisfaction	17.24	31.1	51.78



All Values are in Percentage of Respondents

Figure 1: Results of Passenger Survey on BRT

Speed of BRT Buses:

As regards the speed of the BRT Buses is concerned, the major portion of the surveyed persons (73.6%) was falling under satisfied category and about 14.1 % persons were very satisfied and about 12.3 % of the passengers were

dissatisfied. In the present study a time speed survey was conducted both in peak hours as well as in off peak hours. It was found that the I-bus takes about 44 minutes as average travel time in travelling a distance of about 11.5 kms between two ends. Thus the average speed comes out to be around 15.7 km/hr. In Janmarg BRT system of Ahmedabad, the average speed is coming out to be 20 to 22 km/hr. The BRT system has 21 bus stops and at each stop it takes around 1 to 1.5 minutes time. The major cause of delay in the BRT system is the frequently encountered intersections of major roads. The managers of BRT have improved the signalling system at each of the intersections by prioritising the signals. The speed of the BRT vehicles can be increased by providing Flyovers of the dedicated lanes as well as two adjoining lanes of Mixed Traffic at certain important intersections. This will relieve the congestion problems.

Reliability, Frequency and Overloading of Buses:

As regards the reliability of the BRT buses is concerned 63.3% of the people seem to be very satisfied followed by 21.4% as satisfied. Overall 84.7% people lie in above satisfaction category. The 5th question regarding the Frequency also indicates that about 80.1% of the people are in or above satisfaction category. Presently the BRT buses are maintaining time and are quite frequent in operation. As far as the overloading of the buses is concerned, in peak hours the number of standing passengers is increased. This sometimes chokes the passages as well as the door area and there is a problem in boarding or exiting the buses. Although the percentage of passenger who is dissatisfied is hardly 20.7, one has to pay attention on this point. Few people want that the frequency be increased specifically in the peak hours. If one observes the crowd in the bus, it is quite clear that more buses are required to be plied on the BRT route to cater to the need of the people.

Safety, Convenience and Pedestrian Crossing:

The safety issue in the BRT lane is also indicating similar results. The passengers are safely handled on the BRT bus stops and in the BRT buses. Crossing the Mixed Vehicle Lanes on both sides of BRT is a bit inconvenient task and the safety of the people in this part is in question. However, on the question of convenience in BRT a substantial fraction (21.4 %) seems to be not satisfied though 78.6% of the people are in or above the satisfied category. This has a link with the pedestrian crossing and reaching to the bus stops at various locations (Question 9). The survey indicates that 54.9% of the people are not satisfied with the facilities. This has a relation to the negligible crossing facilities provided at the bus stops, inter sections etc. In order to increase the facilities of pedestrian crossing amenities such as foot over bridges with steps and/or elevators and escalators can be provided at important bus stops. This will not only ensure the safety

of the passengers but also make the BRT system more inclusive and physically challenged persons can also cross the MVL. The bus stops or the shelter portions of BRT should also have facilities such as drinking water and urinals.

Comfort and Cleanliness:

The question about comfort is also akin to these two questions to some extent. However, about 80.6% of the surveyed persons are in and above the satisfaction category. The cleanliness in the buses is quite satisfactory. About 83% of the passengers surveyed have replied in satisfactory and above category. The maintenance of cleanliness is quite meticulous. There are no vendors permitted to sell petty items in the BRT buses. Smoking is strictly prohibited in the buses as well as on the bus stops and tobacco or paan chewers are also not allowed. Moreover food consumption in the buses or at the bus stops is also prohibited. The BRT buses provide utmost comfort in the travel. The seating and circulation arrangement as well as the level boarding alighting facility of the buses is quite comfortable. The route specific travel in i-Bus is much more comfortable in comparison to the poor quality para-transit facilities available in the mixed vehicle lane. Very recently free Wi-Fi facility has been provided at many of the bus stops. This has increased the comfort level of the younger generation.

Width of Foot Path:

The question was framed to consider the safety of the passenger out of the BRT Lane. The foot paths are also shelter from the traffic flows in the MVL as well as traffic moving on the service lane. About 78% of the respondents are above the satisfied category. However, at some of the locations some vendors have occupied the footpath area or some structures such as transformers, distribution boxes of telephone lines or electricity etc. have cropped up as a hassle in the pedestrian movement.

Fare:

This is one of the important USP of the BRT system. The fare structure is quite suitable and 66.3 % of respondents are very much satisfied with the fare structure. Only 12.4 % of the respondents seem to be dissatisfied. However, these fares have not been revised since the inception of the BRT system. This requires a fair consideration because the cost of the fuel and operation and maintenance of the BRT buses is increasing. There is a need of a formula to increase the fare intermittently.

Overall Satisfaction:

As regards the overall satisfaction of the commuters of BRT is concerned, about 83% amongst the respondents are

fully satisfied. This indication is a good sign for the overall success of the BRT System.

The other 4 questions (from question no. 13 to 16) had major answer as YES or NO. The results are indicated in Figures 2 to 5.

Restriction to other Vehicles on BRT Lane:

In the present scenario, the BRT Lane is a dedicated lane meant for the movement of the I-Buses. Only Ambulances have been permitted in the BRT Lane along with the I-Buses. In response to a PIL filed in the Honourable HighCourt of Madhya Pradesh the court had given a ruling that other 4 wheelers vehicles can move in the BRT lane. But with a restriction that there would not be over speeding nor overtaking of the buses at all the stops and signals. However, it was a temporary arrangement and the operators of BRT were successful in getting a verdict to revert the order. However, the case through the PIL is still going on and one has to wait till the clear verdict comes through. The passengers have overwhelmingly declined the other vehicular traffic entry to BRTS. In reply to the question: whether the other vehicles restriction on BRT lane is to be continued? 83.25 % of the people voted for the continuance of the restrictions. The results of the survey are indicated in Figure 2.

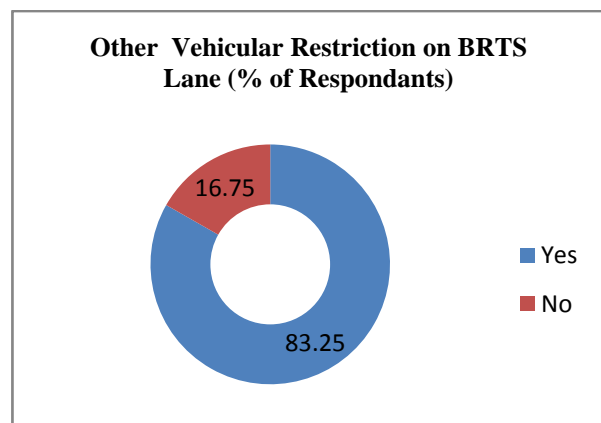


Figure 2: Results of Survey on Restrictions to other Vehicles on BRT Lane

Conveyance to/from BRT Stop to Destination:

Indore BRT operations are on a single road stretch and one has to use various modes of conveyance to reach BRT from the destination or vice versa. The survey in the present study indicates that a substantial number of passengers use private mode of conveyance to Reach BRT (about 42.6 % persons approaching or leaving BRT use this mode). Nearly 34.2 % people approaching BRT and 38.2% of the people leaving the BRT use available public transport such as inter city buses, city buses, vans etc. And around 20.2% people approaching BRT and 17.2 % of the

people leaving the BRT use costlier public transport such as Autorikshaws, Taxies etc. Hardly 2.2 % of the passengers approaching BRT and 0.5 % of the people leaving the BRT do not require any conveyance. This is quite pertinent that the passengers need some conveyance. There are a few points where certain buses and vans from a larger distance provide a suitable transit. But mainly there is a paucity of feeder public transport from the entire city and the surroundings to the BRT system. Figures 3 and 4 indicate the % of people approaching the BRT lane through various conveyance modes.

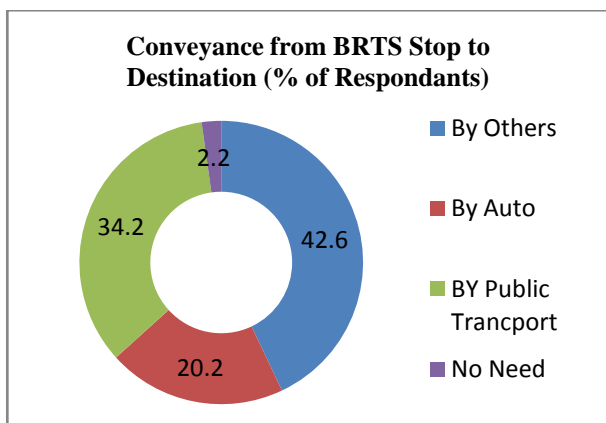


Figure 3: Results of Survey on Conveyance from BRTS Stop to Destination (Percentage)

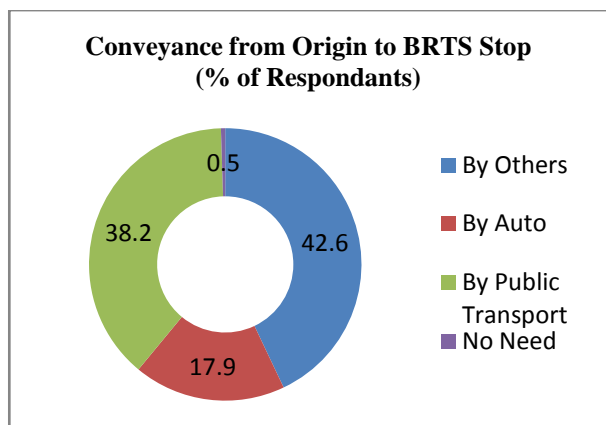


Figure 4: Results of Survey on Conveyance from Origin to BRTS Stop (Percentage)

Improvement of the Physical Amenities on BRT Lane:

To improve the efficiency of the BRT Lane certain physical amenities are required to be improved. One of the most serious aspects of the BRT lane is the approach to the bus stops. The crossing of intersections and mixed vehicle lanes for the pedestrians is quite inconvenient for passengers especially physically challenged, children, ladies and elderly people. The need of skywalks, foot over bridges with elevators and escalators are required urgently

at the bus stops. These amenities will not only fulfil the needs of BRT passengers but also overall pedestrians moving around the BRT lane. This will also facilitate a smooth traffic flow in the mixed vehicle lane. The other aspect is of flyovers. The BRT lane is running parallel to one of the main traffic corridors of the city of Indore and many roads connecting the CBD to recently developed city areas and the other towns cross this corridor. It has been observed that the maximum traffic is passing through this corridor parallel to the BRT lane and crossing the BRT Lane at many places. It will be apt to provide flyovers for the BRT lane as well as the mixed traffic lanes at certain important intersections to increase the speed of the BRT. These needs have been felt by about 85% of the passengers. Figure 5 indicates the split in percentage.

In any major city of India or other countries, the parking of the vehicles is a major issue. As it is stated in the foregoing discussion the about 42.6% of the passengers use private vehicles to reach the BRT lane. This is a substantial fraction. There is an urgent need of provision of parking facility at or around the BRT lanes so that the people can safely park their vehicle. In the original plan of BRT system lot of parking places were shown. However, due to paucity of available land and encroachments the parking amenities have been very low. This needs an improvement. In the survey carried out for the present study about 56% of the respondents indicated the need of parking on the BRT Lane. Presently in around 75% of the wider portion of the BRT lane has been provided with service lane facility. In some of the portions separate cycle tracks are also provided to encourage the Non Motorized Transport (NMT). But most of the service lanes and the cycle tracks are presently being used for parking and it has also become a safe haven for the unauthorized street side vendors and other encroachers. The surveyed data regarding need of parking around BRT Lane can be seen on Figure 6.

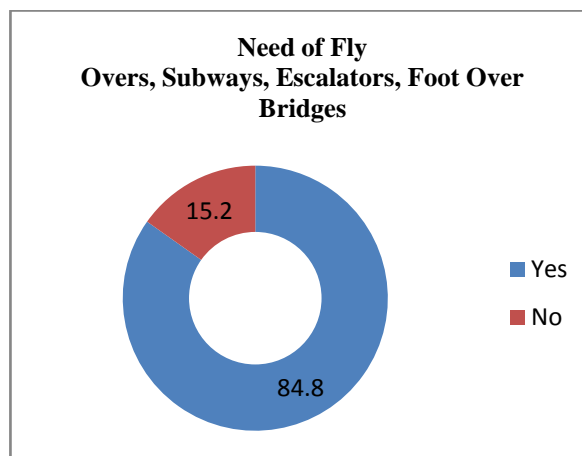


Figure 5: Survey Data Presented in % for Need of Facilitated Movement on BRT Lane

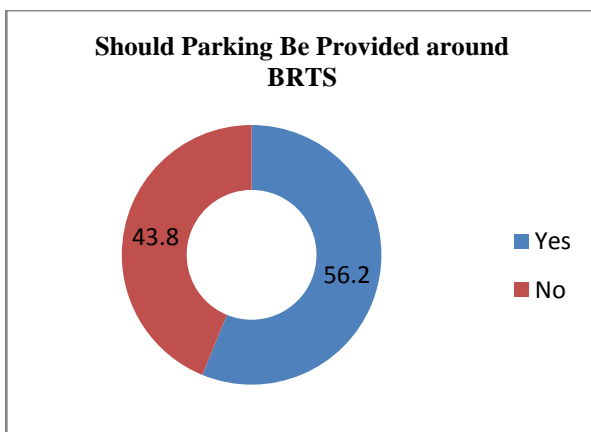


Figure 6: Survey Data Presented in % for Need of Parking on BRT Lane

CONCLUSIONS

Present study deals with the performance of the BRT system of Indore in the present condition from passengers view point. The customers were asked a set of 12 questions which had an answer in terms of Very Satisfied, Satisfied and Dissatisfied. Out of 12 questions asked, in 10 questions more than or nearing 50% of the respondents had an answer that they are Very Satisfied. The answer satisfied had a range from 15.8% to 31.1%. The fraction of dissatisfied passengers was in the range of 12.4% to 27.8%. The 10 questions were Reliability, Safety, Convenience, Frequency, Comfort, Cleanliness, Width of foot path, Over loading problem in I buses, I- bus is having reasonable fare, Overall Satisfaction. In response to the question asked on speed, 73.6% of respondents replied is satisfied category and 14.1% respondents were falling in very satisfied category. Only 12.4% of the respondents were dissatisfied. The response to the question on pedestrian crossing has indicated that 54.9% of the passengers were dissatisfied and 35.3% of the respondents were satisfied and about 9.7% of the respondents were very satisfied.

This indicates that the I-bus has been successful in regards to the majority of the performance criteria. As on today average speed of the BRT is better even than personal vehicles. There are 21 stops on the BRT Lane. Presently there are 10 signalized intersections, one signalized rotary, one non-signalized rotary and a small portion of about 200m mixed lane traffic which has only kerb side bus stop impending buses to change lanes twice. These factors increase the travel time of the I-buses. It is true that there is no provision of proper safety measures and facilities for passenger crossing on the route of I-Bus. This has been emphasized in response to other question in which the need of the subways, elevators, escalators, foot over bridges as well as skywalks is felt by 84.8% of the respondents. About 56% of the respondents were of the

opinion that the BRT route should have proper parking facilities in its surroundings so that the passengers can park their vehicle and board BRT buses conveniently.

Due to the Honourable High-court's interim verdict 4 wheelers were allowed in the BRT Lane for a period of about 13 months. This decision was then reverted and again the BRT lane was reserved for I-Buses as well as Ambulances. In the survey carried out in the present study, 83.25% of the respondents were of the opinion that the entry of other vehicles in the BRT Lane should be strictly banned. As regards reaching or leaving BRT lane from various locations of the city, it is observed that only 38.2% of the respondents use public transport for reaching BRT and 34.2 % respondents use public transport to reach their destination. This has a direct link with the non availability of proper link of other public transport facility with the BRT system. One of the most important aspects of the feeder facilities that is running the I-buses to and from important destinations such as Railway Stations, Bus Turminuses and other commercial hubs like CBDs etc. has been missing in planning. These buses can travel through the BRT Lane partially and connect to important destinations. The BRT stops in that case can act as tranfer points and people can have wider options to use the BRT facility. Presntly he frequency of the BRT Buses in the dedicated lane is quite low and the capacity is not being utilized properly. The planning of plying extra buses will increase the utilty of the BRT Lane. In a nutshell it can be stated that the public transport in the form of BRT is gaining popularity amongst the masses and requires to be improved for better performance. The BRT system in Indore is required to be extended for more areas.

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