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KOLKATA METRO RAILWAY: PERFORMANCE ANALYSIS AFTER 25 YEARS OF OPERATION

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Abstract

The first intra urban rail-based mass transit system of India, the Kolkata Metro Railway, celebrated its 25th anniversary in October 2009. The system was also extended further to the southern suburbs of the city in the middle of the same year and construction is going on to expand it further. This study analyzes the success of the system in terms of the amount of patronage it receives and benefits and problems associated with it. Kolkata Metro Railway receives huge amount of patronage in terms of ridership and extent of the influence area. It has also succeeded in providing almost all the benefits that it used to at the beginning of its operation with the exception of some such as punctuality, safety, and comfort. Some problems have also been resolved like integration with other modes of transportation and underutilization in terms of ridership in the past 25 years.

Keywords: Metro Railway, Ridership, Influence area, Benefits and Problems, Kolkata

Introduction

India, an emerging power in Asia, has witnessed a noticeable increase in travel demands especially in the cities (Pucher et al., 2005). This trend can be attributed primarily to growth in Gross Domestic Product (GDP) and in the urban population of the country. GDP increased by 7.4% in 2009-2010 (India Brand Equity Foundation, 2010) and is estimated to grow by 8% or more annually until 2015 (Stolberg and Bajaj, 2010). This growth surge began after the economic liberalization of the 1990s and peaked between 2005 and 2008 when the GDP growth rate was around 9% (India Brand Equity Foundation, 2008). The urban population has also increased from 109 million in 1971 to 285 million in 2001 (+161%) (Office of the Registrar General of India, 2001; Pucher et al., 2005). That these phenomena have triggered the growth of travel demands is evident from the fact that passenger rail traffic increased by 9.14% from 2004 to 2009 in terms of passenger kilometers (Government of India Ministry of Railways, 2009). Not only has the demand for public transport services increased, but also the demand for privately owned vehicles as well. Sales of cars have increased by 61%, in terms of units sold in the domestic market, from November 2008 to November 2009, the highest when compared to the records of past six years (Doval, 2009).

The rise in travel demands is exerting enormous pressure on the already inadequate transportation system of India, leading to major problems such as increases in traffic injuries and fatalities, environmental pollution, and road congestion. These problems are most serious in large cities like that of Delhi, Mumbai, and Kolkata, despite the fact that more than half of the trips in these cities are made by public transport (Pucher et al., 2005). These large cities and many other Indian cities already have a wide range of public transport services, ranging from cycle rickshaws to three-wheelers or auto-rickshaws to buses to suburban railways. To improve the situation further, cities are now investing in the construction and expansion of underground and elevated intra urban rail-based mass transit systems.

Presently, India has intra urban rail-based mass transit systems in the cities of Kolkata, Chennai, Delhi, and Bengaluru (Bangalore). A similar kind of transit system is under construction in Mumbai and planning is under way for Hyderabad, Kochi, and Lucknow (Vision Around Technology Pvt. Ltd., 2011).

Against this backdrop, the basic aim of this study is to analyze the success of the first intra urban rail-based mass transit system of India, Kolkata Metro Railway. For the purpose both quantitative and qualitative methods have been used:

- *Quantitative analysis*: One important way to analyze the success of any public transport system is to measure the amount of patronage (Knowles, 1996). In this study the amount of patronage has been measured in terms of ridership numbers and extent of the influence area of Kolkata Metro Railway.
- *Qualitative analysis*: Qualitative analysis provides in-depth knowledge on a subject in a way that quantitative analysis cannot (Beirao and Cabral, 2007; Patton, 1990). Therefore, an attempt has also been made in this study to qualitatively analyze the success of Kolkata Metro Railway by examining the perception of its users regarding the benefits and problems associated with it.

Kolkata And Its Transportation System

Kolkata, formerly known as Calcutta, is the administrative capital of West Bengal, a state in the eastern part of India. Situated on the eastern banks of the river Hoogly (Fig. **1**), a distributary of the river Ganges, its origin can be traced back to 1690 (Chatterjee, 1995). According to the 2001 Census, the population of Kolkata proper is 4.5 million with a working population of 1.7 million. Greater Kolkata has a population of 13.2 million and a working population of 4.5 million (Office of the Registrar General of India, 2001). A large section of the working population of Greater Kolkata commutes to the city proper every day, thus increasing its population and the usage of transportation facilities.

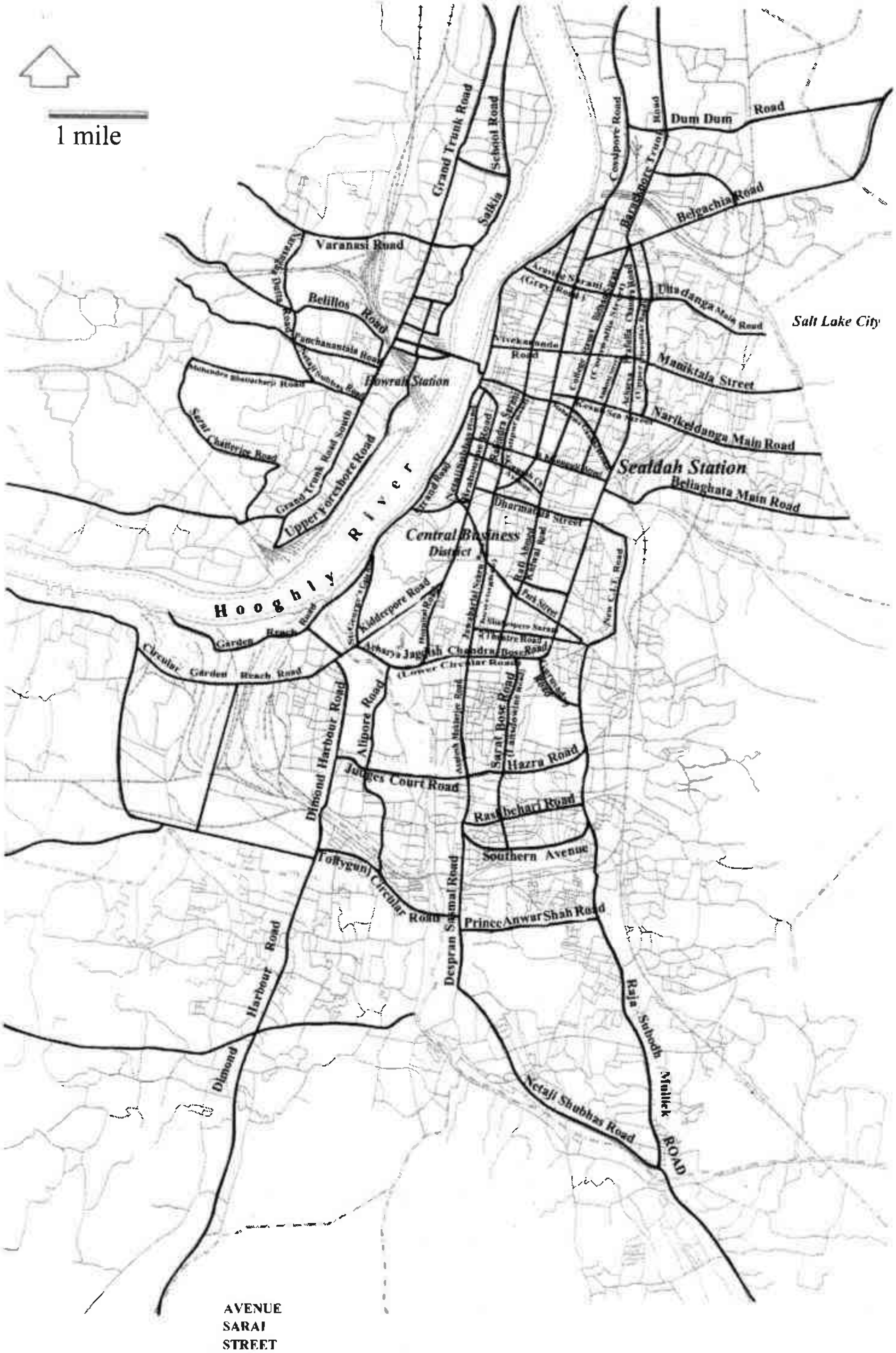

Fig. (1). Arterial streets and highways of Kolkata and Howrah

The city stretches out in an elongated manner in the north-south direction. The traditional Central Business District (CBD) is located at the center of this elongated urban structure. Hence most of the major roads run in a north-south direction (Chatterjee, 1995) bringing passengers from the northern and southern parts of the city to the CBD. There is also an important east-west travel corridor that brings passengers from the two most important suburban railway terminals, Howrah and Sealdah, to the CBD. In Kolkata, 80% of the trips are done through public transport systems (Pucher et al.,

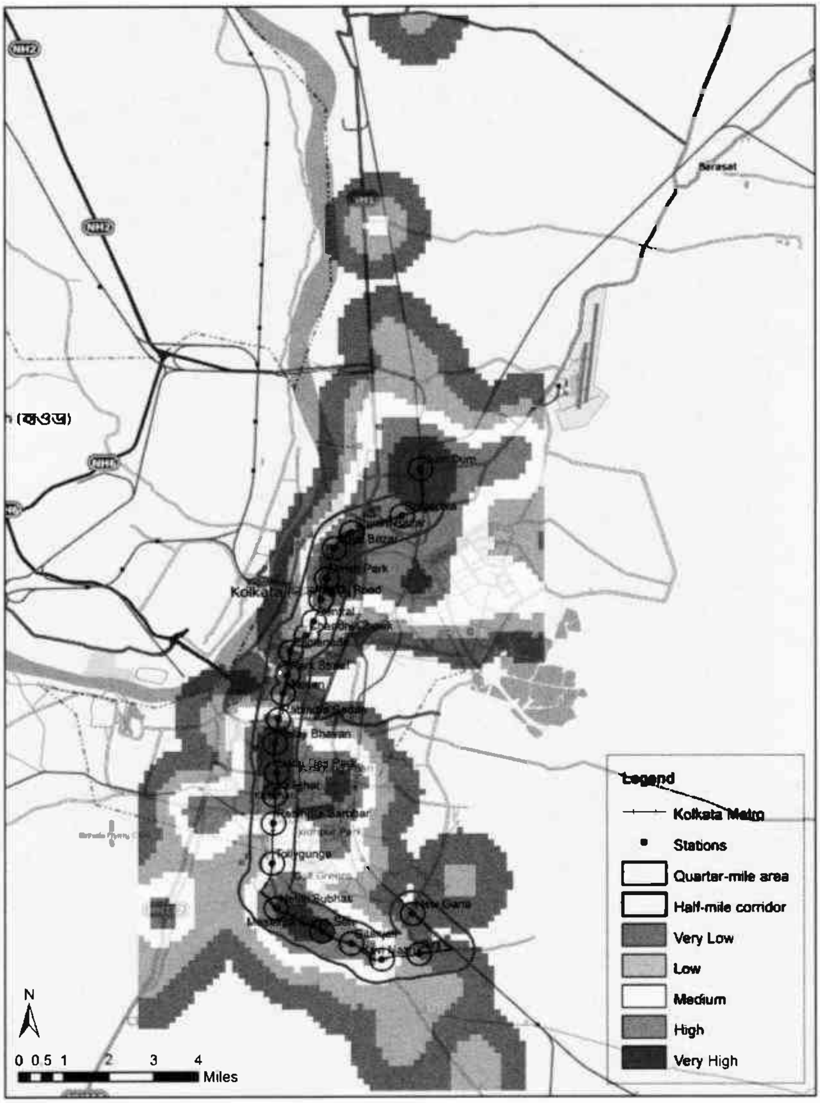

Fig. (2). Kolkata Metro Railway route and its influence area in terms of points of origin of the trips

2005) because the city offers a wide variety of options, ranging from cycle rickshaws to auto-rickshaws to buses to suburban railways to Metro Railway. Yet, the city also suffers from common transportation problems such as traffic congestion, inadequate parking facilities, traffic accidents, and air pollution (Roy, 2002). The fact that a meager 6% of the land area of the city is allotted to roads also contributes to these problems. In comparison, that same figure is 21% in Delhi and 11% in Mumbai (Pucher et al., 2005). The inadequacy of roads has made the operation, maintenance, and expansion of the Kolkata Metro Railway even more important.

Kolkata Metro Railway: Literature Review

Growth and Future Developments

Kolkata Metro Railway began operating on October 24, 1984. During the 1980s and 1990s, a 16.45 km (10.22 mile) long Metro Railway line from Dum Dum to Tollygunge (Fig. **2**) with 15 underground and two over the ground stations (Metro Railway, 2004) was opened for public use in multiple phases (Table **1**). The sections between Esplanade and Netaji Bhavan and Belgachia and Dum Dum were the first to start operation in 1984. The remaining sections opened in 1986, 1994, and 1995.

Table 1. Growth of Kolkata Metro Railway, 1984 – 2010

Metro Railway service Began	Stations	Length of the route
24 October 1984	Esplanade to Netaji Bhavan	3.40 km (2.11 miles)
11 December 1984	Dum Dum to Belgachia	2.15 km (1.34 miles)
29 April 1986	Netaji Bhavan to Tollygunge	4.28 km (2.66 miles)
13 August 1994	Belgachia to Shyam Bazar	1.62 km (1 mile)
2 October 1994	Esplanade to Chandni Chowk	0.71 km (0.44 mile)
19 February 1995	Chandni Chowk to Central	0.60 km (0.37 mile)
	Shyam Bazar to Girish Park	1.93 km (1.20 miles)
27 September 1995	Girish Park to Central	1.80 km (1.12 miles)
	Dum Dum to Tollygunge	16.45 km (10.22 miles)
11 February 1996	M.G. Road	The station opens to public
23 August 2009	Tollygunge to Kavi Nazrul	5.89 km (3.66 miles)
7 October 2010	Kavi Nazrul to New Garia	3.00 km (1.86 miles)

Source: Metro Bhavan, Kolkata

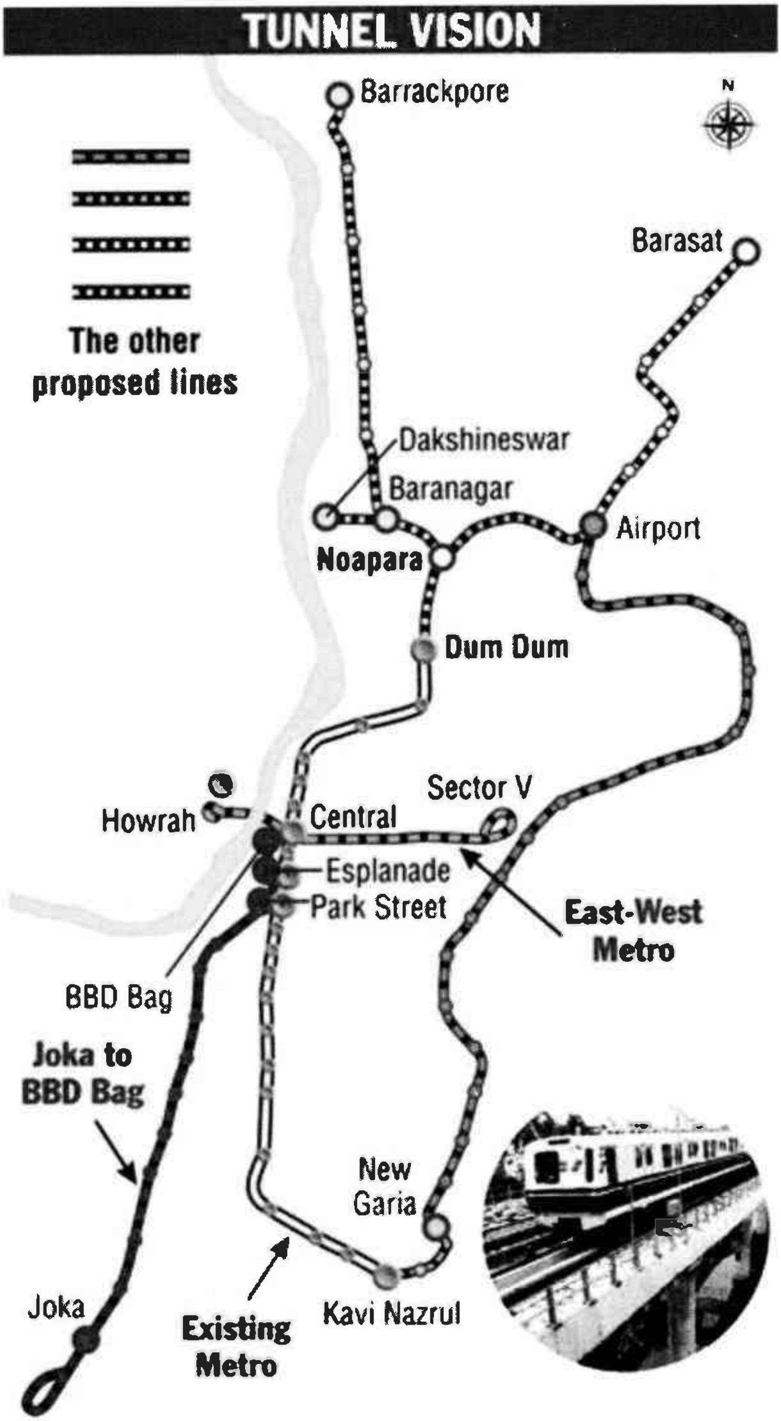

Fig. (3). Proposed extensions of Kolkata Metro Railway

The initial cost of this project according to the 1970-71 price level was $29.17 million, taking an exchange rate of US $1=Rs 48. But due to a delay of 14-15 years, the cost increased almost tenfold to $325.55 million, as per the 1993-94 price level (Singh, 2002).

Recently, the Metro Railway line has been further extended to the southern suburbs of Kolkata. It currently runs for 25 km (15. 53 miles) from Dum Dum to New Garia (Fig. **2**). This extended portion from Tollygunge to New Garia has been constructed on elevated structures and was opened for public use in two phases (Metro Railway, 2009a). The section between Tollygunge and Kavi Nazrul began operating on August 23, 2009, while the section between Kavi Nazrul and New Garia opened on October 7, 2010 (Table **1**).

The initial cost of building this extension, in 1999-2000, was estimated to be $180 million (Rs 907 crore), taking an exchange rate of US $1 = Rs 50 (Metro Railway, 2009b). Later, in 2009, when the project was completed, the cost increased to $205 million (Rs 1,032 crore), taking an exchange rate of US $1 = Rs 50 (Metro Railway, 2009a).

The Ministry of Railways is further extending the Metro Railway line to the northern, eastern and western parts of the city. Presently, construction of the East-West Metro Railway line is in full swing. It will extend from Howrah Maidan in the west, to Saltlake Sector V in the east (Fig. **3**). Part of this corridor will be constructed underground and part will be on elevated structures. The East-West Metro Railway line will connect the two most important suburban railway terminals, Howrah and Sealdah, to the CBD, and the major bus terminals of Howrah, Sealdah, and Saltlake to one another. It will also have a station very close to the Central station of the North-South line for easy transfer between the two lines (KMRC, 2010).

The cost of this project has been estimated to be US $ 968 million (Rs 4,874 crore), taking an exchange rate of US $1=Rs 50 (KMRC, 2010).

Besides the East-West Metro Railway line, construction of four other Metro Railway lines approximately worth US $ 1.8 billion (Rs 9,000 crore), taking an exchange rate of US $1 = Rs 50 (Gupta, 2010), has also just begun (Fig. **3**). When completed, these lines will serve the entire city and its immediate suburbs (Mandal, 2009).

Important Characteristics

Metro Railway operates from 7 a.m. in the morning until 9.45 p.m. at night, except on Sundays and holidays when it begins operation at 3 p.m. The trains arrive at an interval of eight minutes during rush hours and 10-15 minutes during off-peak hours (Metro Railway, 2009b). Running at a speed of 55km/hr (34 miles/hr), the trains take 41 minutes to travel from one terminal station to the other (Banerjee, 2009). The terminal stations are located just beside the suburban railway stations, providing a seamless transfer between the two modes of transport. All of the stations between Rabindra Sadan and M.G. Road primarily serve the CBD, while the rest of the stations serve predominantly residential areas.

The Metro Railway has a progressive fare structure. The lowest fare is Rs 4 (9 cents) for traveling up to 5 km and the highest is Rs 12 (26 cents) for traveling over 20 km (Metro Railway, 2004). To make the payment of fares more convenient, the authority has introduced Smart Cards, Limited Multi-Ride Tickets, and Extended Multi-Ride Tickets, which saves the commuters the trouble of buying tickets everyday. These ticketing schemes also provide riders with some discounts (Metro Railway, 2009a; Metro Railway, 2009b).

Kolkata Metro Railway: Benefits and Problems

Metro Railway provides various benefits to the people of Kolkata. First, it is a "pollution-free, safe, punctual and comfortable" mode of transport (Metro Railway, 2009b). Second, it provides a clean and comfortable commuting environment which helps people to retain their energy and thereby increase their level of productivity in the office. Third, a journey through Metro Railway is often faster than many other surface modes of transport, namely buses, cars and rickshaws (auto and cycle), especially during rush hours when the roads are congested. Fourth, it has increased the rate of urban development and has elevated land prices around the station areas (Basu, 2002). Even though it was supposed to decongest some of the roads of the city (Dutta and Mukhopadhyay, 1992), most probably it has not succeeded in doing so (Dalvi, 1989).

Numerous problems are also associated with Kolkata Metro Railway. First, it is underutilized as it carried only 2-3% of daily commuters in 2000 and trains arrive less frequently than was proposed in the plan (Basu, 2002; Singh, 2002). Second, the system is not financially profitable (Singh, 2002). Since its inception, Metro Railway has been heavily subsidized by the government (Metro Railway, 2007). It has never reached a break-even point in terms of income and expenditure as was expected at the time of planning and initial operation (Dalvi, 1989). Third, the system is not properly served by the other modes of transport (Basu, 2002), which may be one reason behind its underutilization. Fourth, it is not well maintained and so delays and train cancellations due to technical fallouts do occur. Fifth, Metro Railway creates noise pollution with the noise level at 90-100 decibels, greater than the permissible limit of 75 decibels (Basu, 2002). Sixth, Metro Railway has more employees than required and many are poorly trained. Sometimes they are borrowed from the other railway sectors and not specifically trained for Metro Railway. Seventh, the riders are very sensitive to fares and so increasing fares is difficult (Singh, 2002). Finally, acquiring private land for the purpose of Metro Railway line construction has always been problematic. In the 1980s and 1990s, construction was delayed primarily due to several court injunctions obtained by people who were being affected by the construction work (Dalvi, 1989). Presently, Kolkata Metro Railway Corporation (KMRC) is also facing problems acquiring 1.08 hectares (10, 752 square meters) of private land for construction of the East-West Metro Railway line. The project will evict 125 families and destroy 325 shops and 163 commercial structures in several locations along the line (Table **2**) (Times News Network, 2008). Despite these problems, Metro Railway is still being maintained and operated by the Ministry of Railways because of the benefits it provides to the people of Kolkata.

Table 2. Trouble spots for private land acquisition

Station	Shops	Houses/Commercial Structures	Families
BBD.Bag	84	02	-
Central	90	57	75
Bowbazar	80	58	50
Salt Lake	66	45	-

Source: Times of India, August 21, 2008

METHODOLOGY

As previously mentioned, this study analyzes the success of Kolkata Metro Railway both quantitatively and qualitatively. Quantitative analysis measures the amount of patronage of Metro Railway in terms of ridership numbers and extent of the influence area. Qualitative analysis examines the perception of the Metro Railway users regarding the benefits and problems associated with it.

Quantitative analysis

The ridership data were collected from Ministry of Railways for the years 1984-2009. The data were then analyzed through descriptive statistics.

To measure the extent of the influence area, a survey of Metro Railway users was conducted in December 2009. Approximately 200 questionnaires were distributed, of which 178 were collected back and used in the analysis. A snowball sampling technique was adopted for the dissemination of the questionnaires, which were distributed through the friends, relatives, and acquaintances of the authors. At the time of distribution, an attempt was made to capture users boarding at different Metro Railway stations so that the extent of the influence area could be understood. We also tried to capture users of different age, sex, and profession during this process. Due to adoption of the snowball sampling technique, it was possible to track the survey participants and collect the completed questionnaire back from them. Given the small sample size and the use of a snowball sampling technique, the results of the survey should not be generalized.

In the survey questionnaire, Metro Railway users were asked to mention the address of the points of origin and destination of their Metro Railway trips, the time taken to reach the station from the point of origin and the destination point from the station, and the mode of transport to and from the station. The addresses were plotted on a map with the help of ArcGIS 10 to understand the distance people traveled to board the Metro Railway and how far they traveled after stepping down from the Metro Railway. The rest of the data collected were analyzed with the help of descriptive statistics.

Qualitative analysis

For the purpose of qualitative analysis, in-depth interviews of 25 Metro Railway users were conducted. These interviewees consisted of those who agreed to participate in a more detailed interview after completing the short questionnaire. They were contacted later and interviewed over the phone.

Each person was interviewed once and the interviews lasted for 30-45 minutes. In the interview people were asked to give their opinion regarding the benefits and problems of Kolkata Metro Railway. Here, again, it should be noted that the sample is a small one and hence the results of the survey should not be generalized.

Interviewees are of various ages, sexes, and professions, and boards the Metro Railway at different stations. Among the 25 interviewees, 20 are daily Metro Railway commuters and the rest use Metro Railway frequently but do not commute daily.

From the narration of the interviewees we examined whether the benefits and problems of Metro Railway put forward by the Ministry of Railways and several authors mentioned in section '***Kolkata Metro Railway: Benefits and Problems***' still hold true after 25 years of operation and the extension of the line. The interviews also enabled us to learn about other benefits and problems of Kolkata Metro Railway not mentioned before.

In addition to the transport users, two Ministry of Railway officials were also interviewed to identify future plans they have to further improve the condition of the Metro Railway. These interviews facilitated our predictions as to whether some of the problems presently being faced by the users, will be solved in the future.

Quantitative Analysis: Results And Discussion

Changes in Ridership

The ridership of Metro Railway has increased from 1.5 million annual passengers in

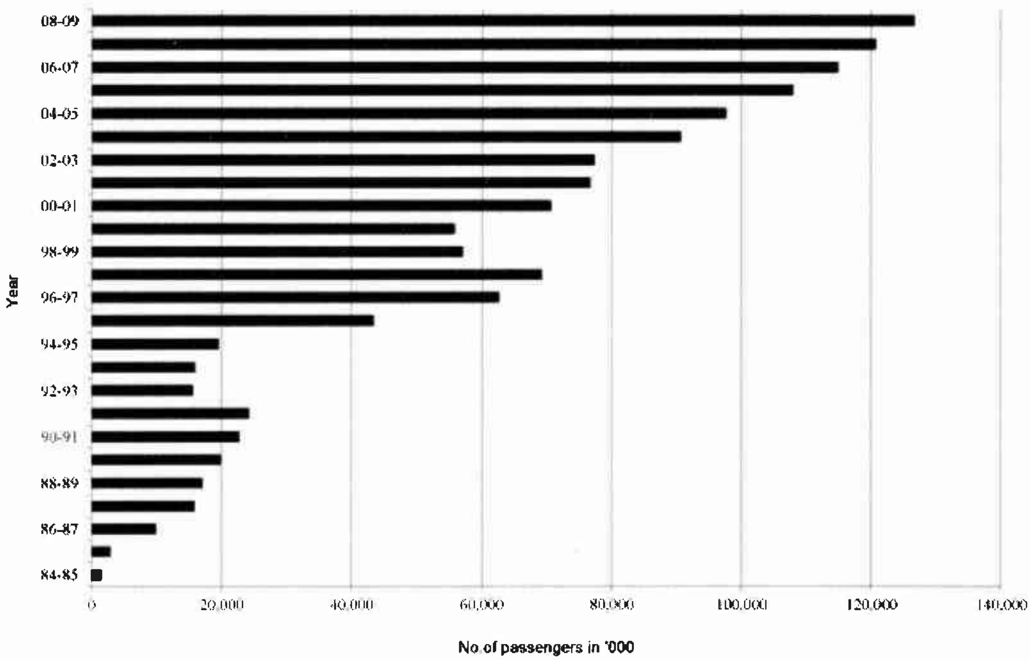

Fig. (4). Annual Ridership, Kolkata Metro Railway, 1984-2009

1984-1985 to 126.5 million passengers in 2008-2009 (Fig. **4**). However, the increase in ridership did not take place continuously and uniformly. There was a 36% decrease in ridership due to a 50% increase in fares from 1991-1992 to 1992-1993 (Singh, 2002). The ridership again dropped during the period between 1997 and 2000 because of an increase in price. The increase in ridership also slowed down after a nominal surcharge was imposed on riders in 2001 (Singh, 2002). On the other hand, there was a 256% rise in ridership due to the opening of a large section of the Metro Railway in 1986 and a 122% increase due to the opening of the entire stretch in 1995 (Table **1**). According to Mr. R.N. Mahapatra, Chief Public Relations Officer of Kolkata Metro (2009), after Metro Railway was extended further to the southern suburbs and four new stations were opened in August 2009, the average daily ridership increased by 0.1 million. Hence, Metro Railway ridership is not only sensitive to price change but

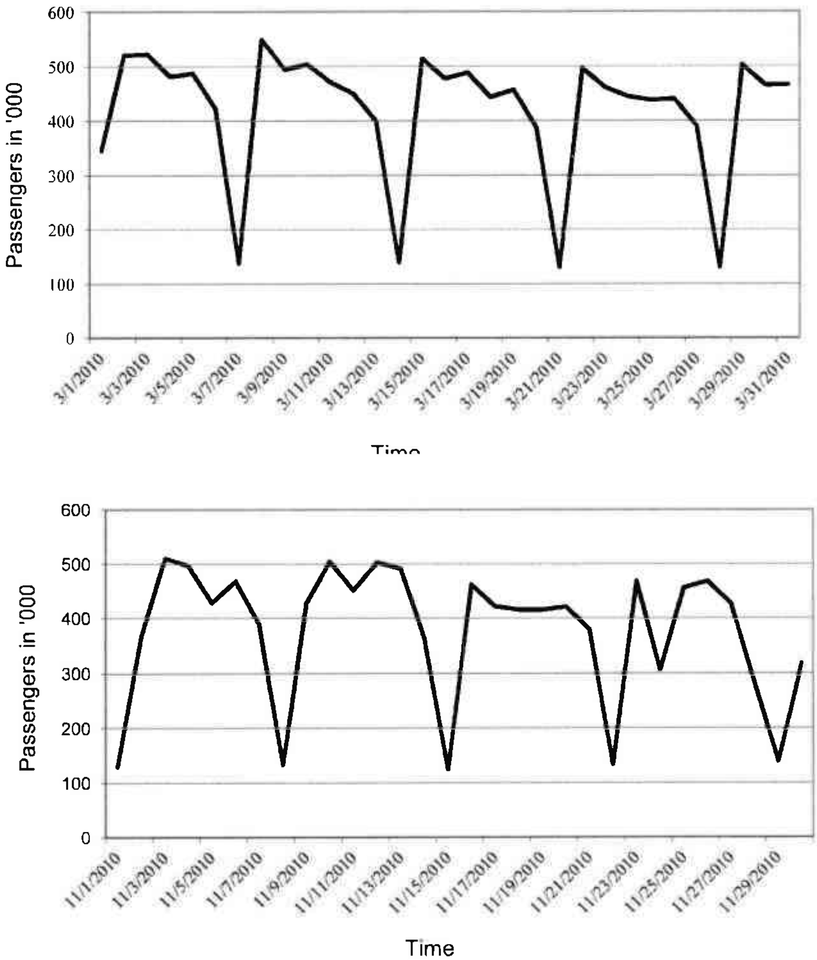

Fig. (5). Monthly (March & November, 2010) and daily variation in ridership of Kolkata Metro Railway

other types of changes as well. While an increase in price affects ridership negatively, an expansion of services affects ridership positively. Despite the significant increase, Metro Railway ridership has never reached the overly-optimistic projection figures. It was estimated that by 2001, the annual number of passengers would be 630 million (Singh, 2002) whereas in reality it was just 70 million in 2000-2001 and 76.6 million in 2001-2002.

Ridership level not only varies annually but also daily and monthly, as is evident from Fig. (**5**). The figure depicts the ridership data of November 2009 and March 2010. In both of these months, the ridership has been higher on Monday than any other day of the week. Ridership has always been very low on Sundays, not only because it is a holiday but also because of the reduced hours of operation. The average daily ridership in November 2009 was 0.37 million and it increased to 0.42 million in March 2010. This increase in ridership from November to March has a twofold explanation. First, due to the hot and humid climate, more people prefer using the underground Metro Railway in March when the winter season has ended in the city and summer has started approaching. Second, there is a natural increase in the number of Metro Railway riders with passage of time and so more people were riding the Metro Railway in March 2010 than November 2009.

Extent of the Influence Area

Fig. (**2**) provides an idea about the influence area in terms of points of origin of the Metro Railway trips. The influence area extends far beyond the quarter-mile radius rings around the stations which are commonly considered as the influence area of rail transit systems. This is mainly because the quarter-mile radius ring is within the walking distance of the stations (Bollinger and Ihlanfeldt, 1997; Cervero, 1994). The quarter-mile radius rings do not even contain all of the highly influenced areas. However, if the rings are extended to half-mile radius then it contains most of the highly influenced areas except around Dum Dum. The entire influence area of Kolkata Metro extends about four miles to the south and east of the railway line and beyond five miles in the north. In the west, it has been truncated by river Hoogly. The main reason behind this truncation is the presence of the intensive suburban railway network.

When a similar kind of map was drawn with the address of the points of destination, a different picture was revealed. The majority of the points of destination lie within the quarter-mile radius rings and the overall influence area does not extend much beyond that except for a few outliers. Hence even though people are ready to travel long distances to board the Metro Railway, they prefer to have their point of destination within walking distance.

Integration between Kolkata Metro Railway and other modes of transport, especially the auto rickshaws, has greatly helped to increase the extent of the influence area. From Fig. (**6**) it is evident that approximately 35% of survey respondents reach the Metro Railway stations from point of origin by auto rickshaw. This percentage is greater than those who walk to the station (29%) from adjacent places. A significant number of users take either multiple modes of transit (11%), the bus (13%) or suburban rail (6%). People who use the suburban rail to board the Metro Railway usually do that at Dum Dum Station, which is located just beside the suburban railway station. Unlike those who avail themselves of a transit mode to reach the Metro Railway station from the point of origin, 79% (Fig. 7) of the survey respondents walk to their point of destination from the station. This is mainly because most people using the Metro Railway work in the CBD where the majority of places are within walking distance of the Metro Railway line. In this case again the predominance of the auto-rickshaws over the other modes of transit is visible.

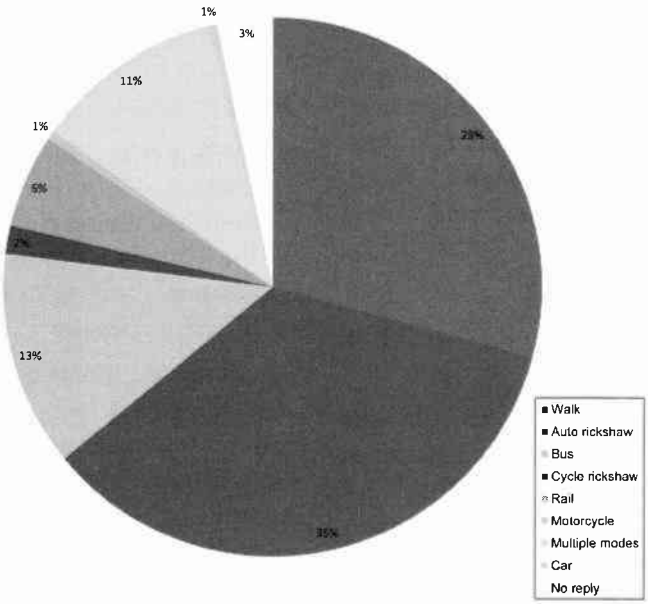

Fig. (6). Modal access to the Metro Railway stations from point of origin

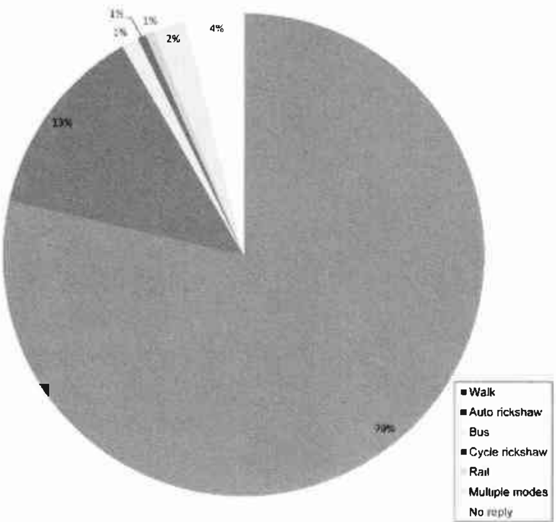

Fig. (7). Modal access to the point of destination from the Metro Railway stations

People are willing to spend a considerable amount of time to reach the stations (Fig. **8**). This willingness has also contributed to the expansion of the influence area. Though the majority of the respondents took 5-20 minutes to reach the Metro Railway station, 14% of the respondents spent more than 30 minutes for this purpose. Conversely, only 5% of the respondents spent 30 minutes or more to reach the destination point from the station (Fig. **9**). These statistics again support the tendency of the Metro Railway riders to have their destination point within walking distance.

Qualitative Analysis: Results and Discussion

In section '*Kolkata Metro Railway: Benefits and Problems*' of this article we mentioned various benefits and problems that have been associated with Kolkata Metro Railway by the Ministry of Railways and authors of several articles. In this section, we will revisit those benefits and problems through the perception of the Metro Railway users. We will try to determine if the benefits (Fig. **10**) and problems (Fig. **11**) mentioned before still exist or whether they have changed with the passage of time, according to people who use the system frequently.

Benefits revisited

Air pollution free: Most interviewees (74%) believe that Metro Railway is a pollution-free mode of transport. Since it is not adding to the already extremely polluted air of Kolkata, it is helping to improve the quality of life of the people.

Punctual: Many people (85%) agreed that Metro Railway helps to reach the point of destination on time and so it is a very reliable mode of transportation for commuting to the office, where punctuality is necessary. However, to some (15%), it is

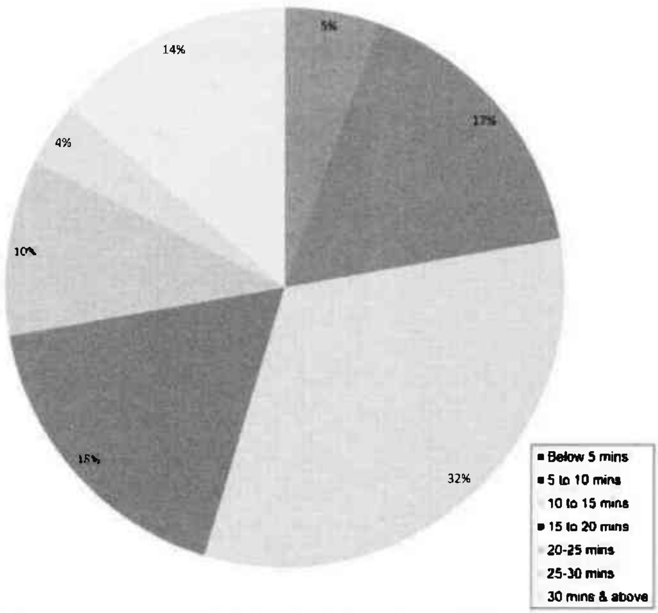

Fig. (8). Travel time to reach the Metro Railway stations from point of origin

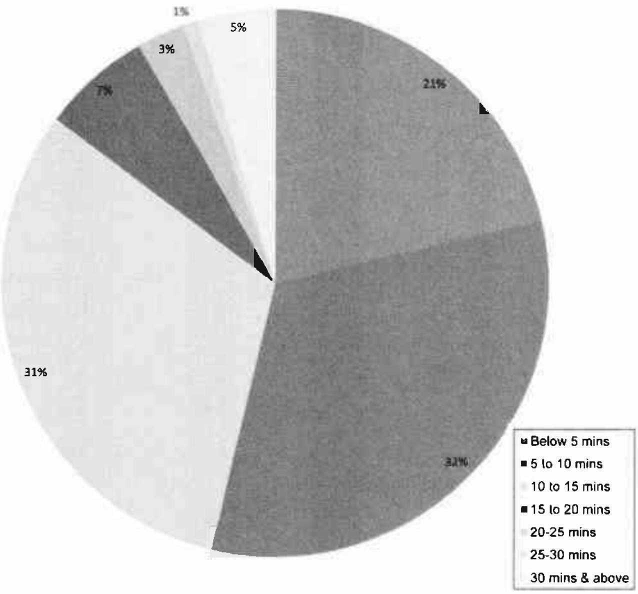

Fig. (9). Travel time taken to reach destinations from the Metro Railway stations

less as reliable and punctual today than it was in the past. After the extension, the numbers of passengers increased enormously but the level of services has not improved at the same pace. This is creating chaos and anarchy, which is contributing to Metro Railway running behind schedule on occasion. As an example of the chaotic situation, Pritha Mukherjee, a working mother, says that the unruly behavior of some passengers prevent the doors of the train from closing on time and this throws off the schedule of the trains.

Safe and comfortable ride increases productivity of office goers: The majority of the interviewees (85%) felt that Metro Railway is no longer a safe and comfortable mode of transport. The huge increase in passengers is again the reason behind the loss of safety and comfort that Metro Railway previously provided. Ramdas Chatterjee, a retired scientist, who has been riding the Metro Railway since 1987 says:

There is gulf of difference in the experience of riding the Metro [Railway] before and after the extension was opened to the public. Nowadays, every coach of the Metro is overflowing with passengers during the peak hours. Due to this situation, sometimes the environment inside the coaches becomes extremely hot and humid as the coaches do not have air condition in them. I do not find the Metro [Railway] ride as enjoyable and comforting as before . . . With the drastic increase in passengers, the number of pickpocket incidences has also increased and that has made it a less safe mode of transport than before.

As per the conversation with Mr. R.N. Mahapatra, Chief Public Relations Officer of Kolkata Metro (2009), this discomfort will no longer exist when the new air-conditioned coaches arrive from Perumbur Rail Factory and are put into operation in late 2010 and early 2011.

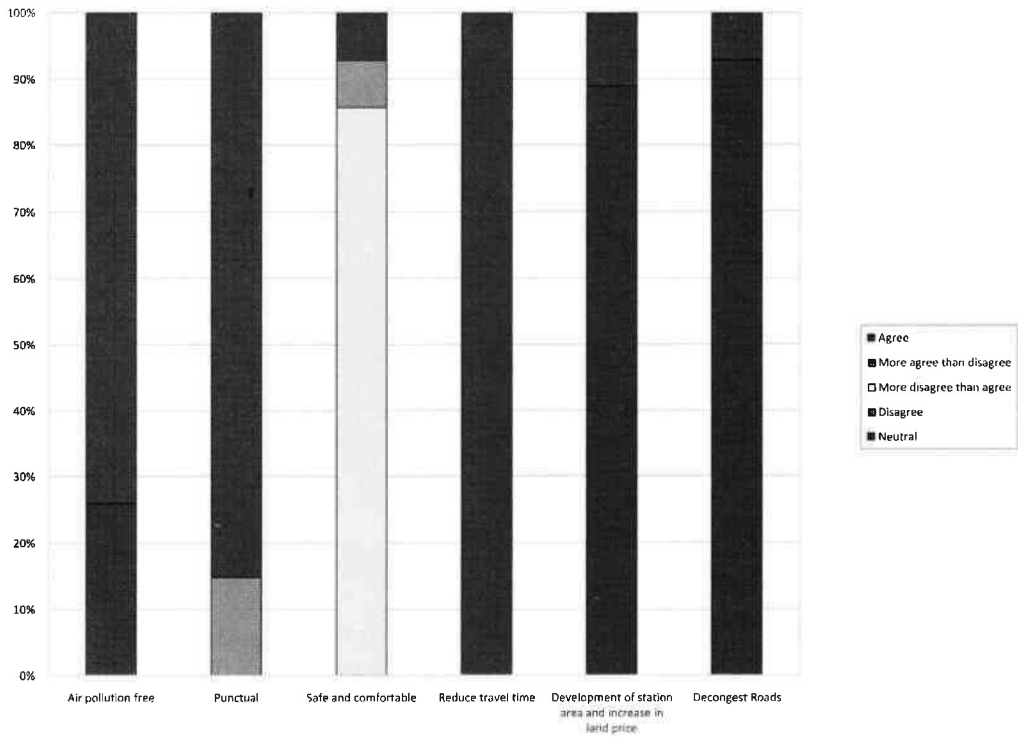

Fig. (10). Opinion of interviewees regarding benefits of Kolkata Metro Railway

However, the situation has not only worsened inside the coaches but also outside it as well, which is evident from the following observation by Jishnu Chakravorty, a 35 year old service man:

Sometimes the Park Street Station is so crowded that people stand beyond the yellow line (the safety line beyond which passengers are not supposed to stand). They can trip and fall into the track anytime if pushed from behind accidentally.

Hence people do not see it as a preferred mode of transport anymore, especially while traveling with children or senior citizens, or while going out for recreation. They prefer to ride a cab, three-wheeler, or luxury bus during these times.

Contrary to the above viewpoints is the one put forward by Amitava Chattopadhyay, a resident of Belghoria, Kolkata. He feels that Metro Railway is still a very comfortable mode of transport and that it helps to retain the energy of the office goers as well as it previously did. He also finds it a very suitable mode of transport because it allows him to remain properly dressed before attending a meeting or visiting a client.

Reduced travel time: Despite the breach in punctuality, Metro Railway it is still the fastest mode of transport, especially during rush hours when roads are extremely congested. All the interviewees agreed that this is one of the main reasons behind using the Metro Railway even today, when it does not provide the previous levels of comfort and safety. Metro Railway has drastically reduced the overall commuting time of the people living in the southern suburbs near the extended part of the line. Previously, those like Sharmila Maiti, a young journalist, had to make three transfers before boarding the Metro Railway from Tollygunge station. Now she does not have to make any transfers to travel to the Kavi Nazrul Station, which can be reached by one auto-rickshaw ride.

Development of station area and increase in land price: Few people (11%) were able to address this issue because most of them boarded the Metro Railway from stations that were built back in the late 1980s or early 1990s. However, those who live around the new stations agreed that the station areas have developed since the opening of the extension in August 2009, with the addition of more shops and apartment buildings. According to Gokul Banik, an executive customer support officer, the values of several apartments around the Masterda Surya Sen Station have increased by almost three-fold.

Decongest roads: Except for a couple of interviewees, none could comment on whether Metro Railway has decongested all of the roads parallel to the Metro Railway line. The interviewees who commented on this topic did find a reduction in the level of congestion of N.S.C. Bose Road, the major arterial road parallel to the extended portion of the Metro Railway. According to Gokul Banik, this decongestion has taken place due to the change in the route of the auto-rickshaws which previously used to take people to the Tollygunge station from places along N.S.C Bose Road. Now that the Metro Railway has been extended along this road, this service is no longer necessary.

Other benefits mentioned by the interviewees: The extension of the Metro Railway line has reduced travel costs for people living in some of the southern suburbs of Kolkata such as Garia, Narendrapur and Rajpur because they can now reach the Metro Railway station after one transit ride instead of multiple rides. Along with travel costs, it has also reduced the trouble of making multiple transfers.

Metro Railway was not affordable to all sections of the population at one point in time because its fare was high in comparison to other surface modes of transport. But now that the fare has become equivalent to other surface modes of transport, especially buses, it is being availed by all sections of the population.

Problems revisited

Underutilized: According to 93% of the interviewees, Metro Railway is not underutilized anymore in terms of ridership. Even though it has not yet reached the projected level, people who ride it every day, especially during rush hours, seriously feel that the coaches are filled to maximum capacity. Presently, Metro Railway also transports a significant number of people during the off-peak hours as has been indicated by Snigdha Banerjee, a housewife and mother of two children. According to Snigdha, after the extension, the Metro Railway remains filled even during the off-peak hours. Previously, she could easily find a place to sit while traveling, but now she considers herself very lucky if she finds a seat.

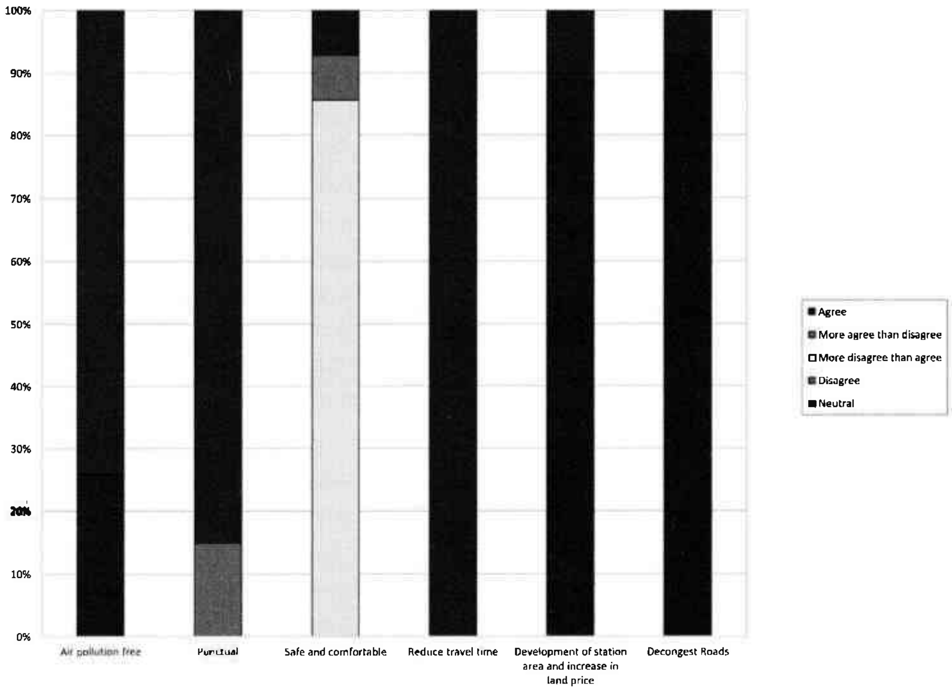

Fig. (11). Opinion of interviewees regarding problems of Kolkata Metro Railway

Integration with other modes of transport: About 93% of the interviewees believe that the problem of integration with the other modes of transport no longer exists. Metro Railway is very well integrated with other modes of transport, especially auto-rickshaws. Either outside or near every station, there is an auto-rickshaw stop. These auto-rickshaws take people to several destinations and have become a very popular mode of transport which is evident from the long queue outside them during the rush hours. Some of the stations also have cycle rickshaw stops and bus stops outside. In addition, the terminal stations are connected to the suburban rail network.

Inadequate maintenance: To 78% of the interviewees, this problem still persists. They believe that the maintenance problem has become worse after extension. There are various problems that they identified in addition to cancellation and delay of trains due to technical fallouts. There is an inadequate number of ticket punching machines which gives rise to long queues during rush hours. Metro Railway has become a convenient place to commit suicide and the authorities are not taking sufficient steps to stop such tragedies, nor are they well equipped to deal with such situations quickly. In addition, the air conditioning system of many stations works inadequately at times and the escalators often malfunction. People have complained about the accuracy of the metal detectors and the process of bag checking. In some of the new stations, the gap between the trains and station platform is larger which leads to inconveniences like slipping of shoes through the gap and may also lead to serious accidents.

Sensitive ridership: Metro Railway ridership is no more as price sensitive as it was before. Daily Metro Railway riders would continue to use the Metro Railway even if the price is raised by Rs 1 (2 cents) or Rs 2 (4 cents). In fact, some of them feel that the fare of Metro Railway is low in terms of the service that it provides and hence it should be increased.

Noise pollution, surplus and inadequately trained staff, financial loss, and problems with acquiring private land: Almost nobody (96%) is concerned about the noise pollution that is created when the train enters and leaves the station. According to Avik Ray, a student, it is less than the noise present on the surface.

All of the interviewees were unaware of problems related to surplus staff. However, they did point out that Metro Railway staff is not very well trained or equipped to handle emergency situations quickly. Interviewees also could not provide much opinion about the financial loss that Metro Railway has been incurring since the beginning nor the problem of acquiring private land.

Other problems mentioned by the interviewees: Previously, the Metro Railway stations were named and decorated on the basis of the specialty of the area where the station is situated (Metro Railway, 2004). Riders find the names of the older stations more appropriate than the new ones. The new stations have been named after iconic personalities and this confuses people since they have no relationship to the area where the stations are situated.

Most of the stations lack escalators and almost none have elevators, causing inconveniences to the elderly and handicapped. According to J.K. Mitra, Chief Operations Officer, Metro Railway (2009), the stations were built when the concept of making them handicapped and senior citizen friendly was absent in India. However, the situation is being addressed and the authority has plans to put these facilities in all stations. To date, they have already installed more escalators in some of the stations, such as the Central Station.

CONCLUSION

Kolkata Metro Railway, the first intra urban rail-based mass transit system of India, has successfully served the people of Kolkata since October 1984. The system's success in increasing the amount of patronage in terms of ridership numbers and extent of influence area has been impressive. In 25 years (1984-2009), its ridership has increased from a meager 1.5 million to 126.5 million annual passengers. However, it should be noted that Metro Railway has also experienced periods of bust when the ridership numbers slowed down or decreased due to rise in fare in 1991-1993 and 1997-2000. The bust period did not have much impact on the increase of ridership in the long term.

Presently, the influence area of Kolkata Metro Railway extends beyond four miles in all directions except the west where the presence of river Hoogly and an intensive suburban railway network has truncated it. An influence area of four miles and more is far beyond the usual extent of quarter mile influence areas around the station (Bollinger and Ihlanfeldt, 1997; Cervero, 1994). Improvement in integration of Metro Railway with the other modes of transport, especially auto-rickshaws, and the willingness of the people to travel long distances to ride the Metro Railway, has immensely influenced the increase in ridership and extent of the influence area.

Kolkata Metro Railway's success also lies in the fact that it has continuously provided several benefits to the people of Kolkata since its inception and added new ones with the passage of time. From the opinion of the interviewees, it is clear that Metro Railway has always been the fastest mode of public transport within the city especially during the time of traffic congestion. It has also successfully decreased the air pollution of Kolkata by remaining a pollution-free mode of transport, increased productivity of office goers by providing them with a relatively cleaner and more comfortable mode of transport, and increased development around some station areas. The huge increase in ridership has solved the problem of underutilization in terms of ridership numbers. With time, the fare of Metro Railway has not increased at par with the other modes of transport and it became more affordable to all sections of the population. The integration of Metro Railway with other modes of transport has made it accessible to more people. After the extension in 2009, Metro Railway has reduced the travel time and cost of many living in the southern suburbs of Kolkata.

Kolkata Metro Railway would have been a major success if it did not have several problems associated with it. Although some of the past problems – underutilization in terms of ridership, integration with other modes of transport, and ridership sensitivity in terms of fare increase – do not exist anymore, many others need to be solved. The system is still dealing with problems like financial non-profitability, noise pollution, surplus and inadequately trained employees, improper maintenance, lack of facilities for handicapped and senior citizens, and private land acquisition during construction phase. According to the Metro Railway authorities, the problems are being addressed and will be eliminated in the near future. It should also be noted that after extension to the southern suburbs, Metro Railway has become less comfortable, safe, and punctual. If these issues are not dealt with immediately, then in the future they will become problems of the system instead of being among its benefits. Despite the problems, Kolkata Metro Railway can be considered a successful intra urban rail-based mass transit system and Calcuttans feel proud about its existence.

This study does not provide any insight into the difference between Kolkata Metro Railway and other similar kinds of transport systems throughout India and the world. Kolkata Metro railway is not as extensive as Delhi Metro Railway, which started operating in 2003 and presently has a route length of about 97 miles serving 132 stations (DMRC, 2010). Kolkata Metro Railway is also not comparable in terms of scope to the New York City subway, serving 468 stations, the London subway, serving 275 stations, or Moscow Metro, noted for having 3.2 billion passenger rides every year (Metro Railway, 2004). However, the system still plays a very important role in the proper functioning of the city and extends several benefits to those riding it every day. In the future, it will be interesting to conduct a more elaborate study on the similarities and differences between Kolkata Metro Railway and other major Metro Railways around the world in terms of patronage and associated benefits and problems.

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