

BROAD SPECTRUM SURVEY OF METRO RAIL SERVICE

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ABSTRACT

Delhi which has seen an unexpected growth of population from all surrounding areas was faced with the problem of mobility. The roads were over congested with traffic, buses overloaded and still the people were seen on various boarding points waiting for public transport. It is at this juncture, the development of Metro Rail started taking place to cater to the mobility needs of the people of NCT of Delhi. The Delhi Metro Rail Corporation Limited was registered on May 3, 1995 under the companies Act, 1956. The DMRC designed its programme in such a way that it covered the whole of NCT in a phased manner. The success of Metro Rail project lies in the effectiveness with which the programmes are executed. The paper attempts to study the procedure adopted in the implementation of Metro Rail Services in Delhi.

Keywords: *MRTS, Detailed Project Report, GNCTD, DMRC*

I. INTRODUCTION

The growth of Metro Rail took place under the banner of DMRC (Delhi Metro Rail Corporation). The DMRC was formed with equal equity participation of Government of India (GOI) and Government of National Capital Territory of Delhi (GNCTD). The DMRC doesn't fall under the category of a central public sector undertaking because neither of the two government has the minimum 51% equity. Among the public sector corporations in India, it enjoys a unique position, greater autonomy and a corporate attitude which is necessary to execute massive projects involving state of the art technology at a great speed. Delhi Metro Rail Corporation functions as a Delhi Mass Rapid Transit System which today extends to the National Capital Region (NCR) which covers parts of two states of Haryana and Uttar Pradesh. First section of the system was inaugurated on 24th December, 2002 and commercial services started the very next day and with that Delhi joined the list of Metro cities of the world.

The DMRC today has a total coverage of about 213 km. It caters to 2.6 million population per day on an average and has a frequency of about three minutes during peak time.

II. OBJECTIVE OF THE STUDY

1. The present paper provides an overview of the dimensions of the MRTS.
2. To study the procedure adopted in implementation of Metro Rail service in Delhi.
3. To study the future prospects of growth.

III. RESEARCH METHODOLOGY

The methodology involved use of secondary data such as articles, journals, websites, books published by DMRC etc. Proper reference has been mentioned wherever required.

IV. DIMENSIONS OF THE PROGRAMME

Delhi metro, though started with a slow pace had a large target to achieve. It had Delhi at this centre and National Capital Territory of Delhi at its periphery to cover. The DMRC designed its programme in such a way that it covered the whole of NCT in a phased manner. The dimensions of the programme are being implemented in four phases of which two are fully operational, third is partially operational while all four phases are to be made operational by 2021.

4.1 MRTS Phase I

Phase I of the network comprises 65 km of route length and is now fully operational. Delhi Metro Rail Corporation (DMRC) was able to complete Phase I in seven years and nine months, though the projected time period was ten years. According to Sreedharan (2007, The Hindu), small and lean teams of dedicated professionals were major contributing factors behind the successful implementation of the first phase of Delhi Metro in advance scheduled time.

The first section of the Delhi Metro Rail was opened to the public on 25th December 2002. Over the next four years, newer sections were regularly opened. The Phase-I of Metro Rail Network connects some of the most populated and important areas of Delhi.

4.2 MRTS Phase II

Phase II of the network comprises 124.9 km of route length and is now operational. The first section (Shahdara- Dilshad Garden Line) was opened in June 2008. Phase II includes corridors connecting parts of Delhi with NCR like Noida and Gurgaon. Construction of phase II of the project includes a high-speed line to the Indira Gandhi International (IGI) airport. This is the first corridor, where a PPP model has been followed. The link between the New Delhi station and the Indira Gandhi International Airport is known as Airport Express Link. Trains will run at a maximum speed of 140 kmph and this distance will be covered in about 16 minutes (DMRC Annual Report 2007-08, p-7).

4.3 MRTS Phase-III and Phase-IV

Phase III (160.57km) and IV (103 km) are planned to be completed by 2017 and 2021 respectively, with the network spanning about 450 km by then, making it larger than London's Underground metro network.

As the city expands beyond its city limits, there will be further extensions of the network in suburbs, because the northern outskirts of Delhi and the suburbs beyond it (Kundli, Sonapat) and the south-eastern suburb of Greater Noida are currently left untouched in the Delhi Metro Master plan 2021. DMRC officials, however, said as was the case in the previous phases, there is the possibility of more lines being added to the final network with time. Phases III and IV of Delhi Metro will cover most of the remaining parts of Delhi and even extend its services to some areas belonging to the neighboring states of Delhi.

V. PROCEDURE ADOPTED IN IMPLEMENTATION OF METRO RAIL SERVICE

Implementation is a stage where all the planned activities are put into action. Before the implementation of a project, the implementers should identify their strength and weaknesses, analyse the existing situation, its resources and constraints in the concerned area, also the feasibility analysis have to be done. Projects have to be organized for implementation. The success of a project lies in the effectiveness with which programmes are executed.

The planning for the Metro in Delhi had started in the 1950s. Numerous studies were conducted for studying the feasibility of a rail based mass transit system. It was in 1970 when the Central Road Research Institute (CRRI) after an exhaustive study on traffic and travel characteristics of Delhi recommended a Mass Rapid Transit Network for the city. As many as 35 more studies on Delhi's transport problems were conducted subsequently by various entities like the Metropolitan Transport Team (MTT) of the Indian Railways, Delhi Development Authority (DDA) and the Study Group of the Ministry of Railways. . Almost all these studies recommended the Mass Rapid Transit System (MRTS) as a mean to solve Delhi's traffic problems. In order to mitigate the growing traffic and transport problems in Delhi, the Government of National Capital Territory of Delhi (GNCTD) commissioned RITES Limited in 1988-89 to study the feasibility of introducing an Integrated Multi-modal Mass Rapid Transit System for Delhi. In 1990, RITES recommended a Mass Rapid Transit System (MRTS) comprising Rail corridor, Metro corridor and dedicated Bus way for a total network of 198.50 Kilometers ([_www.delhimetrorail.com/corporates/ecofriendly/chapter%201.pdf](http://www.delhimetrorail.com/corporates/ecofriendly/chapter%201.pdf)).

The first step towards the construction of the Metro was initiated when the Delhi Metro Rail Corporation Ltd. under the Companies Act, 1956 was set up in May 1995 and E. Sreedharan was appointed managing director (MD) of the DMRC. Physical construction work on the project started on October 1, 1998. The entire project was divided into four Phases.

The procedure adopted can be studied under the following heads:

5.1 Enactment of the Metro Railways (Construction of Works) Act, 1978

The proposal of Delhi Metropolitan Rail first of all was conceived in Delhi Master Plan, published in 1960. For the implementation of this Project, the Metro Railway (Construction of Works) Act, 1978 was enacted and Delhi Metro Rail Co. was formulated. The responsibility for implementation of this project was given to Shri Sreedharan by appointing him as Managing Director of Delhi Metro Rail Corporation Ltd. He is also known for the completion of Konkan Railway Project in India before schedule. A technocrat, he had a long stint in the Indian Railways (IR). During his service with IR, he had earned a reputation for completing major projects on time and within the budget.

Delhi Metro railway (Operation and Maintenance) act, 2002 provides for the power to acquire land etc. for this, it shall apply to the central government which notifies this in official gazette. If there are no objections, land is acquired by the government and compensation is paid.

5.2 Funding of the Project

For Phase I, 28% was financed through equity contributions subscribed equally by the Central Government and the State Government. The two Governments also agreed to provide an interest-free subordinate loan to cover

the cost of land acquisition, which is roughly 5% of the project cost. Remaining 7% funds were internally generated through property development. The Japanese Government financed about 60% of the cost by way of a soft loan through the Japan Bank for International Corporation (JBIC) now called Japan International Cooperation Agency (JICA).

For phase II, JICA loan has contributed 54.47% of the funding and equity from GOI and Government of Delhi is 16.39% each. The construction and cost in the NCR towns like Noida and Gurgaon is borne by respective state governments. For phase III, funding pattern was same, JICA contributed 48.57% of the funding requirement and GOI and Government of Delhi financed 10.04% each.

5.3 Planning the Project

It took two decades to build the Kolkata Metro which was a result of bad planning and it was badly delayed. In Delhi Sreedharan (MD, DMRC) faced no such problem. When people in old Delhi (Chandni Chowk area) objected to the demolition of their houses, the DMRC used the tunnel boring machine technology to solve the problem. The same technology is being adopted in south Delhi's densely populated areas. At the same time it is ensured that there are no major bottlenecks and no demolitions.

In India, major infrastructure projects are often stalled because of a lack of funds, political interference, lack of professionalism and accountability, property disputes, corruption, etc. Therefore, even before the commencement of the project, the DMRC attempted to put in place effective systems to ensure the smooth progress of the project.

Funding was not an issue in the case of the Delhi Metro project because it was settled even before the project commenced. In order to steer clear of political interference, the DMRC sought autonomy on all major matters and the GOI promised to give it this autonomy.

5.4 Selection of General Consultants

The Delhi Metro was planned and developed as a technology exchange, whereby international firms with expertise in the development of metro railways were contracted to aid with specific tasks such as general planning, station design, construction management and rolling stock production. These international firms, from countries such as Japan, Korea, France and the US, were required to partner and transfer their expertise to Indian firms, so that indigenous companies could take a lead role in the later stages of the Delhi Metro project. It was also planned that the indigenous firms would later be able to disseminate their knowledge to other cities in India that were seeking to develop metro railways.

One of the important decisions was the choice of project's General Consultants. For selecting the General Consultants, detailed terms and conditions had been outlined in tender documents. The purpose was to ensure that the best consultants were selected to direct the project. All technical bids were evaluated by DMRC and the consortium led by Pacific Consultants International (Japan) was ranked first in the bidding process. The consortium included Parsons Brinkerhoff International (USA), Japan Railway Technical Services (Japan), Tonichi Engineering Consultants (Japan) and Rail India Technical & Economic Services from India.

DMRC formed consortiums to advise it on the project and to provide it with the latest technology. It also saw to it that the foreign companies worked with the Indian companies to ensure that the latter assimilated their expertise and technological know-how.

5.5 Designing the Metro

The design of the structures of the Delhi Metro posed a number engineering challenges for the Metro Design Engineers especially in the underground sections as there are no yardsticks available in India for designing civil Metro structures to withstand earthquakes. Delhi metro engineers had to look to international standards and codes from countries such as Japan which are highly earthquake prone. In the elevated construction, British Standard Codes and Elevated Codes for designing have also been used to ensure structural adequacy and economy during construction apart from using the established Railway codes

5.6 Construction Management

While doing construction work, DMRC took care to see that traffic disruption should be as minimal as possible. Prominent signages are put up at all construction sites. Before digging into the earth, DMRC drew out a detailed plan for relocating the debris quickly. It also coordinated with civic bodies to control and restore traffic, water supply and communication lines affected by construction activity. The following four techniques of construction of Delhi Metro Rail Corridor were adopted:

5.6.1. Bottom Up Construction Technique:

This is the technique which is normally adopted by every builder similar to the construction of a basement. It is the easiest and cheapest Way of construction. This technique was adopted where alignment of underground metro rail was passing through vast open space. Through this technique first of all earth is excavated and there after construction is started from the bottom of the excavated land/basement. Such construction was carried out 25 to 30 meters below the ground level.

5.6.2. Top Down Construction Technique:

This technique was adopted where underground metro rail was proposed below any road thus having very narrow open space for digging the soil. Through this technique, the sidewalls and roof is constructed first before excavating the earth. Since in this technique construction has started from top to down, therefore, this technique is accordingly named as Top Down Construction Technique. Such construction was carried out 25 to 30 meters below the ground level.

5.6.3. Tunnel Boring Technique:

The tunnel boring technique was adopted where underground Metro Rail was constructed below the constructed buildings and roads. Such tunnels were constructed 25 to 30 meters below the ground level.

5.6.4. Elevated Rail Construction Technique:

The elevated rail construction technique was adopted where Metro Rail was proposed to run in the centre meridian of the existing roads. Under this technique, after constructing pillars, the Box segments/girders were connected through high tensile wires in the form of flyovers and railway tracks were constructed thereon.

5.7 Metro Rail Construction Strategy of the Construction Team:

For the construction of underground and elevated Metro Rail within a specified time, the construction work of total length of Metro Rail was sub divided into different stretches. For the construction of different stretches different construction teams of specialized Civil Engineers were deployed. Similarly the works relating to underground and elevated railway stations were also allotted to different specialized teams of Civil Engineers. .

5.8 Managing the Stakeholders

Effective project management involved not only completing the project on schedule and within the budget, but also managing the project's stakeholders. DMRC managed the various stakeholders like central and state governments, the contractors, the funding agencies, and the general public to ensure that the project was implemented smoothly and successfully.

Compensation was paid for relocation of shops, commercial cum residential buildings and hutments which are likely to be affected due to the project along the alignment. Incentives and facilities would also be given to Project Affected People (PAPs).

5.9 DMRC's Environment policy

DMRC follows Environment Quality Management Manual that provides guidelines for keeping construction impacts to minimum. It includes use of silencers on construction equipment, minimizing the vibration and rattling of machinery, continuous monitoring of air quality and noise levels.

DMRC stands committed to planting 10 trees for every tree cut during implementation of the Metro Rail project. It adopts environment friendly construction methods and practices so as to cause minimum inconvenience to the public and prevent ecological degradation.

VI. FUTURE PROSPECTS OF GROWTH

DMRC planned to cover the whole of Delhi with a metro network by the year 2021. It would completely link Delhi with the entire National Capital Region encompassing a network of around 450 km. Apart from current lines in Phases I-IV, additional lines are expected to be announced in near future. There will be further extensions of the network in suburbs.

The long-term vision of DMRC is to cover the whole city of Delhi with a very modern and world-class type of Metro in regard to safety, reliability, punctuality, comfort, and customer satisfaction. The ideal situation will be, that, anybody should be able to find a metro station in 15 minutes from anywhere in the city. In the course of implementing phase-I, DMRC have acquired a lot of expertise which is not available with any other organisation in the country. DMRC can help other cities to have metro rail too and conceive a proper project with technical guidance and help them to get government clearance. Once DMRC prepare the DPRs, the governments will have a lot of confidence about the viability of such a project because of Delhi Metro's experience in this field. After the project is cleared, they can get assistance like a prime consultant, to oversee certain aspects like technical parameters and timeframe and also in DPRs.

DMRC has been appointed the Prime Consultant for Hyderabad, Kochi and Mumbai Metro. Detailed project reports of Pune, Ludhiana, and Chandigarh are being prepared by the Delhi Metro. The impact of Metro Rail is such that every big city now dreams of having such mode of transport.

VII. CONCLUSION

The DMRC presently has 216 train sets of 4, 6 and 8 coaches. Trains operate at the interval of 3 to 5 minutes between 6:00 am to 11:00 p.m. Coaches on all trains are well ventilated and air conditioned. Trials of driverless trains have already started on some lines. There are plans to provide Wi-Fi services on various stations.

The DMRC faced number of technical and systemic challenges during the construction of the Metro. However, thanks to thorough planning, an effective project design, and a 'we-mean business' culture, it was able to overcome all these hurdles. The organizational culture was based on punctuality, honesty, and a strict adherence to deadlines. The DMRC successfully managed the various stakeholders in the project like the general public, government bodies, etc., and also ensured that the project was environmentally safe.

The Delhi Metro's experience clearly demonstrates that a world-class modern public transport can be executed in one of the world's largest and most congested cities in a developing country ahead of schedule and within budget. The future of intra-city commuting is metro rail-cheap, fast and comfortable in all weathers. *"The successful implementation of the Delhi Metro project would not have been possible without timely availability of funds and the necessary political support. An equally important role has been played by the DMRC's corporate culture, which emphasizes that targets are most sacrosanct and our dignity is in performing our duty well."* **E. Sreedharan, (Former Managing Director DMRC Ltd., in 2005).**

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