Discussion Paper No. 2/2012 (37)
December 2012

Kolkata Metro:
A Study On Passenger Movement And Financial Health
(1990-2010)

Koyel Bhattacharjee

Centre for Urban Economic Studies
Department of Economics,
University of Calcutta

Kolkata Metro: A Study On Passenger Movement And Financial Health (1990-2010)

Koyel Bhattacharjee

December 2012

Centre for Urban Economic Studies
Department of Economics
University of Calcutta
1 Reformatory Street
Kolkata 700 027
India
cuescu@gmail.com
+91-33-2479-0156

First Published: December 2012

Publisher: Mahalaya Chatterjee
CUES
1 Reformatory Street
Kolkata 700027

Printer: Slitters Supremus
C 224 Salt Lake City
Kolkata 700 064

Preface

One of the indicators of an efficient urban system is the presence of an efficient public transport system. And it must be admitted that in about three decades of its existence (in three different length of distances covered since its inception in 1984), the Metro Rail of Kolkata has served the purpose. At the time of its construction, it promised to add the 'wings' to the city and surely it had added wings of speed. The snarling traffic of the early eighties, is a matter of history now. In a normal day, the north-south stretch of Metro carries a sizeable proportion of the total traffic volume of the city. At the same time, it also serves as a feeder transport for east-west traffic and suburban commuters coming to the city and city-people going out to places along the suburban railroutes.

Even with this level of service, there are several snags in the functioning of the Metro rail. Even with the increase in the volume of passengers, the whole system is heavily subsidized. There are technological upgradations here and there, but there is no comprehensive plan for modernisation, and regular 'wear and tear' without maintenance is playing havoc with the system On the other hand, various other metro rail projects are under construction in different parts of the metropolis. So, it is high time for introspection and this Dicussion Paper of CUES is an attempt in this direction. In early nineties, one of the CUES Discussion papers described the functioning of the metrorail in its nascent stage. It was by Kuntala Lahiri-Dutt, one of the renowned geographers working on urban issues. This particular discussion paper is comprised of two different articles. The first by Anis Mukhopadhyay is more concerned with the planning of metrorail system from the early days and the lessons not learnt and applied for the upcoming east-west metro. On the other hand, Koyel Bhattacharjee, a geographer by discipline, analyses the passenger movement and financial condition of the north-south metro.

We expect that this discussion paper will initiate academic discussion of the necessity and economic viability of the metro system which is rightly the 'pride' of the city.

December 1, 2012

Mahalaya Chatterjee
Director
Centre for Urban Economic Studies

KOLKATA METRO:
A STUDY ON PASSENGER MOVEMENT AND FINANCIAL HEALTH
(1990-2010)

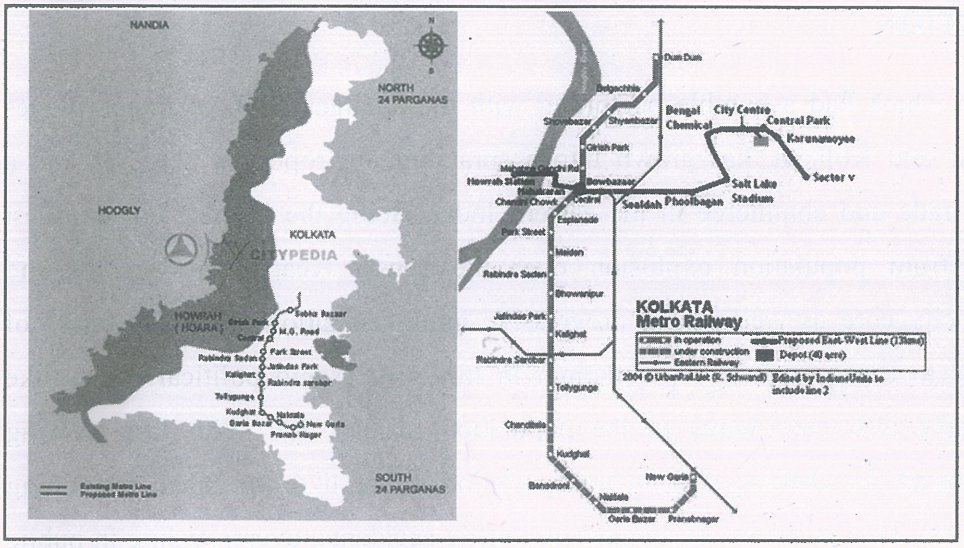
1. INTRODUCTION

The city of Calcutta which had a humble beginning with the amalgamation of three villages Sutanuti, Gobindapur and Kolkata, has grown into a sprawling metropolitan complex and a principal centre for trade and commerce in the eastern India. Being the primate city in West Bengal it suffered from population explosion over the census years. The growth and development of the city core as well as the progressive industrialization along the banks of Hooghly, contributed to the spurt in the population. In fact some socio political events like partition of India have also contributed to the population of the city. With fast growing population the city faced the challenges from transportation sector like any other developing cities of the third world. The problems of congestion, traffic accidents, overcrowding in public modes became common to the Calcuttans no sooner, and hence something was to be done to solve the problem .The panacea was given by Dr B.C .Ray and metro project in Calcutta was entirely his brain child.

Emergence of metro railway is a landmark event in the history of Kolkata. London was the pioneer in introducing underground railway in 1863, New York followed in 1867, Budapest in 1896, Tokyo in1927, Rome in 1955, Pyongyang (North Korea) in 1973 and Hong Kong metro in 1979.

The Metropolitan Transport Project (Railways) established in 1969 in the then Calcutta came up with the idea of construction of metro railways and the final construction started in 1973-74. After overcoming innumerable hurdles and crossing all barriers of disbelief, Kolkata Metro, India's first and Asia's fifth, came into reality with the commencement of operation on October 24, 1984. Since then the metro rail has expanded in phases. Presently the Kolkata metro is operating from Dum Dum to New Garia with a total stretch of 25.9 km with total 23 stations including the two terminal stations

MAP.1 EXISTING AND PROPOSED ROUTE NETWORK OF METRO RAILWAYS



source: http//www.mapsofindia.com MAP 1

2. OBJECTIVES

The study will highlight the performance of the metro railways in terms of the following objectives

- To examine the trend of passenger volume catered by the metro since 1990 s in general.
- To show the trend of the net traffic earnings in lakhs at constant prices of the Kolkata metro since 1993.
- To correlate between passenger growth and net earnings and that between net traffic earnings at constant prices of the metro from 2000-2010.
- To analyse the expenditure profile at constant prices since 1993 and evaluation of the financial health of the Kolkata Metro since the year 2000.
- To find out the centrality of the stations in terms of distance, time and fare.
- To decipher the reason behind metros popularity among the passengers between the fast moving modes through a passenger perception survey.

3. DATABASE AND METHODOLOGY:

With regards to the database, secondary data is collected from the Office of the Metro Railways, from their published reports and personal interviews with the officials. the time series data related with passenger growth, (1990-2010), earnings and expenditure (1993-2010), are procured from Metro Bhavan, both through interview, and consulting their published reports The earning and expenditure figures are converted from the current prices to the constant prices, by dividing the total earnings and the total expenditure, by the price index numbers of the respective years to remove the effect of inflation and reflect the real situation in terms of prices.

Simple statistical tool like Pearson's correlation is used for data analysis and suitable cartograms are used for data representations. Statistically for testing the significance of bi-variate data the null and the alternative hypotheses are formed.

A passenger perception survey is conducted to have an idea about the satisfaction of the passengers.

4. PASSENGER GROWTH: ESTIMATED AND ACTUAL

During the inception period of the Kolkata metro it was envisaged that the north south lines from Dumdum to Tollygunge would be completed by 1978 and then the traffic projections would necessitate the completion of the second rapid transit lines connecting Howrah and Sealdah by 1983 and the third such line again in north south direction by 1991.On the basis of these time thresholds, the estimated passenger volume in 1978 was 469 million; in1983 it was 543.9 million; 612.4 million in1990: in 2000 it was 630.1 million [2]. However the reality has been completely different. Metro came into existence in 1984, and the full stretch of north- south corridor measuring only 16.45 km was completed in 1995 only .Of late, metro has expanded to further south connecting Dumdum to New Garia in 2010 and the so called east-west stretch connecting Salt Lake to Howrah Maidan is under construction. Regarding the other proposed lines, work is now on along the 5.2 km DumDum-Dakshineswar route, which will be further extended 12.5 km to Barrackpore. Another 18.5-km route from Noapara to Barasat via Netaji

Subhas Chandra Bose International Airport has also been sanctioned and construction has started on this stretch. Construction work has also begun along the 16.72 km-long-metro line from Joka in extreme South Kolkata to BBD Bagh in central Kolkata. Only foundation stones have been laid for extension project between New Garia and the airport (32 km) via EM Bypass and Salt Lake.

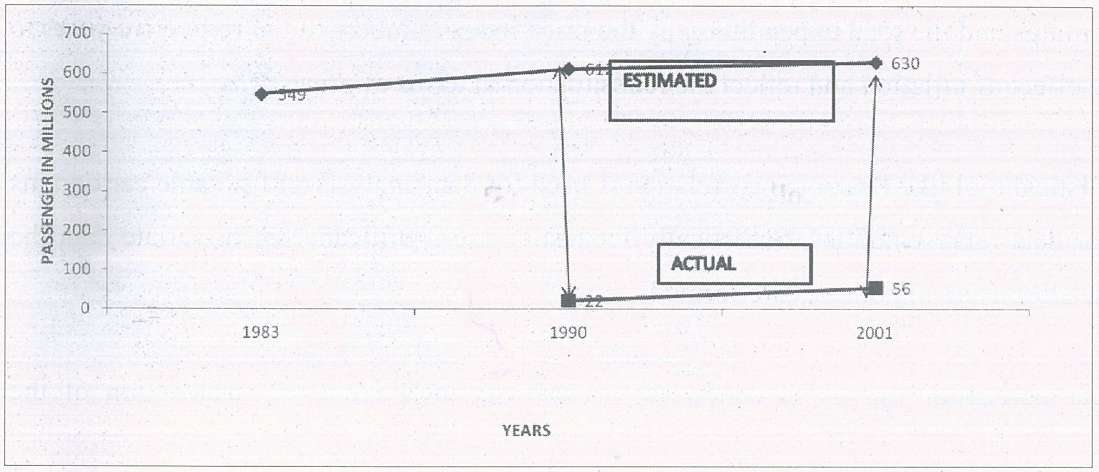


Figure 1. Gap between Estimated and Actual Passenger Growth of Kolkata Metro

Under this situation the passenger growth evidently fell well below the estimated plan prepared by Mass Transit report in 1971. The actual passenger volume in 1990- 91 was only 22.6 million, and in 1999-2000 it rose to only 55.8 million, which is much below, approximately one eleventh of the estimated traffic ten years ago in 1990. The aforementioned figure brings out the gap between estimated and actual passenger traffic.

5.1 TOTAL PASSENGER MOVEMENT: 1990-2010

The total passenger movement in the Kolkata metro has risen considerably although the total passenger has fallen below the projected passenger during the formulation of Calcutta Mass transit plan in 1971. The adjoining diagram represents the growth graph of the total passenger movement. The graph exhibits frequent dips and rises, which is responsive to the commissioning of the new stations in different phases and several other local factors influencing the passenger movement.

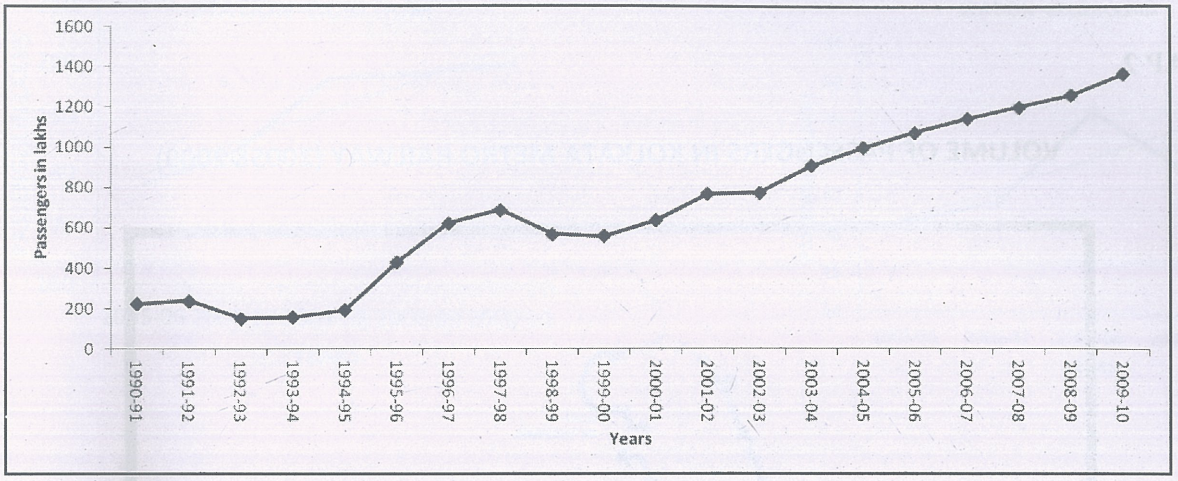


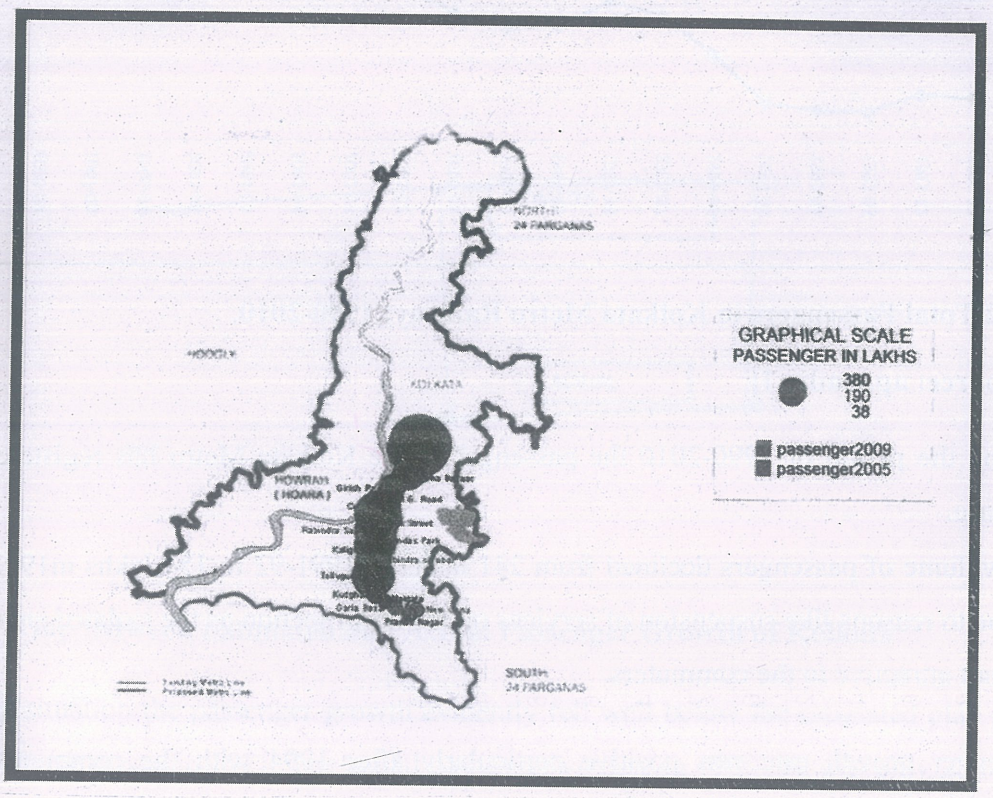
Figure 2.Total Passengers in Kolkata Metro Railway: 1990-2010.

[Data source: appendix 1]

- During the period of 1990-2010 the passenger in the Kolkata Metro has registered 500 % increase.
- The volume of passengers declined from 241 lakhs in 1991-92 to 154 lakhs in1993-94 may be due to reasons like suspension of services on the north section as the isolated small section was not attractive to the commuters.
- Passenger growth rate was positive particularly after 1994 with the commencement of services in Belgacchia-Shyambazar along with Dumdum- Belgacchia stretch on August, 1994.
- The spurt in the growth of passengers after 1995 i.e. 195 lakhs in 1994-95 to 433 lakhs in 1995-96 was due to the commencement of the continuous services along the north-south corridor i.e. from Dumdum to Tollygunge covering a total distance of 16.45 km
- The growth of passengers continued to be positive except in the years 1998-99 and 1999-2000 may be due the stiff competition from the private and state run buses due to the introduction of new routes and buses.
- From the year 2000-2001 onwards the passenger growth rate was positive and it reached to 1369.52 lakhs in 2010 may be due to expansion of Metro to Garia.

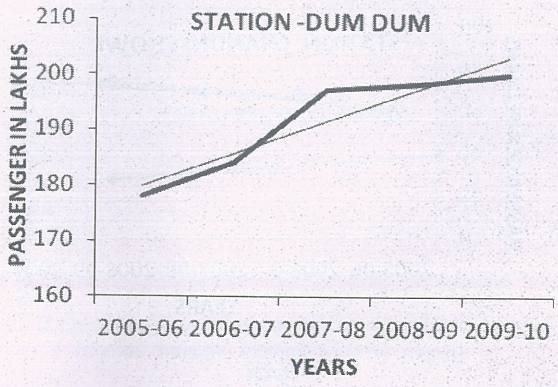
MAP 2

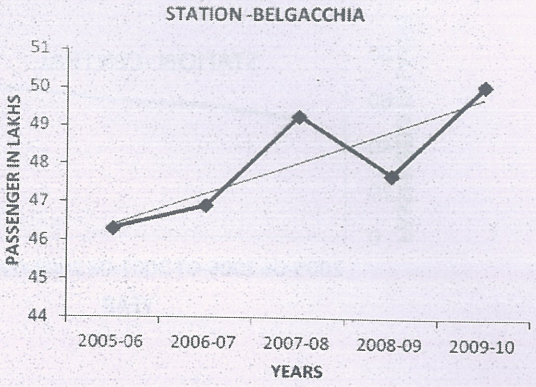
VOLUME OF PASSENGERS IN KOLKATA METRO RAILWAY (2005&2009)

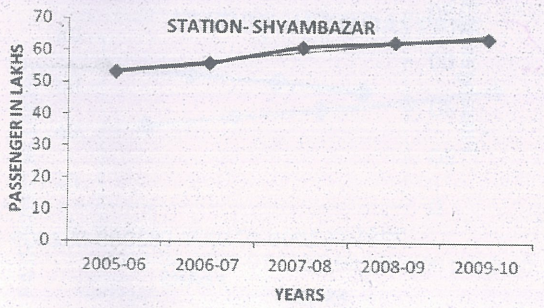


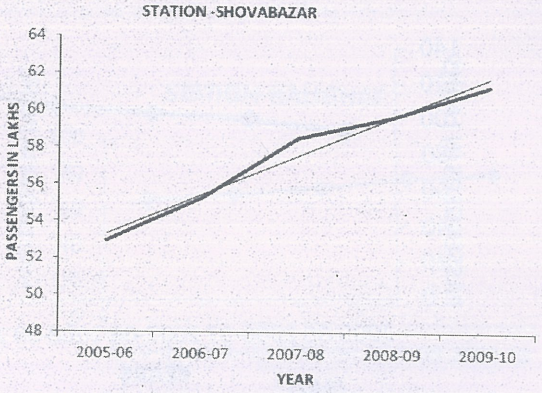
5.2 STATIONWISE PASSENGER MOVEMENT (2005-2009)

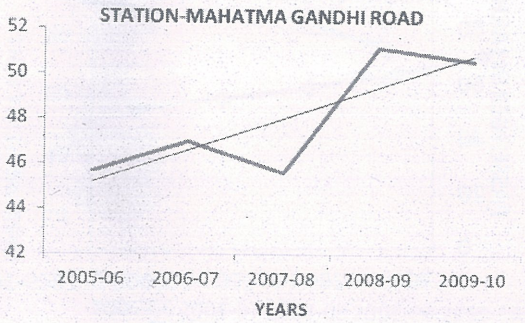
The objective of this section is to have an idea about the temporal variation in the passenger movement from Dum-Dum in the north and Kavi Nazrul in the south in order to ascertain the relative importance of the stations in terms of passenger movement .The adjoining time series graph prepared for each station along with the trend line is showing the yearly fluctuation in the passenger movement from Dum, Dum to Kavi Nazrul.The time series graphs prepared for the stations like Kavi Nazrul, Geetanjali could not be prepared since the services in these stations commenced from2009.

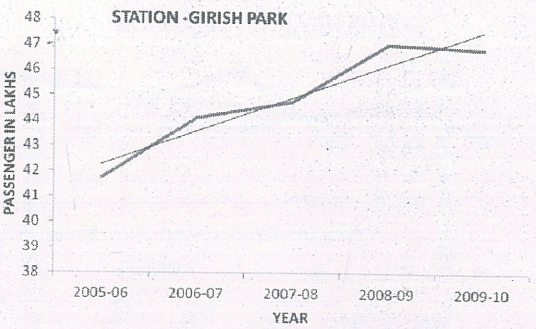

STATION -DUM DUM
PASSENGER IN LAKHS
210
200
190
180
170
160
2005-06 2006-07 2007-08 2008-09 2009-10
YEARS

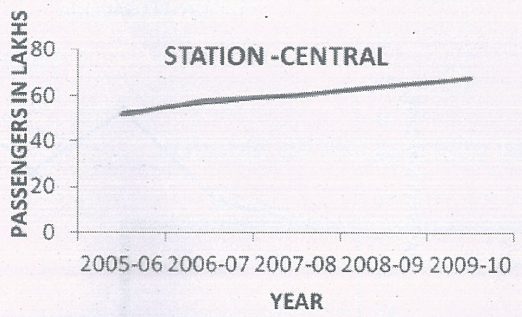

STATION -BELGACCHIA
PASSENGER IN LAKHS
51
50
49
48
47
46
45
44
2005-06
2006-07
2007-08
2008-09
2009-10
YEARS

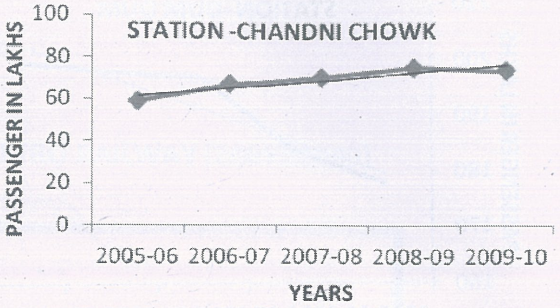

STATION- SHYAMBAZAR
PASSENGER IN LAKHS
70
60
50
40
30
20
10
0
2005-06
2006-07
2007-08
2008-09
2009-10
YEARS

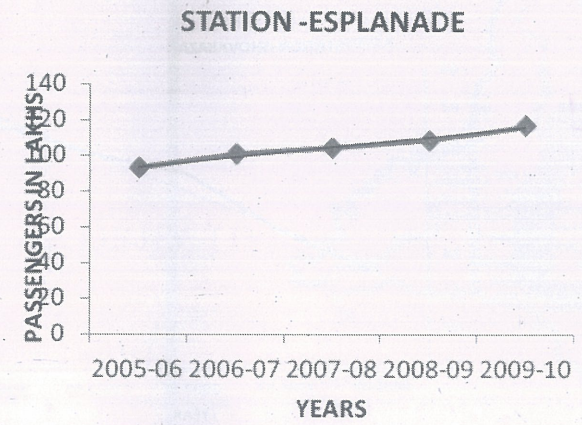

STATION -SHOVABAZAR
PASSENGERS IN LAKHS
64
62
60
58
56
54
52
50
48
2005-06
2006-07
2007-08
2008-09
2009-10
YEAR

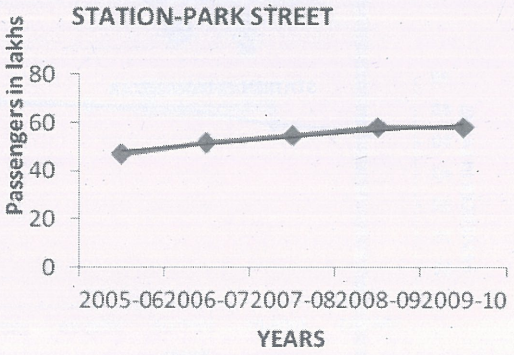

STATION-MAHATMA GANDHI ROAD
52
50
48
46
44
42
2005-06
2006-07
2007-08
2008-09
2009-10
YEARS

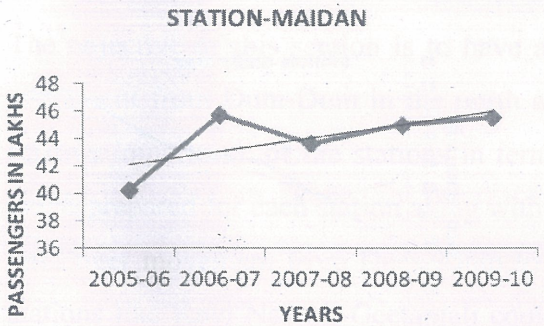

STATION -GIRISH PARK
PASSENGER IN LAKHS
48
47
46
45
44
43
42
41
40
39
38
2005-06
2006-07
2007-08
2008-09
2009-10
YEAR

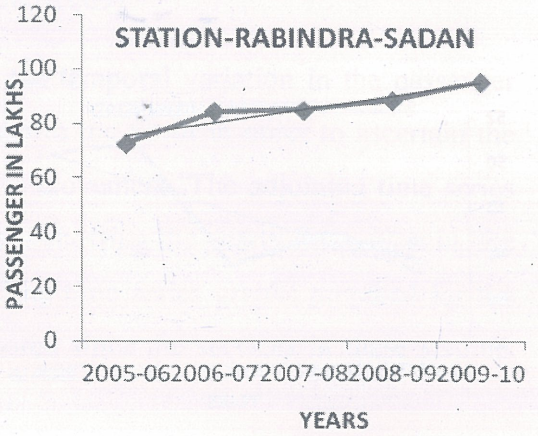

STATION -CENTRAL
PASSENGERS IN LAKHS
0
20
40
60
80
2005-06 2006-07 2007-08 2008-09 2009-10
YEAR

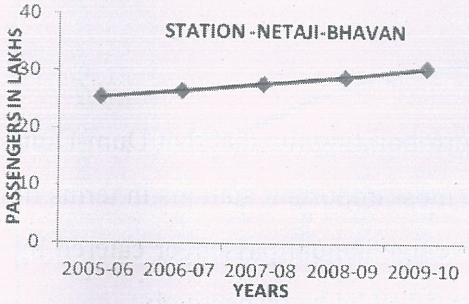

STATION -CHANDNI CHOWK
PASSENGER IN LAKHS
0
20
40
60
80
100
2005-06 2006-07 2007-08 2008-09 2009-10
YEARS

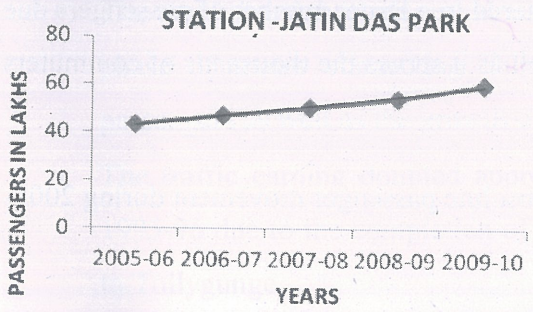

STATION -ESPLANADE
PASSENGERS IN LAKHS
0
20
40
60
80
100
120
140
2005-06 2006-07 2007-08 2008-09 2009-10
YEARS

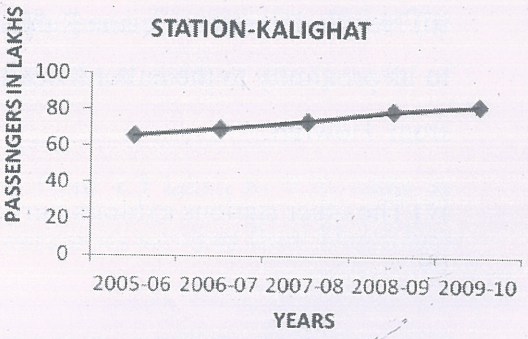

STATION-PARK STREET
Passengers in lakhs
0
20
40
60
80
2005-062006-072007-082008-092009-10
YEARS

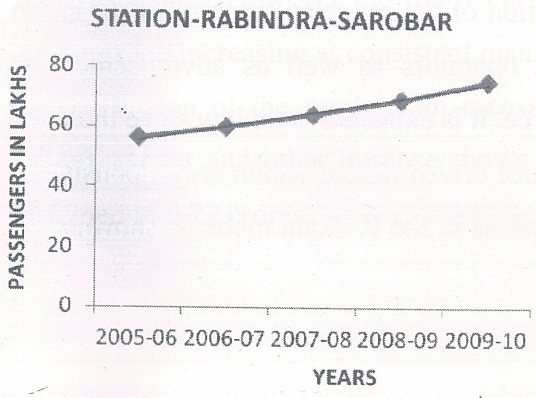

STATION-MAIDAN
PASSENGERS IN LAKHS
36
38
40
42
44
46
48
2005-06 2006-07 2007-08 2008-09 2009-10
YEARS

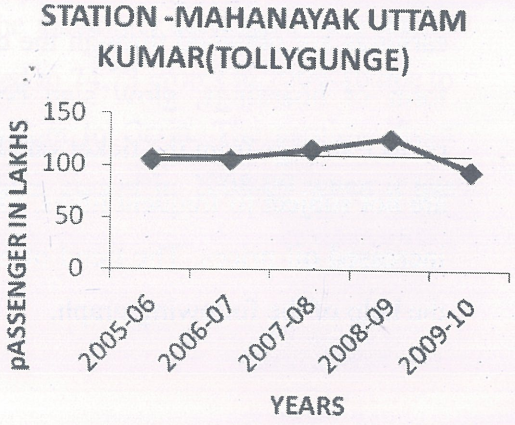

STATION-RABINDRA-SADAN
PASSENGER IN LAKHS
0
20
40
60
80
100
120
2005-062006-072007-082008-092009-10
YEARS


STATION -NETAJI-BHAVAN
PASSENGERS IN LAKHS
40
30
20
10
0
2005-06 2006-07 2007-08 2008-09 2009-10
YEARS


STATION -JATIN DAS PARK
PASSENGERS IN LAKHS
80
60
40
20
0
2005-06 2006-07 2007-08 2008-09 2009-10
YEARS


STATION-KALIGHAT
PASSENGERS IN LAKHS
100
80
60
40
20
0
2005-06 2006-07 2007-08 2008-09 2009-10
YEARS


STATION-RABINDRA-SAROBAR
PASSENGERS IN LAKHS
80
60
40
20
0
2005-06 2006-07 2007-08 2008-09 2009-10
YEARS


STATION -MAHANAYAK UTTAM KUMAR(TOLLYGUNGE)
pASSENGER IN LAKHS
150
100
50
0
2005-06
2006-07
2007-08
2008-09
2009-10
YEARS

OBSERVATIONS

i) The passenger growth graph along with the trend line is corroborating the fact that Dum-Dum and Mahanayak Uttam Kumar (erstwhile Tollygunge) are the most important stations in terms of passenger movement because of their terminal nature. The average annual passenger catered by these two terminal stations during these periods is 191 lakhs and 110 lakhs respectively.

ii) Apart from that Esplanade is an important station with greater number of passenger because of its centrality, and nearness to the central business district and the commercial hub of the city. The average passenger population during this period is 101lakhs.

iii) Next in importance came Rabindra Sadan which catered to a larger number of passengers due to its proximity to the cultural hearth of Kolkata as well as it serves the thousands of commuters from Howrah.

iv) The other stations exhibits fairly constant trend in absolute passenger movement during 2005-09.

5.3 TREND OF EARNINGS IN KOLKATA METRO AT CONSTANT PRICES (1993-2010)

In Kolkata Metro passenger traffic is the main source of earning, unlike other zonal railways which have the freight traffic as the major source of revenue. Besides other miscellaneous earnings are obtained through the commercial exploitation of the property, advertisement in the form of hoardings, glow sign board, mobile phone operators as well as advertisement at rakes.Earnings from the ticket sale being the major source, it is expected to be low since the fares are not subject to frequent hikes, like the diesel and petrol driven modes which are responsive to increased oil prices. The trend of earning at constant prices in the Kolkata metro is shown with the help of the following graph.

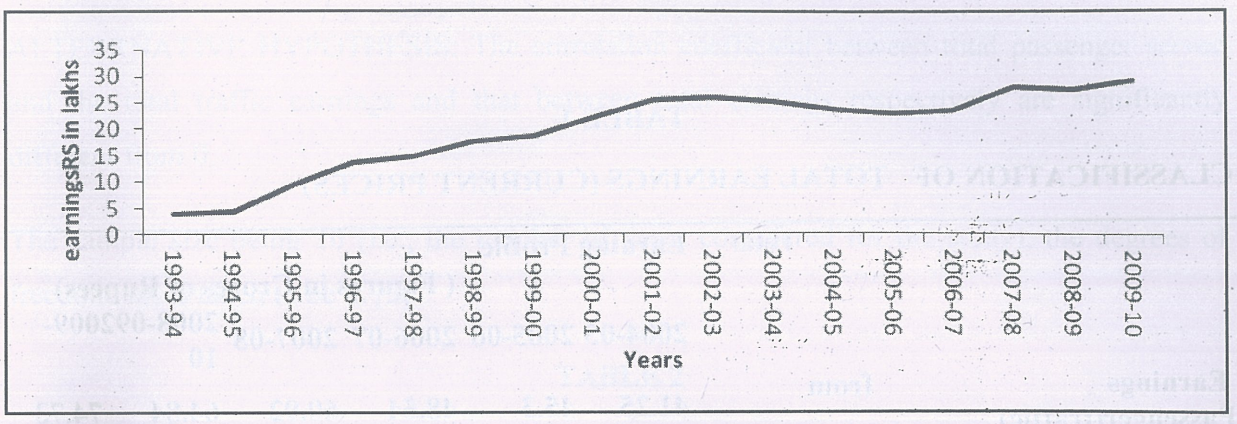


Figure 3.Total traffic earnings in Kolkata metro-1993-2010.

The figure shows that earnings have increased in a regular fashion. However graph shows

- The major breakthrough period was the year 1995, i.e. the year of completion of the first phase of metro connecting Dumdum to Tollygunge, which marked the growth of passengers as well as the growth of earnings.
- The traffic earning doubled approximately increasing from 4.5 lakhs to 9.36 lakhs in 1995-96 due to the completion of the first phase of continuous services from Dum Dum to Tollygunge.
- From the year 2000 the rate of growth of earning is showing positive trend .In course of the study period the total earning have risen greatly, when computed at current prices.

As it has already been said the the earnings from the metro consists of two broad section, passenger earning and sundry earnings which mainly comprise of the earnings from advertisements. However the following figure shows that the passenger earnings or the traffic earnings are increasing at consistent manner, and it has reached to 74.73 crores in 2009-10 due to the expansion of the north-south metro corridor from Dumdum to Garia. The earnings from advertisement and other purpose shows increase over the time, except in 2008-09 when it has declined to 9.22 crores.

TABLE 1

CLASSIFICATION OF TOTAL EARNINGS (CURRENT PRICES)

Total Earning Profile (Figures in Crores of Rupees)	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10
Earnings from Passenger(traffic)	41.25	45.3	48.54	60.92	64.84	74.73
Earnings from other activities	5.63	7.26	11.16	14.41	9.22	14.96

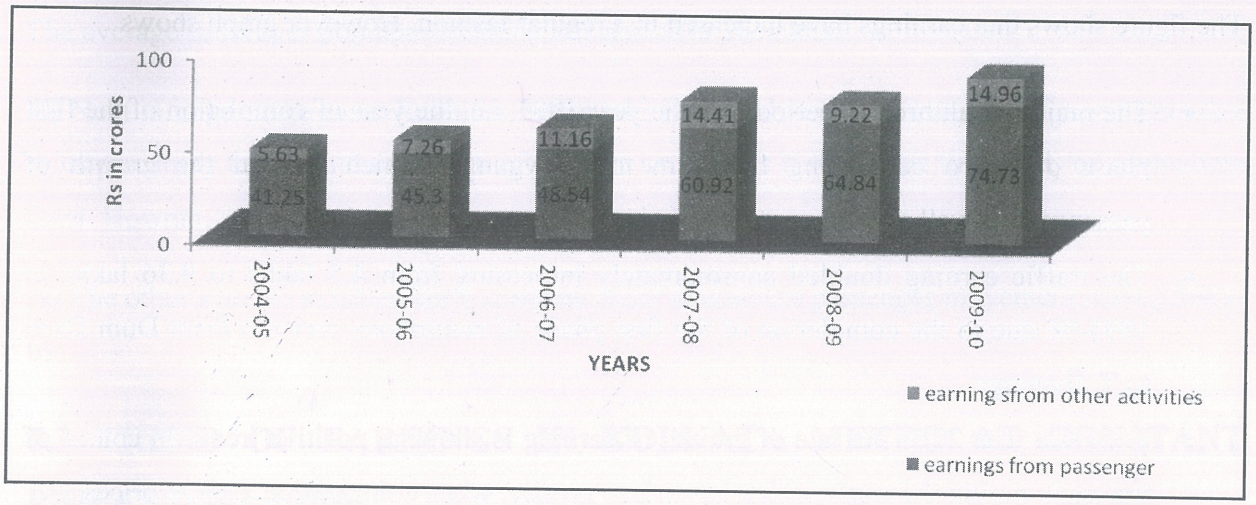


FIGURE 4 Source: http://www.mtp.indianrailways.gov.

5.4.1 CORRELATION BETWEEN THE GROWTH OF PASSENGER AND THE TOTAL TRAFFIC EARNINGS AND TOTAL EARNINGS IN THE KOLKATA METRO

For the present analysis, product moment correlation coefficients were found out between the total passenger served and the total traffic earnings and that between total earnings from the year 2000 to 2010.

NULL HYPOTHESIS: The correlation coefficient between total passenger served and the total traffic earnings and that between total earnings respectively are equal to 0.

ALTERRNATIVE HYPOTHESIS: The correlation coefficient between total passenger served and the total traffic earnings and that between total earnings respectively are significantly different from 0.

The sample size being 10 (i.e., the number of years considered for the study), the degrees of freedom, *df*, is taken to be 8. [5]

TABLE 2

COMPUTATION OF THE TOTAL TRAFFIC EARNINGS AND THE TOTAL EARNINGS AT THE CONSTANT PRICE USING PRICE INDEX NUMBERS

YEARS	TOTAL TRAFFIC EARNINGS IN LAKH	TOTAL EARNINGS IN LAKHS
2000-01	20.66	22.08
2001-02	22.18	24.28
2002-03	22.61	23.08
2003-04	25.14	25.81
2004-05	23.79	25.03
2005-06	22.96	26.87
2006-07	23.62	28.95
2007-08	28.23	34.92
2008-09	27.72	31.66
2009-10	29.29	39.57

TABLE 3

VALUES OF CORRELATION COEFFICIENT

CATEGORIES	Correlation coefficient (r)
Total earnings and total passengers	0.86
Total traffic earnings and total passengers	0.91

CATEGORY 1: The correlation coefficient between the total traffic earning and the total passenger served in the Kolkata metro is 0.86, which is significant at 99% confidence level. So the Null Hypothesis is rejected and the Alternative Hypothesis is accepted.

CATEGORY 2: The correlation coefficient between the total traffic earnings and the total passengers served is 0.91, which is significant at 99% confidence level. So the Null Hypothesis is rejected and the Alternative Hypothesis is accepted.

The Kolkata metro serves 2% passengers approximately in the Kolkata Metropolitan Area. [7] Although the percentage is meager and facing a stiff competition from the bus services and the suburban railway, it plays an important role in transporting people belonging from different cross sections of the society, along the north south corridor, linking places of employment, education, culture, commercial activity etc. Further, the recent expansion has improved the connectivity profile by linking the southern suburbs of Kolkata to the busiest city core. The absolute passenger volume has increased during the study period, which has a definite bearing on the traffic earnings of the metro railways in Kolkata.

5.4.2 EXPENDITURE AND FINANCIAL EFFICIENCY OF THE KOLKATA METRO AT CONSTANT PRICES

Expenditure of the railway is broadly divided into two categories, viz. Ordinary Working Expenses which includes repairs, maintenance, operating Expenses, staff cost, etc. and Plan-Head Expenditure. Capital or the Plan-Expenditure varies on the basis of the priorities of the investments from year to year. The adjoining diagram is representing the expenditure pattern (total working expenses) from the year 1993-2010.

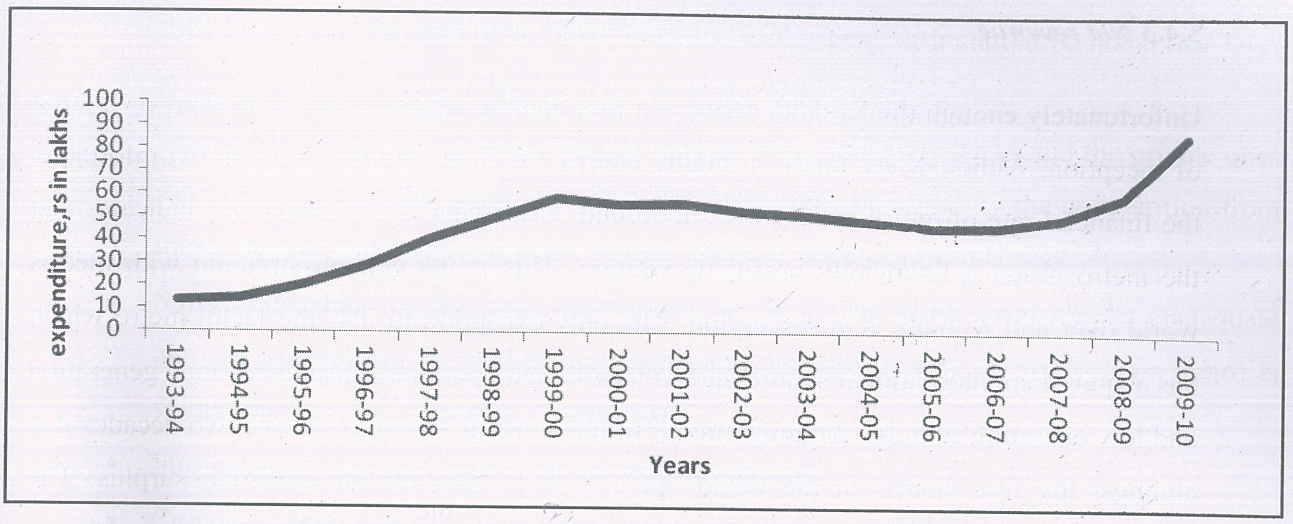


Figure 5. Total Working Expenses in the Kolkata Metro Railways, 1993-2010.

The graphical representation of the total working expenditure shows the expenses are increasing in a regular fashion. However the period from 2001-02 to 2006-07 is showing a constant control over the total working expenses which may be attributed to the all round fiscal discipline and the financial efficiency of the railways. From 2008 the expenditures are soaring up and reached all time high of Rs 22000 lakhs in the financial year 2009-10.Several reasons may explain this phenomenon.

- The construction of Tollygunge-Garia stretch at a rapid pace and final completion on October 2010.
- The hike in the employees pays packages: in the financial year 2008-09 and 2009-10 the employees got 60 and 40 percent arrears respectively which were due to them in the sixth pay commission.
- Substantial increase in the power tariff in the recent years. With few air conditioned rakes operating nowadays, the power consumption has shot up to new heights.[8]
- In face of rising expenditure the metro authorities are not increasing the fare regularly, to make it commensurate with the other metro systems in India.

In this paper an attempt has been made to assess the financial health of the Kolkata metro railways on the basis of two indicators i) net revenue ii) operating ratio .

5.4.3 *Net revenue*

Unfortunately enough the Kolkata metro is a loss making organization, from the very period of inception. Although the metro is highly energy efficient, reliable, safe and comfortable, the financial rate of return is very low; at around 3.5 percent [6]. It essentially indicates that the metro is not a financially profitable venture. This is the general situation with metros world over and Kolkata is no exception. The only exception to it is the Delhi metro which has acquired an international stature, due to its efficient operation, surplus revenue generation and low operating ratio.[6] Although junior to the Kolkata Metro by almost two decades it is amongst the five metros in the world out of 130 to generate an operating surplus. The adjoining graph shows the losses incurred by the Kolkata metro from 1993-2010.

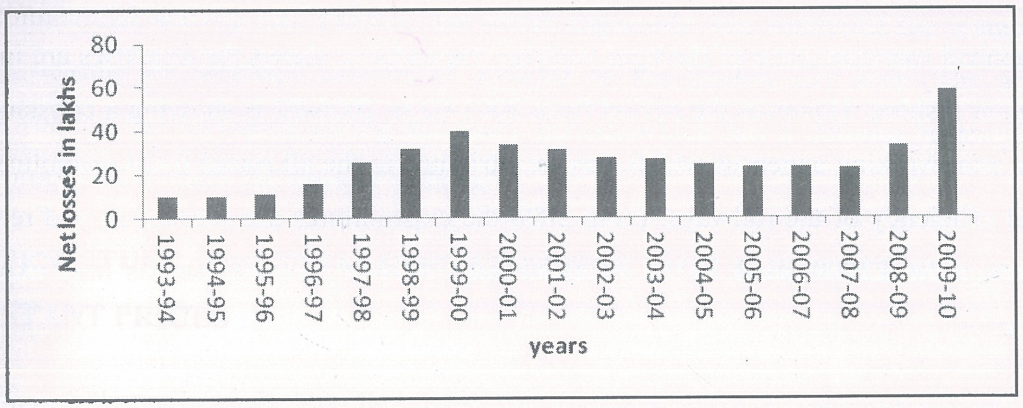


Figure 6. Net losses incurred by the Kolkata metro railways, 1993-2010.

The graph shows that the losses are a increasing at a consistent manner which depicts the financial sickness of the Kolkata Metro in course of the study period .The losses stood at 58.04 lakhs in 2009-10 which is an abysmally high figure and questions the viability of metro in Kolkata. The Kolkata Metro Railway reported loss of Rs 99.26 crores in the fiscal year 2011-12. [8] Several reasons may be held responsible for such huge amount of losses.

- Fares are not increasing for the last few years, as the commuters in Kolkata are very sensitive to fare increase and frequent and substantial increase in fare may cause modal

shift in favor of bus and para transit systems. In this context it should be noted that fares in Kolkata metro are only half of fares as in the Delhi metro.

- Easy availability of alternative bus transport modes; both state buses and the private ones running parallel to the metro corridor. The metro may be killed by the competition from these cheaper and more accessible modes which it sought to complement.
- Subsidy provided by the state government for the power tariffs seems to be inadequate and the government is not keen on increasing the subsidy rate as the Kolkata metro is solely operated by the central Government.
- Surplus staff is a huge burden on the metro exchequer.
- Certain infrastructural bottlenecks may be held responsible. It is reported that approximately 10000 passengers are using metro without tickets as the ticket checking infrastructure is in shambles.[2] Recently with the introduction of new technology i.e. tokens and the flap gates, the conditions are likely to improve.

5.4.4 *Operating ratio*

This is another important indicator to assess financial health of the metro. It is simply expressed as the ratio between total working expenses to the total earnings

TABLE 4

CALCULATION OF THE OPERATING RATIO

Years	Total earnings in lakhs	Total working expenditure in lakhs	Operating Ratio
2000-01	22.08	55.80	2.53
2001-02	24.28	56.52	2.33
2002-03	23.08	52.91	2.29
2003-04	25.81	51.52	1.96
2004-05	25.03	48.41	1.94
2005-06	26.87	46.26	1.72

2006-07	28.95	46.63	1.61
2007-08	34.92	50.70	1.45
2008-09	31.66	60.63	1.91
2009-10	39.57	87.34	2.20

The operating ratio in Kolkata metro is on the higher side since the maintenance cost for an underground system is always higher than the over ground one and the expenditure have increased sharply in response to the completion of the north south corridor as well as due to the enhanced pay packages to the employees. Thus it is evident Kolkata metro needs a well formulated plan and government aids to upgrade its financial condition to gain an international accreditation like the Delhi Metro. It may be stated that the operating ratio ranges from 0.3 to 0.6 in case of the Delhi metro from its inception, till date [6].The working expenditure in Kolkata metro is more or less double the earnings in almost all the years ,indicating the financial ill health

6. CENTRALITY OF THE STATIONS

In lexical parlance, centrality is defined as the quality or state of being central or central situation or the tendency to remain in or at the centre. The objective of this exercise is to ascertain the centrality of the stations (from Kavi Nazrul to Dum Dum) which is considered as nodes in a linear alignment in a matrix. The parameters taken for measuring centrality are i) distance ii) time iii) fare. Distance and time are static variable, will remain unchanged, whereas the third parameter, fare is considered as quasi-static and is expected to remain unchanged unless subjected to revision.

The data for inter station distance is available from the Metro Bhavan .Time taken for the journey is registered during onboard journey whereas the information for the inter station fare is obtained from the station fare chart .With the help of this data three matrices are prepared for each parameter (APPENDIX 6,7,8)

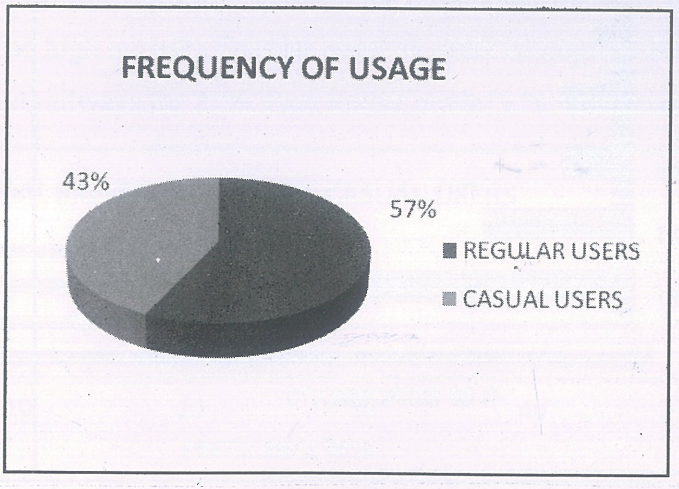
Centrality is determined on the basis of the score computed through the matrices. The least the score will be, higher will be the centrality and hence accessibility.

From the study Esplanade came out to be the most central station with respect to time; Rabindra Sadan came out to be the central station with respect to distance and Maidan became the central station with respect to fare. So these stations on account of their least score became the most accessible stations.

7. PASSENGER PERCEPTION OF THE METRO USERS.

The purpose of the survey is to collect basic information about the satisfaction level of the passengers about the performance of metro in terms of service. The usefulness and the performance of this mode was examined in a passenger perception survey involving the interview survey of passengers The interview survey was conducted both onboard trains as well as three stations Kavi Nazrul, Rabindra Sadan and Dum Dum metro stations over a week period covering both weekdays and Saturday . The random sample indicated that there was slightly high percentage of male respondents with about 65%of being male. Majority of the respondents were from physically and economically active age range of 20 to 50 forming about 95%of the respondents.

In order to have meaningful analysis the metro rail users were studied on the basis of frequency of usage and the criteria was regular users and casual users. The survey revealed that 57% of the respondents fall into the former group and 43% belonged to the latter.

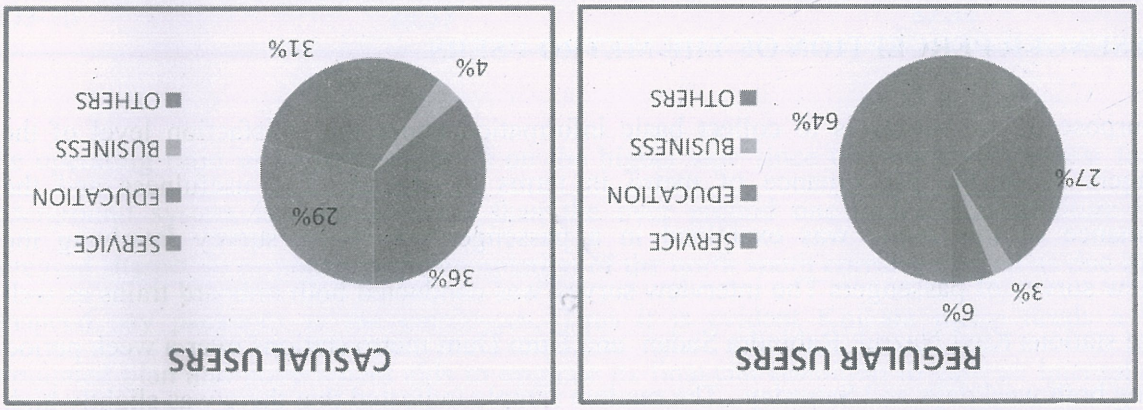


SOURCE: PRIMARY SURVEY FIGURE 7

For trip purpose the passengers were interviewed on the following criteria like service, business, education and other categories. For the regular users service comprised about 64%, education

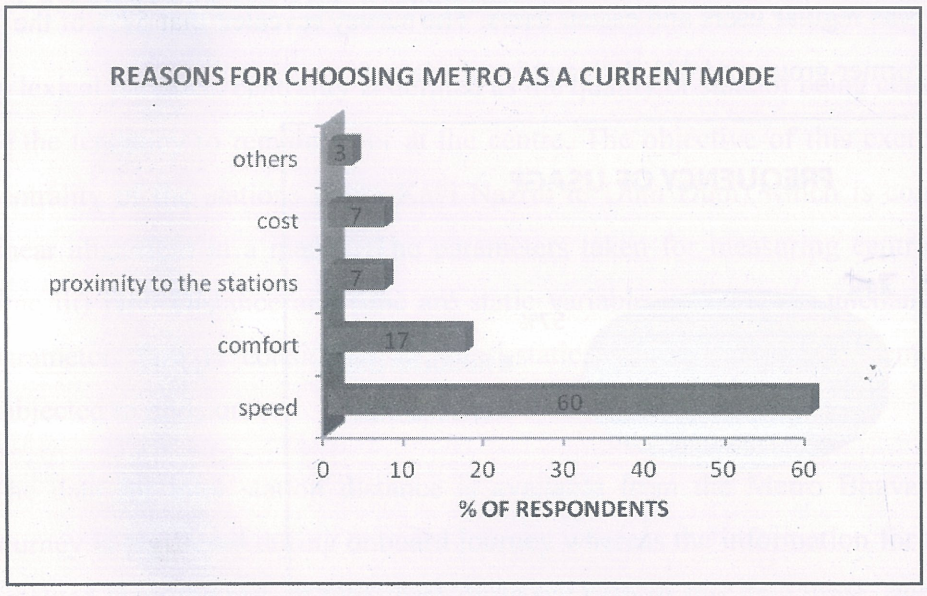
27%, business accounted 3%, others account for 6%.The corresponding percentage for the casual users are 29%, 31%, 4% and 36% respectively.

TRIP PURPOSE



SOURCE: PRIMARY SURVEY FIGURE 8

The regular users were interviewed about the reasons for choosing metro as the current mode of travel. The result was speed 60%,comfort 17%,cost 7% and close proximity was another factor comprising 7%. No other reason accounted more then 3%.

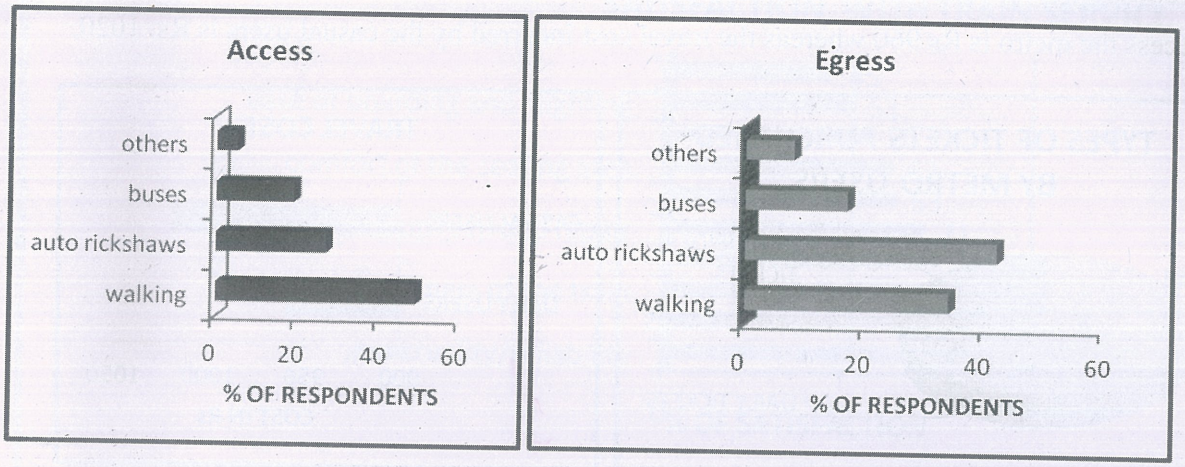


SOURCE: PRIMARY SURVEY FIGURE 9

The metro users were interviewed about the modes of access to and egress from the metro station in order to identify the modal split The main modes identified to access the metro station were walking 49%, auto

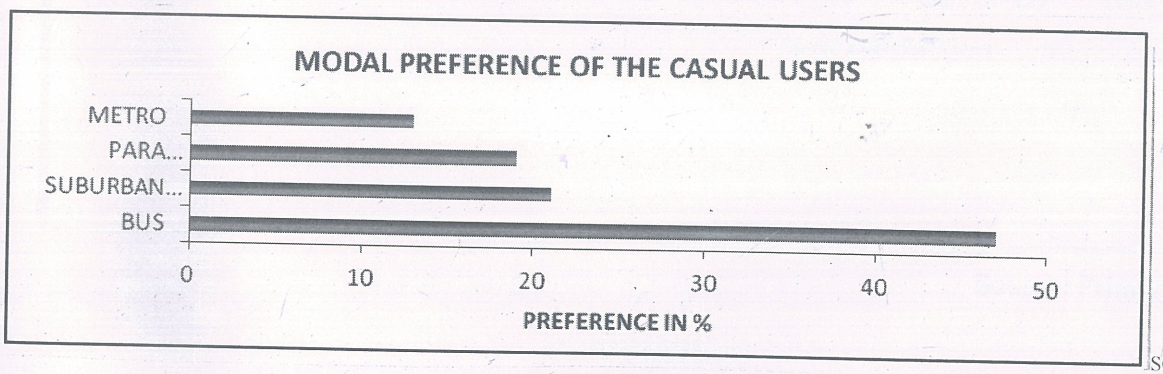
rickshaws 27%, Buses 19%, others 5%.The modes identified for egress out of the station are walking 34%,auto rickshaws 42%, buses 17% and others 7%.this shows that the passengers walk out of the station and uses different modes to reach their final estination.

MODAL SPLIT



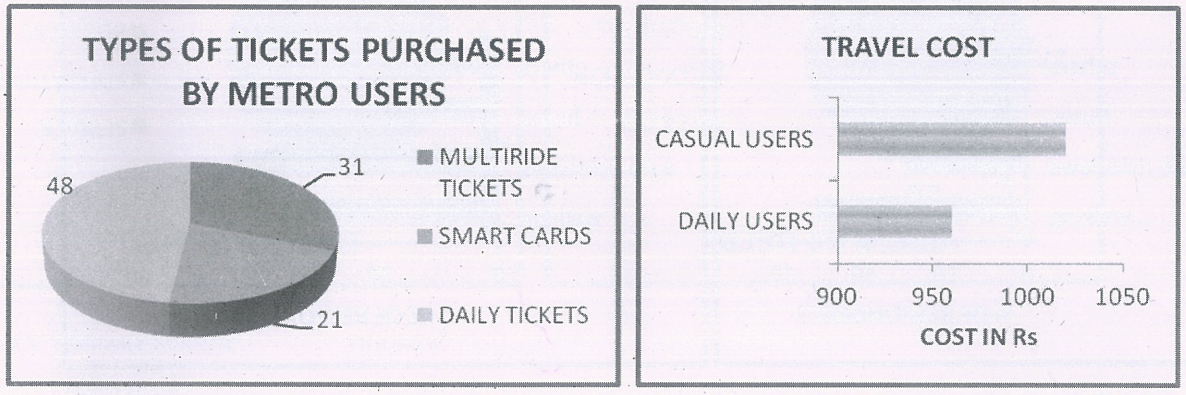
SOURCE: PRIMARY SURVEY FIGURE 10

Considering the fact that metro is the most sought after mode for the regular users, the casual users were interviewed about their modal choice and the survey revealed the casual users depend on metro during emergency or some special purpose, but bus services is the most preferred mode for them for its wide availability and easy accessibility throughout the city .Dependence on the para transit modes was also high in case of casual users. In order of importance bus services were popular for 47%, suburban railways for 21%, Para transit mode19 % and metro constituted 34%.



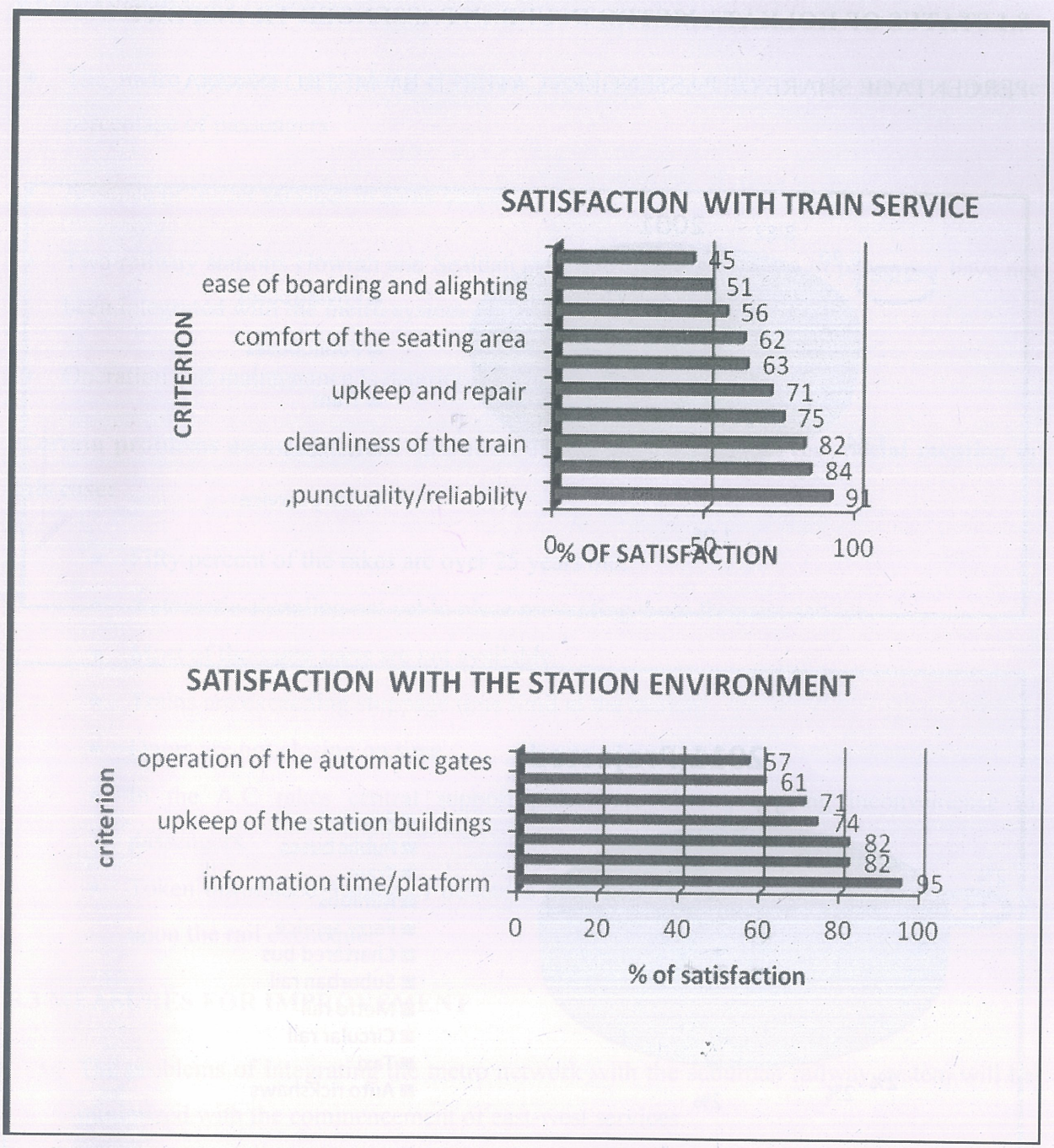
SOURCE: PRIMARY SURVEY FIG 11

The metro authority usually sells two way tickets, double tickets, and group tickets. The majority of the daily users avails the facility of limited multi ride ticket or the smart cards, since they offer a good amount of rebate. Among the respondents 32% use multiride tickets, 21% use smart cards and the rest daily tickets which may be one-way or both ways. The travel cost incurred by the metro users were enquired. The average cost for the daily users including all the modes they use to access the metro is Rs 960 whereas the travel cost incurred by the casual users is Rs. 1020.



SOURCE: PRIMARY SURVEY FIG URE 12

The respondents were interviewed about the overall service of the trains and the stations on the basis of selected criterion. Two separate set of criterion for assessing the services of the train and the stations were presented to the passengers. The passengers expressed their satisfaction on each criterion and the results of the study are presented with the help of following diagram.

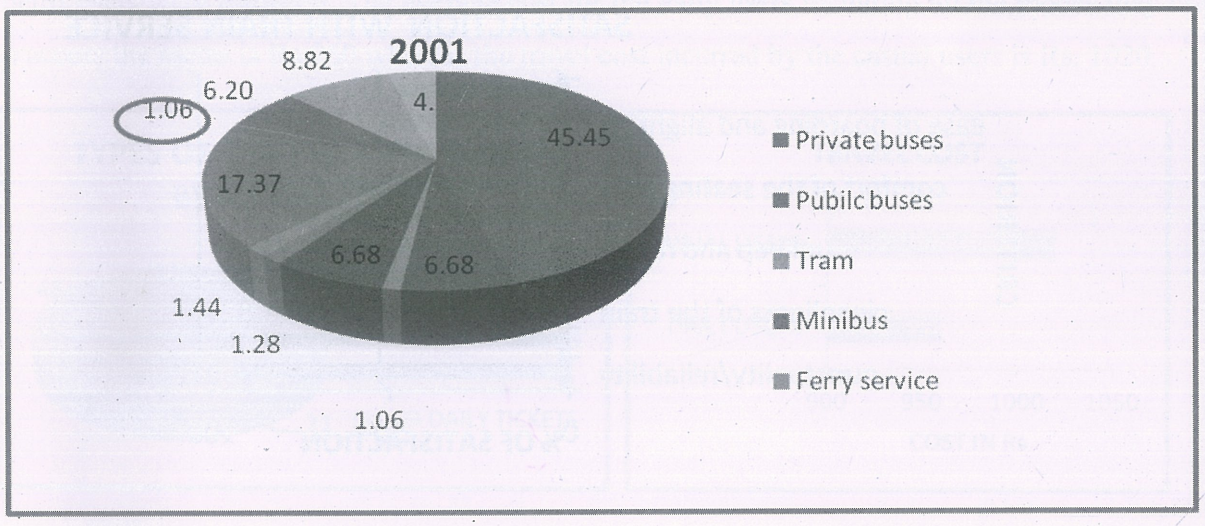


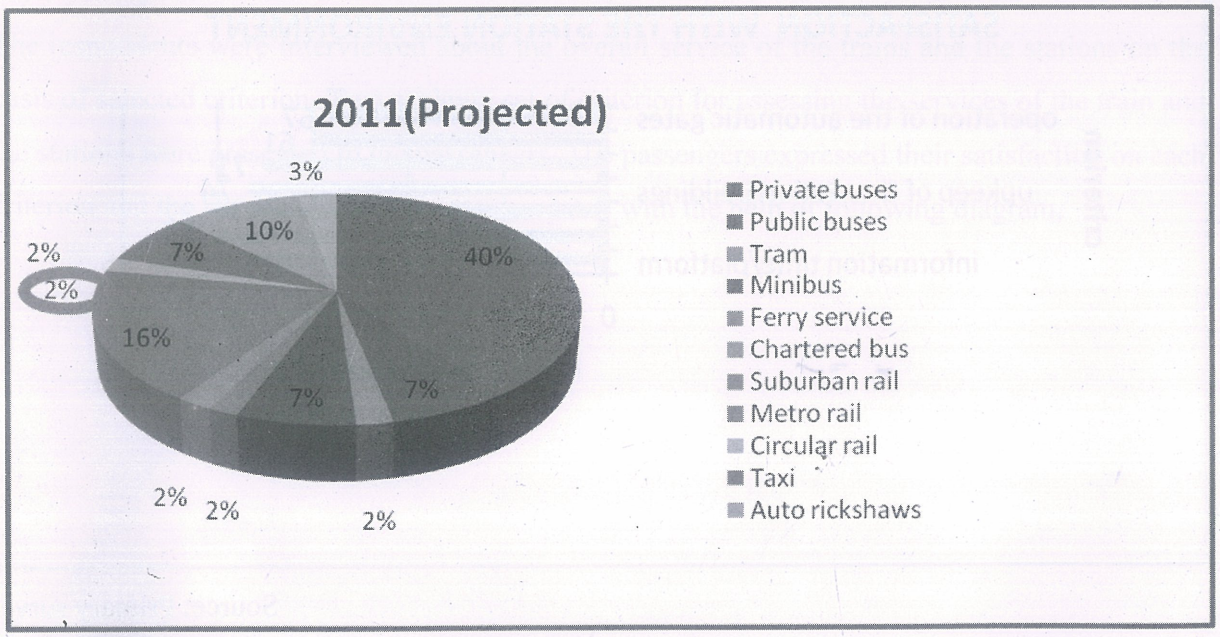
Source: Primary survey

FIGURE 13

8.1 STATUS OF KOLKATA METRO IN URBAN PASSENGER TRANSPORT

PERCENTAGE SHARE OF PASSENGERS CATERED BY METRO IN KMA





SOURCE:KMDA REPORT FIGURE 14

According to the perception survey metro is quite a popular mode; however the KMDA survey reveals that metro caters only to a meager 2% of passengers in KMA [7]

8.2 REASONS

- The metro operates only along a narrow north south corridor, hence serves a meagre percentage of passengers
- Absence of feeder services in some cases.
- Two railway stations Howrah and Sealdah that have the largest share of passenger have not been integrated with the metro system.
- Operation and maintenance is deteriorating day by day.

Certain problems associated with operation and maintenance deserves special mention in this case:

- Fifty percent of the rakes are over 25 years old.
- Automatic signaling not yet in place preventing more frequent service.
- Most of the spare parts are not available.
- Trains are exceeding stoppage time limit at the station.
- Doors are not closing on time.
- In the A.C rakes central support pillars are absent, causing inconvenience to passengers.
- Token introduced instead of tickets is not yet ubiquitous and loss of token is telling upon the rail exchequer.

8.3 MEASURES FOR IMPROVEMENT

- The problems of integrating the metro network with the suburban railway system will be minimized with the commencement of east-west services.
- Automatic signaling has been implemented
- Efforts being undertaken to increase the speed of trains.
- More A.C rakes to arrive in phases which may solve the problem of overcrowding in metro.

9. FINAL CONCLUSIONS

The paper attempted to analyze the present situation of the Kolkata Metro with respect to the passenger growth (1990-2010), total traffic earnings, and total earnings, total working expenditure, net revenue losses and operating ratio for the years 1993-2010.the latter part of the paper aimed to focus on the centrality aspect of the stations and to assess the reasons for popularity in Kolkata metro, if any both by primary and secondary data

The results of the correlation coefficient exhibits fairly positive relationship between total passengers and total earnings and total traffic earning respectively. The volume of passenger is increasing in the metro with the expansion in phases, amidst constant price or the constant fare for the last ten years. As it has been found out that Kolkata metro is suffering from a persistent loss which is also in a rising trend together with increasing passenger. So to mitigate the finance crunch it is advisable to increase revenue or to decrease expenditure, however the former is impossible unless fare gets revised. Due to political compulsions in a democratic set up it is not possible for the authority to increase fare substantially in the present situation. Coming to the expenditure part, the causes for increased expenditure have been pointed in the previous section.

An integrated transport policy should come with the coordination of the existing railway system with the road based modes making arrangement for intermodal transfers as well as rationalizing the fare structure. However, the Kolkata metro, the first metro system in India, is still in the incipient stage. The existing north south metro is catering to only a part of the passenger in the Kolkata Metropolitan Area. Once the proposed metro network gets completed and come into operation the connectivity profile of the KMA will definitely improve as in Delhi, or any other metro system in the world and it is expected to generate surplus revenue.

The major findings from this study are enumerated as follows:

- The passenger growth although increasing at consistent manner, fell below the projected growth estimated by the planners, during the formulation of the plans for Kolkata Metro. Another very important fact is that the growth in the passengers is the direct outcome of the completion of the full stretch of north-south corridor.

- The total traffic earning has also increased in manifold which is related with the growth of passengers, as the fare box is the main source of earning.
- The correlation coefficient computed between total traffic earning and total earning, respectively and the passenger served is positive as well as significant indicating the optimal utilization of the capacity in Kolkata Metro.
- Finally the expenditure in Kolkata metro has been always greater than the earning resulting a persistent net revenue loss and low operating ratio reflecting the sordid state of finance in Kolkata Metro.
- The centrality exercise undertaken in this paper brings out the fact that Esplanade, Rabindra Sadan and Maidan are the central stations in terms of time distance and fare respectively.
- Finally metro is a popular mode among the Kolkatans as revealed by the passenger perception survey, although its share in catering to the passenger of the KMA is quite negligible.

APPENDIX.1 TOTAL PASSENGERS IN KOLKATA METRO

YEARS	PASSENGERS IN LAKHS
1990-91	226
1991-92	241
1992-93	154
1993-94	159
1994-95	195
1995-96	433
1996-97	626
1997-98	691
1998-99	570
1999-00	558
2000-01	637
2001-02	766
2002-03	773
2003-04	905
2004-05	996
2005-06	1078
2006-07	1149
2007-08	1206
2008-09	1265
2009-10	1370

Data source: Office of the Metro railways, Kolkata

APPENDIX2. PASSENGER DATA (STATIONWISE)

STATION DUM-DUM	Passengers in lakhs
2005-06	178.05
2006-07	184
2007-08	197.05
2008-09	198.15
2009-10	199.85

BELGHACHIA	Passenger in lakhs
2005-06	46.32
2006-07	46.93
2007-08	49.31
2008-09	47.75
2009-10	50.06

SHYAMBAZAR	passenger in lakhs
2005-06	53.43
2006-07	55.98
2007-08	61.31
2008-09	62.85
2009-10	64.05

SHOVABAZAR	Passenger in lakhs
2005-06	52.92
2006-07	55.26
2007-08	58.51

2008-09	59.68
2009-10	61.32

GIRISH PARK	Passenger in lakhs
2005-06	41.76
2006-07	44.12
2007-08	44.76
2008-09	47.02
2009-10	46.85

MG ROAD	Passenger in lakhs
2005-06	45.69
2006-07	46.95
2007-08	45.6
2008-09	51.14
2009-10	50.57

CENTRAL	Passenger in lakhs
2005-06	51.57
2006-07	58.23
2007-08	60.23
2008-09	64.33
2009-10	67.88

CHANDNI CHOWK	Passenger in lakhs
2005-06	58.81
2006-07	66.96
2007-08	70.35
2008-09	74.8
2009-10	73.56

ESPLANADE	
2005-06	92.88
2006-07	100.55
2007-08	104.46
2008-09	108.94
2009-10	116.9

PARK STREET	
2005-06	47.4
2006-07	51.83
2007-08	54.9
2008-09	58.15
2009-10	58.21

MAIDAN	
2005-06	40.22
2006-07	45.77
2007-08	43.66
2008-09	45.04
2009-10	45.57
	220.26

RABINDRA SADAN	Passenger in lakhs
2005-06	72.64
2006-07	84.32
2007-08	84.93
2008-09	88.52
2009-10	95.35
	425.76

NETAJI BHAVAN	Passenger in lakhs

2005-06	25.47
2006-07	26.45
2007-08	27.77
2008-09	28.91
2009-10	30.66
	139.26

JATIN DAS PARK	Passenger in lakhs
2005-06	43.38
2006-07	47.21
2007-08	50.22
2008-09	54.35
2009-10	60.12
	255.28

KALIGHAT	
2005-06	65.87
2006-07	69.35
2007-08	73.55
2008-09	79.87
2009-10	82.72
	371.36

RABINRA SARAOBAR	
2005-06	56.32
2006-07	59.74
2007-08	63.68
2008-09	68.94
2009-10	74.75
	323.43

MAHANAYAK UTTAM KUMAR

2005-06	106
2006-07	106.46
2007-08	115.88
2008-09	126.91
2009-10	96.28
	551.53

APPENDIX 3: TOTAL EARNINGS IN METRO RAILWAYS

YEARS	TOTAL EARNING IN LAKHS
2000-01	3438
2001-02	3578
2002-03	3773
2003-04	4423
2004-05	4456
005-06	4492
2006-07	4871
2007-08	6091
2008-09	6484
2009-10	7379

Datasource: Office of the Metro railways, Kolka

APPENDIX4: TOTAL TRAFFIC EARNINGS, WORKING EXPENDITURE AND NET REVENUE LOSSES IN KOLKATA METRO

YEARS	TOTAL EARNING IN LAKHS(2)	TOTAL WORKING EXPENSES IN LAKHS(3)	NET REVENUE LOSS IN LAKHS(4)
1990-91	300	822	522
1991-92	327	1002	675
1992-93	438	1084	646
1993-94	403	1373	970
1994-95	502	1647	1145
1995-96	117	2548	1378
1996-97	1742	3720	1978
1997-98	1965	5384	3419
1998-99	2416	6792	4376
1999-00	2693	8491	5798
2000-01	3218	8689	6221
2001-02	3578	9118	5540
2002-03	3773	8826	5053
2003-04	4423	9063	4640
2004-05	4456	9067	4611
2005-06	4492	9048	4556
2006-07	4871	9615	4744
2007-08	6091	10934	4843
2008-09	6484	14181	7697
2009-10	7379	22000	14621

Data source: column 2&3: Office of the Metro railways, Kolkata

Column 4: computed by the author

APPENDIX 5.WHOLESALE PRICE INDEX NUMBER WITH BASE 1993-94

YEARS	WHOLESALE PRICE INDEX NUMBER
1993-94	100
1994-95	112.6
1995-96	121.6
1996-97	127.8
1997-98	132.8
1998-99	137.1
1999-00	145.3
2000-01	155.7
2001-02	161.3
2002-03	166.8
2003-04	175.9
2004-05	187.3
2005-06	195.6
2006-07	206.2
2007-08	215.7
2008-09	233.9
2009-10	251.9

Data source: http://:www.usinflationcalculator.com/inflation/

	Time in minutes																					
stations	KNZL	*GTN*	MSS	NTJ	MUK	RSB	KGHT	JPK	NBN	RSN	MDI	PKS	ESP	CWC	CEN	MHR	GPK	SHO	SHY	BEL	DMI	score
KNZL	0	*2*	4	8	12	14	16	18	20	22	24	26	28	30	31	33	35	37	39	42	45	486
GTN	2	*0*	2	6	10	12	14	16	18	20	22	24	26	28	29	31	33	35	37	40	43	448
MSS	4	*2*	0	4	8	10	12	14	16	18	20	22	24	26	27	29	31	33	35	38	41	414
NTJ	8	*6*	4	0	4	6	8	10	12	14	16	18	20	22	23	25	27	29	32	35	38	357
MUK	12	*10*	8	4	0	2	4	6	8	10	12	14	16	18	19	21	23	25	27	30	33	302
RSB	14	*12*	10	6	2	0	2	4	6	8	10	12	14	16	17	19	21	23	25	28	31	280
KGHT	16	*14*	12	8	4	2	0	2	4	6	8	10	12	14	15	17	19	21	23	26	29	262
JPK	18	*16*	14	10	6	4	2	0	2	4	6	8	10	12	13	15	17	19	21	24	27	248
NBN	20	*18*	16	12	8	6	4	2	0	2	4	6	8	10	11	13	15	17	19	22	25	238
RSN	22	*20*	18	14	10	8	6	4	2	0	2	4	6	8	9	11	13	15	17	20	23	232
MDI	24	*22*	20	16	12	10	8	6	4	2	0	2	4	6	7	9	11	13	15	18	21	230
PKS	26	*24*	22	18	14	12	10	8	6	4	2	0	2	4	6	7	9	11	13	16	19	233
ESP	28	*26*	24	20	16	14	12	10	8	6	4	2	0	2	4	5	7	9	11	14	17	229
CWC	30	*28*	26	22	18	16	14	12	10	8	6	4	2	0	1	3	5	7	9	12	15	248
CEN	31	*29*	27	23	19	17	15	13	11	9	7	5	3	1	0	2	4	6	8	11	14	255
MHR	33	*31*	29	25	21	19	17	15	13	11	9	7	5	3	2	0	2	4	6	9	12	273
GPK	35	*33*	31	27	23	21	19	17	15	13	11	9	7	5	4	2	0	2	4	7	10	295
SHO	37	*36*	34	29	25	23	21	19	17	15	13	11	9	7	6	4	2	0	2	5	8	323
SHY	39	*37*	35	31	27	25	23	21	19	17	15	13	11	9	8	6	4	2.	0	3	6	351
BEL	42	*40*	38	34	30	28	26	24	22	20	18	16	14	12	11	9	7	5	3	0	3	402
DMI	45	*43*	41	37	33	31	29	27	25	23	21	19	17	15	14	12	10	8	6	3	0	459

APPENDIX 6. TIME MATRIX

DISTANCE IN KMS

stations	KNZL	GTN	MSS	NTJ	MUK	RSB	KGHT	JPK	NBN	RSN	MDI	PKS	ESP	CWC	CEN	MHR	GPK	SHO	SHY	BEL	DMI	SCORE
KNZL	0	1.04	2.807	4.592	5.936	7.179	7.8	8.838	9.678	10.69	11.418	12.22	12.924	13.52	14.557	15.32	16.32	17.24	18.87	21.02	22.8	234.7677
GTN	1.26	0	1.767	3.525	4.869	6.112	6.733	7.771	8.611	9.626	10.353	11.153	11.85	12.45	13.48351	14.25	15.25	16.17	17.79	19.94	21.72	214.6806
MSS	2.3	1.04	0	1.785	3.129	4.372	4.993	6.023	6.863	7.873	8.6	9.4	10.11	10.71	11.74712	12.51351	13.51	14.442	16.07	18.21	19.99	159.4178
NTJ	4.067	2.807	1.767	0	1.344	2.584	3.205	4.243	5.086	6.10108	6.8288	7.637	8.3415	8.939	9.9755	10.742	11.743	12.668	14.29	16.4443	18.22	157.036
MUK	7.094	5.834	3.525	1.758	0	1.243	1.864	2.902	3.745	4.755	5.4817	6.29	6.99	7.584	8.6144	9.3801	10.38	11.3	12.92	15.08	16.86	143.6002
RSB	7.196	5.936	4.896	3.129	1.344	0	0.621	1.659	2.499	3.51408	4.24	5.04	5.74	6.339	7.37569	8.14169	9.14	10.061	11.68	13.83	15.61	127.9916
KGHT	8.448	7.188	6.139	4.372	2.587	1.243	0	1.038	1.881	2.89608	3.623	4.42	5.12	5.721	6.75	7.51	8.51	9.43	11.06	13.21	14.99	126.1361
JPK	9.033	7.77	6.733	4.966	3.208	1.864	0.621	0	0.843	1.855	2.58	3.38	4.08	4.67	5.70926	6.475	7.47	8.39	10.01	12.16	13.94	115.7573
NBN	10.08	8.82	7.77	6.004	4.246	2.902	1.659	1.038	0	1.015	1.7417	2.54	3.24	3.83	4.868	5.63	6.63	7.55	9.17	11.32	13.1	113.1537
RSN	10.91	9.657	8.608	6.841	5.083	3.739	2.499	1.878	0.84	0	0.7276	1.52	2.327	2.91	3.94	4.7136	5.71	6.63	8.258	10.4	12.18	109.3712
MDI	11.92	10.65	9.613	7.846	6.08	4.74	3.501	2.88	1.85	1.01	0	0.8	1.5	2.09	3.12	3.886	4.886	5.806	7.43	9.58	11.36	110.548
PKS	12.64	11.38	10.34	8.573	6.815	5.471	4.228	3.607	2.577	1.737	0.7276	0	0.7	1.29	2.32	3.08	4.086	5	6.62	8.77	10.55	110.5116
ESP	13.45	12.19	11.15	9.3861	7.6281	6.28	5.044	4.4231	3.385	2.54208	1.527	0.8	0	0.59	1.63401	2.4001	3.4	4.32	5.94	8.09	9.87	114.0494
CWC	14.669	13.62	11.85	10.086	8.328	6.984	5.741	5.1201	4.0821	3.24208	2.227	1.5	0.7	0	1.03	1.80251	2.80	3.72	5.344	7.49	9.27	116.8088
CEN	14.74	13.48	12.44	10.06	8.924	7.58	6.72	5.6895	4.8495	3.8345	2.8245	2.08	1.2975	0.598	0	0.766	1.766	2.686	4.31	6.46	8.24	119.3445
MHR	15.58	14.32	13.28	11.518	9.76	8.416	7.173	6.5521	5.7	4.86908	3.854	3.127	2.327	1.627	1.03	0	1	1.92	3.544	5.69479	7.47	128.7622
GPK	16.53	15.27	14.22	12.46	10.7	9.35	8.119	7.498	6.46	5.62808	4.613	3.88	3.08	2.339	1.796	0.766	0	0.92	2.54	4.69	6.47	137.3288
SHO	17.542	16.28	15.23	13.46	11.7	10.36	9.121	8.5	7.47	6.63	5.62	4.89	4.09	3.39	2.796	1.766	1	0	1.62	3.77	5.55	150.787
SHY	18.44	17.18	16.15	14.382	12.62	11.28	10.04	9.421	8.391	7.551	6.541	5.814	5.014	4.31	3.724	2.69	1.9285	0.9285	0	2.15	3.93	162.484
BEL	20.213	18.95	17.91	16.146	14.388	13.04	11.8	11.183	10.15	9.313	8.47	7.46	6.7378	5.938	5.34	4.31	3.54	2.547	1.625	0	1.78	190.8403
DMI	22.284	21.02	19.97	18.2	16.45	15.1	13.86	13.24	12.2	11.36	10.34	9.61	8.81	8.1	7.5	6.47	5.7	4.7	3.77	2.15	0	230.834

APPENDIX7. DISTANCE MATRIX

station s	KNZL	GTN	MSS	NTJ	MUK	RSB	KGHT	JPK	NBN	RSN	MDI	PKS	ESP	CWC	CEN	MHR	GPK	SHO	SHY	BEL	DMI	SCORE
KNZL	0	4	4	4	6	6	6	6	6	8	8	8	8	8	8	10	10	10	10	12	12	154
GTN	4	0	4	4	4	6	6	6	6	6	8	8	8	8	8	8	10	10	10	10	12	146
MSS	4	4	0	4	4	4	4	6	6	6	6	6	8	8	8	8	8	8	10	10	10	132
NTJ	4	4	4	0	4	4	4	4	6	6	6	6	6	6	6	8	8	8	10	10	10	124
MUK	6	6	4	4	0	4	4	4	4	6	6	6	6	6	6	6	8	8	8	10	10	122
RSB	6	6	4	4	4	0	4	4	4	4	4	6	6	6	6	6	6	8	8	8	10	114
KGHT	6	6	6	4	4	4	0	4	4	4	4	4	6	6	6	6	6	8	8	8	8	112
JPK	6	6	6	4	4	4	4	0	4	4	4	4	6	6	6	6	6	6	8	8	8	110
NBN	8	6	6	6	6	4	4	4	0	4	4	4	4	4	4	6	6	6	6	8	8	108
RSN	8	6	6	6	6	4	4	4	4	0	4	4	4	4	4	6	6	6	6	8	8	108
MDI	8	8	6	6	6	4	4	4	4	4	0	4	4	4	4	4	4	6	6	6	8	104
PKS	8	8	8	6	6	6	4	4	4	4	4	0	4	4	4	4	4	4	6	6	8	106
ESP	8	8	8	6	6	6	6	4	4	4	4	4	0	4	4	4	4	4	6	6	6	106
CWC	8	8	8	8	6	6	6	6	4	4	4	4	4	0	4	4	4	4	6	6	6	110
CEN	8	8	8	8	6	6	6	6	4	4	4	4	4	4	0	4	4	4	4	6	6	108
MHR	10	8	8	8	6	6	6	6	6	4	4	4	4	4	4	0	4	4	4	6	6	112
GPK	10	10	8	8	8	6	6	6	6	6	4	4	4	4	4	4	0	4	4	4	6	116
SHO	10	10	10	8	8	8	6	6	6	6	6	4	4	4	4	4	4	0	4	4	6	122
SHY	10	10	10	8	8	8	8	6	6	6	6	6	6	4	4	4	4	4	0	4	4	126
BEL	12	10	10	10	10	8	8	8	8	6	6	6	6	6	6	4	4	4	4	0	4	140
DMI	12	12	10	10	10	10	8	8	8	8	8	6	6	6	6	6	6	4	4	4	0	152

APPENDIX8. FARE MATRIX

APPENDIX 9

QUESTIONAIRRE TO ASCERTAIN PASSENGER PERCEPTION IN KOLKATA METRO

Name:

2. Age: 3. Sex: 4.Number of family members:

5. Address:

6. Profession: Service /Business/student/Housewife/others:

7. Reasons for choosing metro as popular mode of transport:

i)speed

ii comfort

ii) Nearness of the station to residence

8. Modal choice of the casual users

I) Bus

ii) Para transit modes

iii) Suburban railways

iv) Others

9. Access to and egress from the station for both daily and casual users (modal split)

i)Walking

Ii) Auto rickshaw

iii) Buses

iv) Others

10. Trip purpose

i) Service

ii) Education

iii) Business

IV) Leisure trips

V) Others

10. Satisfaction derived from the metro railway

i) Satisfaction with train service

a. Punctuality and reliability

b. Scheduled journey time

c. Ease of boarding and alighting

d. cleanliness of the train

e .personal security on board

f .information on board

g. Safety measure

h. operation of automatic gates

Satisfaction with station environment

i) information time/platform
ii) coordination with public transport
iii) ticket buying facilities
iv) cleanliness of the station
v) upkeep and repair of station building

SELECTED REFERENCES

1. http://www.mtp.indianrailways.gov.
2. http://newsleaks.in
3. Singh.Y.P (2002) Performance of Kolkata Metro: Case Study, *Urban Mobility for all* Swets and Zeitlinger ,Lisse.
4. http://:www.usinflationcalculator.com/inflation/consumer-price-index-and-annual-percent changes-from-1913-to-2008
5. http://experiment-resources.com/Pearson product moment correlation.html
6. http://www.business-standard.com/india/news/qa-e-sreedharan-md-delhi-metro-rail-corporation/422021/
7. *Master Plan for Traffic and Transportation in Kolkata Metropolitan Area-2001-25*. Draft Final Report. KMDA (2000-01)

Centre for Urban Economic Studies

Discussion Paper Series

1. Solid Waste Management in Calcutta Metropolis – *Pabitra Giri and Sulipi De* (May 1992)
2. Waterlogging and Issues Relating to Drainage in Calcutta Metropolitan District –*Arpita Bhattacharyya* (June 1992)
3. The Structure and Working of an Urban Labour Market in India: A Survey of Two Residential Locations in Calcutta – *Asis Kumar Banerjee* (July 1992)
4. Evolution and Growth of Municipal Towns in Calcutta Metropolitan Area –*Mahalaya Chatterjee* (August 1992)
5. Wholesale Market: Study of a Market in Calcutta –*Projjwal Sengupta* (September 1992)
6. Thika Tenancy in Bustees of Calcutta: A Study – *Swati Ghosh* (October 1992)
7. Aspects of Goods Flow in Calcutta Metropolitan Area –Pabitra Giri (November 1992)
8. Housing in Calcutta: Problems and Policy Issues – Nipa Ghosh (December 1992)
9. The Metro Rail of Calcutta: A Study – *Kuntala Lahiri* (January 1993)
10. Passenger Transport in Calcutta Metropolitan District –*Sudeshna Sen* (February 1993)
11. Consumption and Income in Calcutta Metropolitan Area – *Indrani Chakrabarty* (March 1993)
12. Some Aspects of Calcutta Port – *Arun Prasad Sen* (April 1993)
13. Metropolitan Growth and Demographic Changes in Calcutta –*Pabitra Giri and Sukla Bhaduri* (May 1993)
14. Urban Environmental Issues: A Study of Calcutta – *Ashish K. Ghosh* (January 1994)
15. Calcutta Port: Problems and Prospects – *Sachinandan Sau* (February 1994)
16. Urban Decentralization: A Case Study of Kalyani Township –*Nandita Dasgupta* (August 1994)
17. Urban Sanitation Problems: A Study of Calcutta –*Swadesh Kumar Bhattacharya* (September 1994)
18. Market Towns in Tamilnadu and West Bengal – Eight Development Issues for Field Research and Action – *Barbara Harriss-White* (June 1997)
19. Wetlands and Urban Environment - *Ashish K. Ghosh, Sivabrata Chatterjee and K. J. Nath* (July 1999)
20. Contrasting Urban Patterns: West Bengal, Punjab and Kerala –*Biplab Dasgupta* (May 2000)
21. The Indian Hill Stations: A Study in Social Space – *Aditi Chatterji* (July 2000)
22. Transportation Policy for the Control of Vehicular Air Pollution in Urban Areas: Applying Lessons from North to Calcutta, India – *Madumati Dutta* (September 2001)
23. Urbanisation in the Pre-colonial Bengal –*Biplab Dasgupta* (December 2001)
24. Emerging Issues in Bio-Medical Waste Management – *Sushma Wadhwani* (January 2002)

25. Urbanization and Agricultural Change in North-Eastern India – *J. B. Ganguly* (October 2003)
26. An Analytical Study of the Growth Experience in the Small Industries of Howrah and Burdwan Districts, 1988-2000 – *Nandita Basak* (October 2003)
27. Truck Terminals in Kolkata Metropolitan Area: Master Planning and Market Response – *Anis Mukhopadhyay* (August 2004)
28. Labour Market Segregation and Gender Bias –*Pampa Sengupta* (September 2004)
29. Urbanisation, Migration and Urban Society in Colonial Bengal - *Biplab Dasgupta* (December 2005)
30. The Growth Experience of the Small Scale Industries of North 24 Parganas and Medinipur Districts, West Bengal, 1988-2001- *Nandita Basak* (October 2007)
31. An Environmental Valuation of an Urban Wetland: A Case Study of the Jodhpur Park Lake – *Simanti Banerjee and Ashish K. Ghosh* (2007)
32. Evolution and Growth of Municipal Towns in Kolkata Metropolitan Area –*Mahalaya Chatterjee* (August 2008)
33. Polluting Behaviour of Different Modes of Transport in Big Cities and Policy Implications for Pollution Reduction: The Case of Kolkata, India – *Madhumati Dutta, Mohit Roy and Sudip K. Roy* (July 2009)
34. Mousumi Ghosh: Spatial and Economic Changes in Asansol, 1951-2001
35. Somali Chakravorty & Malabika Dasgupta: Some Aspects of Urbanisation in Eastern India
36. Modern Mobility, Rejuvenation of Howrah and the East-West Metro – Anis Mukhopadhyay
37. Kolkata Metro : A Study on Passenger Movement and Financial Health (1990-2010) – Koel Bhattacharjee

Database Series

1. Functional Classification of Urban Areas in India 1961, 1971, 1001 –*Mahalaya Chatterjee and Pabitra Giri* (August 2001)