"A Critical Evaluation of Impact of Jaipur Metro on Means of Transport"

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By
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ABSTRACT

Amongst the fastest growing economies in the world, the economy of India has accelerated at the rate of 7.5% per annum in recent years. With a growing population too, the country is facing a lot of challenges of which developing an effective transportation system is vital. Transport service, as an essential source of development, brings socio-economic opportunities to the poor and enables an economy to be more competitive. A well developed transport infrastructure connects people to jobs, education and health services; it enables the supply of goods and services around the world and allows people to interact and generate the knowledge that creates long term growth. Therefore, improving public transportation in India is on priority although private vehicle ownership is growing and therefore causing major congestion problems, air pollutions and traffic accidents in cities. Safety of vulnerable road users, high consumption of non-renewable resource, and quality of human environments are other issues which cause challenges for the sector.

In order to solve these problems there is a need to have an effective public transportation mode which is able to offer favourable environmental conditions, speedy and fast travel, better mobility and better quality of life. The solution is Mass Rapid Transit System (MRTS) also known as Metro Rail. It is a reliable means of public transport which has the capacity to carry equal amount of passengers as five lanes of bus traffic or twelve lanes of private two and four wheelers.

Jaipur, being the capital of Rajasthan with rapid industrialization, increasing tourism and intense commercial development has observed a steep rise in travel demand in recent times. The existing public transport infrastructure in the city is not adequate in terms of capacity, safety and service. Public transportation share has reduced from 26% to 19% in last few years due to unavailability of suitable mode of transport. It has forced passengers to use personalized transport. As a result, congestion on roads has become intense leading to increased air pollution, more number of road accidents and longer time for travel. In order to improve the system state government of Rajasthan initiated to develop mass rapid transit system.

The present study has been conducted to study the level of satisfaction that customers have been deriving from using Jaipur Metro and its impact on other means of transport viz., auto-rickshaws, taxies, buses etc. Switching passengers towards Metro has affected the livelihood of other means of transport or not is the prime concern of the study.

Descriptive research design was used for the present study. Secondary data including dissertations, theses, research reports and journals were consulted, in an attempt to formulate a theoretical basis for this study. Thorough understanding of the concept of Metro helped in designing questionnaires and building the research path of the study.

An intensive research was done during the year 2018-19 analyzing all possible factors pertaining to the problem under study. Purposive Random Sampling has been used to collect data relevant to solve the problem under study. Sampling units i.e. respondents have been selected from various metro stations located in Jaipur. The sample size of the present research work comprises of 415 passengers and 50 para transport operators. The researcher has tried to study the existing perceptions of Metro users in Jaipur and the owners of other modes of transport who got affected by switching of customers towards Metro; without manipulating in anyway the scenario as it stands presently. Thus the study is largely empirical in approach.

The data so gathered was analyzed using suitable statistical tools in order to validate stated hypotheses. At the final step of this study an assessment of the findings was done. This was done to draw suitable conclusions and make appropriate recommendations. The conclusions revolved around the impact of Metro on other means of transport.

CANDIDATE'S DECLARATION

I, hereby, certify that the work which is being presented in the thesis entitled **"A Critical evaluation of impact of Jaipur metro on means of transport"** I partial fulfillment of the requirement for the award of the Degree of Doctor of Philosophy, carried out under the supervision of Dr. Gopal Dhaker submitted to university of Kota, Kota represents my idea in my own words and where other ideas or words have been included. I have adequately cited and referenced the original sources. The work presented in this thesis has not submitted elsewhere for the award of any other degree or diploma from any institution.

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Place

This is to certify that the above statements made by Yogita Sachdeva (Reg. No. RS/293/16) is correct to the best of my knowledge.

Date Dr. Gopal Dhaker

Place Research Supervisor

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Yogita Sachdeva

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ABBREVIATIONS

CAGR	Compound annual growth rate
EXIM	Export Import
MRTS	Mass Rapid Transit System
MoUD	Ministry of Urban Development
NHAI	National Highways Authority of India
PMGSY	Prime Minister's Gram Sadak Yojana
DIPP	Department of Industrial Policy and Promotion
TOT	Transfer of Technology
NHDP	National Highways Development Project
UITP	International Association of Public Transport (French: L'Union internationale des transports publics)
JMRC	Jaipur Metro Rail Corporation
EPC	Engineering-Procurement-Construction
DMRC	Delhi Metro Rail Corporation
PPP	Public Private Partnership
PHPDT	Peak Hour Peak Direction Traffic
DPR	Detailed Project Report
ADB	Asian Development Bank
CII	Confederation of Indian Industry
VGF	Viability Gap Funding
BEML	Bharat Earth Movers Limited

CHAPTER 1

PROFILE OF TRANSPORT SECTOR IN INDIA

CHAPTER –I

PROFILE OF TRANSPORT SECTOR IN INDIA

1.1 INTRODUCTION

India is one of the fastest growing economies in the world and at present its growth is accelerating at the rate of 7.5% per annum. With a growing population too, the country is working hard to transform itself over the next few decades. Transport service, as an essential source of development, brings socio-economic opportunities to the poor and enables an economy to be more competitive. Transport infrastructure connects people to jobs, education and health services; it enables the supply of goods and services around the world and allows people to interact and generate the knowledge that creates long term growth. Therefore, improving public transportation in India is on priority although private vehicle ownership is growing and therefore causing major congestion problems in cities. Due to increasing travel demand and preferences in using private vehicle is causing rapid motorization in many countries around the world. An increased private motorization has resulted in an increased traffic congestion which in turn results in longer travel times for many people (Beirão & Sarsfield Cabral (2007)).

Further, safety of vulnerable road users, high consumption of non-renewable resource, and quality of human environments are other issues which cause challenges for the sector. In order to cope up with these challenges, many researchers as well as public decision makers have recommended developing an attractive public transport service as an alternative transport mode in many cities/towns. However, initiatives have been taken by Government to revamp bus systems and invest in metro networks. The present chapter deals with the overview of transportation service, its history, various modes of Transportation and a snapshot of present scenario of public transport sector and initiatives taken by Government.

1.2 OVERVIEW OF TRANSPORTATION SERVICE

Economic and social development of a country depends largely upon its well built transport infrastructure. It provides opportunities to the unprivileged and enabling economies to face the challenges effectively. A strong Transport infrastructure connects remote places, thus makes it easy for the people to work, get education, health and other services; it enables the availability of goods and services at every place all over the world. Availability of transportation services in rural areas is also helpful in increasing farmers' income because of finding markets, preventing maternal deaths, promoting girl education etc. Hence, this industry is playing an essential role in boosting business, reducing poverty, enhancing prosperity, and achieving the Sustainable Development Goals. The following section briefly discusses the significance of transport.

1.2.1 SIGNIFICANCE OF TRANSPORT

Transport plays a significant role in the overall economic development. Transportation results into growth of infrastructure, industrialization and massive production.

Advancement in the transport sector has resulted into comfort and convenience. Well-functioning transportation systems form the basis for economic prosperity and social well being of societies.

- **Development of Industries**

  Transportation and the Industrial development are interrelated. Without improved modes of transportation it would have been harder for the industrial producers to produce and then sell their goods to the wider markets.

  Transportation facilitates movement of raw material and other requirement from the place of supply to the place of production. Efficient transport is indispensable to the economic development of the nation.

- **Generating Employment**

  Transport also contributes to economic development through job creation. It creates both direct and indirect employment opportunities. In India, a sizeable

portion of the country's working population is directly or indirectly employed in the transport sector.

It also facilitates movement of labours and thereby encourages employment resulting into industrial development and thereby economic development.

- **Creating place utility**

  Transportation enables movement of commodities from the producer to the final consumer whenever and wherever they are demanded. It creates place utility. Transportation plays an essential role in the agricultural sector.

  Agricultural requirements are made available to the farmer at a short span of time. It is an integral part t of commerce. It gives place and time utility to goods by removing them from the place of production to the places where they are to be consumed.

- **Reducing distance among countries**

  No country in the world is self-sufficient. They have to depend on one another to fulfil their requirements. Transportation has brought the countries closer. It not only caters to the need of mobility but also provides comfort and convenience.

  Travelling is a part of our daily lives. People travel for business purpose, education purpose and vacation purpose etc. The transport system is doing a great job by easing the pain of covering vast distance of land thereby bringing the countries closer.

- **Uniformity in prices**

  Goods can be transported to places where there is scarcity and the prices are high from places where there is surplus and the prices are low. Such transfer of goods from the place of surplus to the place of scarcity enables to stabilise the prices of the commodity. Thus stability of prices restricts the local producers to charge prices at their own will. This discourages monopoly and encourages competition.

- **Raising Standard of living**

  Transportation raises the standard of living, making possible improved housing, clothing, food and recreation.

- **Fulfilling several purposes**

  Transportation provides access to natural resources and promotes trade, allowing a nation to accumulate wealth and power. Transportation also allows the movement of soldiers, equipment, and supplies during war.

  Hence transportation is vital to a nation's economy as it serve several purposes. It includes the manufacture and distribution of vehicles, the production and distribution of fuel, and the provision of transportation services.

1.2.2 CHALLENGES CAUSED BY TRANSPORTATION

However, development in transport infrastructure is causing challenges worldwide, particularly in developing economies. These economies have various factors in common that contribute to the severity of their transport problems. Rapid growth, low incomes, and extreme inequality are among the main underlying causes of transport problems in developing countries. Although the nature and extent of transport problems obviously vary from one country to another, virtually all developing countries suffer from the following:

- The number of vehicles on the road has been rising rapidly due to increasing ownership and use of private cars and motorcycles which is resulting into traffic congestion. Time lost due to congestion erodes prosperity. High mobility costs cut the disposable income of the poor who often lack reliable and affordable public transportation.

- Production of commercial vehicles increased to 894,551 in 2017-18 from 567,000 in 2009-10 at a CAGR of 5.87 per cent (www.ibef.com). Due to rise in number of vehicles; the consumption of oil, use of energy and environmental pollution are also on rise.

- Extremely high levels of transport-related pollution including air and noise pollution are causing severe health hazards, especially in large cities.
- Extremely congested roads with an unmatched mix of both motorized and non-motorized vehicles traveling at widely different speed cause inconvenience to commuters.
- Development of Transport if not planned, disorganized may lead to limited network of roads, often narrow, poorly maintained, and unpaved thus cannot offer much help.
- Road safety is another big challenge which is the result of unplanned and unorganized transport infrastructure. Developing and under developed countries account for 90% of the deaths due to road accidents although they own just half the world's motor vehicles.
- Unsystematic or non-existent traffic control and management, often without even the most basic street signage.
- Overcrowded, uncomfortable, unreliable, time-consuming, uncoordinated, inefficient, and dangerous public transport.

As the developing world rapidly urbanizes, there is an opportunity to build safer, cleaner, more efficient and accessible transport systems that reduce congestion and pollution, facilitate access to jobs, and lower transport energy consumption. In emerging mid-size cities, where most of the new urban dwellers will live, city planners have an opportunity to design sustainable and inclusive transport systems from the start, leapfrogging more polluting and costly modes. In older or larger cities, technology and big data are helping better map travel patterns and needs, engaging citizens, and improving the quality and efficiency of transport solutions.

1.3 HISTORY OF TRANSPORTATION

1.3.1 BACKGROUND

Movement of things or people from one place to another is as old as human existence. However, the mode used in this movement has changed from time to time. Transport

helps people in removing this unwarranted barrier of physical separation and "enables a given flow of resource to produce greater results" (Bonavia, 1954). It also promotes homogeneity among the people of a country, and this sense of oneness strengthens political unity. "Transport the de facto barometer of economic, social and commercial progress has transformed the entire world into one organized unit. It carries ideas and inventions to the people, and has considerably contributed to the evolution of civilization" (Ogburn, 1946). The demand for transport may not be fundamental for human being as essential commodities. "It is an indispensable part of culture, as the hallmark of civilization" (Ambaprasad, 1960). Transport industry which enables movement of persons and things from one place to another; have contributed towards one of the most important activities of men in every stage of advanced civilization. It plays an important role in the spread of development of culture. Hence, a society without an advanced transportation system remains primitive (Jagadish, 1998). The history of transport reveals that social life and movements have developed together. Transport drives the whole of civilized life like the arteries and veins in the human body. Its services take people to whichever place they want to go. It is instrumental in spreading and mixing of cultures. According to a famous author about the general significance of transport in the modern world, "The transport is one of the great fundamental institutions of mankind. Its history dates back to the dawn of recorded history and beyond. It develops with man's advance; it retrogrades with the breakdown of a social order. People without transport would be a people without interaction with outside world and hence without the attributes of civilization. Man the transporter thus cannot be separated from man the builder of civilization".

The growth of the ability and need to transport large quantities of goods or numbers of people over long distances at high speeds in comfort and safety has been an index of civilization and in particular of technological progress. With the invention of wheel after fire, human life changed tremendously. As a result, people could move faster and farther, explore more and also exploit more resources. To put things on wheels we have invented steam based automated engines followed by fossil fuel and new renewable energy resources.

1.3.2 EVOLUTION OF TRANSPORT

The transport system has evolved with the development of human culture. It has developed across several stages like the hunting stage, the pastoral, agricultural, industrial and commercial stages. Man has made many achievements in the development of transport and at the same time has also helped civilization to develop. In the olden days, before human civilization, roads did not exist, and people used to walk miles for their livelihood and social life. Long distance walking tracks developed as trade routes in Palaeolithic times. In human history, the only mode of transport apart from walking was through domestic animals (www.wikipedia.org). The first earth tracks were created by human was by carrying goods and following game trails. Tracks were naturally created at points of high traffic density. As animals were domesticated, horses, oxen and donkeys, dogs, camels etc, became an element in track creation. With the growth of trade, tracks were flattened and widened to accommodate animal traffic. Thus, different animals were used in different regions for transport according to local conditions. Use of domestic animals for social life was a part of development of human culture (William, 1969: 425). Animal drawn wheeled vehicles developed in Europe and India in the 4th millennium B.C. and China is about 1700 BC. Elephants were tamed for transport in the 3rd millennium BC. Representation on seals show a close knowledge of the animals and part of elephants' skeleton has been found in a high level at Mohanjodaro (Prasad, 2003:100).

1.3.3 TRANSPORT SYSTEM IN INDIA DURING VEDIC PERIOD

The Vedic people were conscious of the necessity of the different forms of transport and regarded the maintenance and protection of the public highways as one of the duties of the King. The ancient Indian transport system was grouped under two divisions, land and water. The Rig-Veda hymns refer these forms of transport. (Prasad, 2003:100). The animals were tamed and were employed by man as draft animals during Vedic period. Bull is well represented in Indian literature as a means of conveyance. The Nandi seals found from different sites of Indian culture clearly speak of the use of bulls as the means of transport and communication. The camels were frequently used for transport or carriage loads. Part of the scapula of camel found is the only direct local evidence of the existence of this animal at that time (Prasad, 2003:102). In the later Vedic period, people learnt using vehicles for carrying men and commodities. The knowledge of transport

made man learn craft of trade and commerce along with the social life. The three types of vehicles used and termed as 'Yana's' are, a) Golimgam – A cart of medium size drawn by bulls b) Sakata– Big cart The long distance travel was named as 'Disayatra'. This was used like modern mail as well as passenger vehicle. Vedic literature gives detailed information about chariot vehicles in India. Harappa civilization clearly indicates the existence of chariot in the 3rd millennium B.C. Apart from this; there were two types of public passenger chariot, it was carried by three or four horses namely, 1. Yana Ratha (utility chariot): This was used for both carrying goods and passengers. 2. Aupvada (Travelling carriage): It was a chariot for passengers only (Prasad, 2003:103).

1.3.4 IN ANCIENT TIMES

Excavations at Mahanjodoro and Harappa established beyond doubt that the Indians had adopted the art of road building even during 4000 year B.C. But the importance of road and transport came to be realized only when the organized government was established. Kautilya, the celebrated economist of the Mourayan period has written that in his times city roads were 24feet wide and the roads leading to the battlefield and villages were 48 feet in width. In the regime of Chandra Gupta Mourya there was a transport department and a Grand trunk road connected to Patna with NWF province. Starato confirms that along this road the two Greek travellers Magasthenes and Irastathenes travelled north India during the regime of Emperor Ashoka; there were good roads in India, whose mention has creditably made by Chinese traveller Fahien. According to the illustrations of foreign travellers, even roads were well developed and public transport system was existed for common man. But vehicles were used by kings and elite of the society in a larger scale. (Srivastava 1953, Kuriyan,1969).

1.3.5 DURING MEDIEVAL PERIOD

During Moghul period the roads and transport were well developed for the growth of trade and commerce. Though the public passenger vehicles were not found in large number, goods carriers were developed in larger scale. Mohammed Tughlaq had constructed a trunk road from Delhi to Daulatabad which, according to Ibn Batuta, was travelled in 40 days. Shershah was very famous for the construction of roads. A monumental volume "Tarikhe-Shershah" reveals that, in his time roads were looked after and manage by the state. There is a mention in one of the famous book of the

Moghul period- “Chahar Gulshan” that, in those days there were 24 roads out of which 13 are very important for transport (Srivastava, 1953, Kuriyan, 1969).

1.3.6 DURING BRITISH RULE

During British rule in India, the administrators concentrated on the developments of roads and transport in India for the convenient of marketing and administration. Lord William Bentinck reviewed the idea of constructing the roads by connecting Peshawar, Delhi and Calcutta. Lord Dalhousie created public works department for the improvement of transport. Lord Mayo and Lord Rippon acted as a stimulus to the development of road and transport in India. During World war II road construction activities increased. Even though, public transport was in practice, Indian villages were self sufficient and most of people were using carts and animals for goods carrier. Elites were using their own Carts for transport. After independence Indian roads were developed under five year plans. In 1st five year plan Rs, 97.6 crocs released for road development programmers to be undertaken by the Centre and the various states.

1.4 MODES OF TRANSPORTATION

There are three modes of transportation namely, Air Transport, Water Transport and Land Transport.

1.4.1 AIR TRANSPORTATION

Airways refer to the movement of goods and a person from one place to another through the air. It is quickest, comfortable and costlier means of transportation. It is suitable for carrying precious articles, mail and high class passengers. It does not require construction and maintenance of the tracks for its operations but it is most expensive because heavy investments are required for the construction of aero planes, air ports, hangers, repair shops, wireless and metrological stations, wind indicators, control towers, neon bacons, and flood light- houses etc. It requires the permission of other countries for flying over the air territories. The potential of air transport in India was first realized in 1911, when an aircraft carried mail from Allahabad to Naini across the river Ganga. However it was only in 1924 after world war-I British Imperial Airways started the first regular air service to India to provide a link with UK. The first civil aviation company which was manned and managed by India was set up by TATA sons

in 1932. The airline was set up under the Air Corporations Act 1953 with an initial capital of Rs. 32 million and started operations on 1 August 1953. It was established after legislation came into force to nationalize the entire airline industry in India. Indian Airlines came into being with the enactment of the Air Corporations Act, 1953. It was renamed "Indian" on December 7, 2005. Indian Airlines started its operations from 1st August, 1953, with a fleet of 99 aircraft and was the outcome of the merger of seven former independent airlines, namely Deccan Airways, Airways-India, Bharat Airways, Himalayan Aviation Airlines, Kalinga Air Lines, Indian National Airways and Air Services of India. Indian airway is controlled by ministry of civil aviation, government of India. It has two divisions namely; Indian Airlines and Air India. Apart from this there are many private air transportation serving after privatizations of air transport system (Srivastava 1953).

Airports in India handled 295 million passengers in 2017. Currently, India is having third largest domestic civil aviation market in the world and is expected to overtake UK to become the third largest air passenger market by 2024 (www.ibef.org). The dramatic increase in air traffic for both passengers and cargo in recent years has placed a heavy strain on the country's major airports. To cater to the rising air traffic, the Government of India has been planning to increase the number of airports. As of March 2019, India has 103 operational airports. India has envisaged increasing the number of operational airports to 190-200 by FY40.

Further, the rising demand in the sector has pushed the number of airplanes operating in the sector. As of July 2018, there were nearly 620 aircraft being operated by scheduled airline operators in India. The number of airplanes is expected to grow to 1,100 planes by 2027.

1.4.2 WATER TRANSPORTATION

Water transportation refers to the movement of goods and passengers on water through boats, steamers and ships. It has two kinds of transportation - Inland water transportation and Ocean transportation. Two third of the world’s surface is covered by water. The use of boat as a means of transport is the oldest means of transport in the world. It is a natural means of transport and less expensive and slow and risky mode of transportation. Water transport is more flexible and uncertain in maintaining schedule times. Water

transport has come for all nations but serves to limited areas. Inland water is the cheapest mode of transport for certain kinds of travel both long and short distances. This transportation which comprises 93 canals, rivers and lakes had received a set-back in the past due to completion from the railway and road transport systems. Whereas Ocean transport was considered in olden days as a big hindrance, in modern times they are instrumental in promoting international trade.

Water transport is considered the most economical and efficient mode of transporting goods as the large volume of goods can be carried for long distances at a fraction of a cost of other modes of transport like rail, roads, air etc. The Shipping industry accounts for transporting 90% of the world trade (www.careratings.com). The domestic shipping industry has a share of 7-7.5% as of 2015-16 of India's overseas trade. It gains significance owing to the country's 7,517 km coastline and 12 major ports & over 150 non-major ports along the long coastline. The 12 major ports cater to EXIM, coastal shipping and cruise shipping. Among the non-major ports, only 30-35% of the 150 ports can cater to coastal shipping and much fewer can cater to EXIM trade. In terms of maritime cargo handled in the country, major ports registered a growth of 4.77% during FY18 at 680 million tonnes.

1.4.3 LAND TRANSPORTATION

Under land transportation the prime factors to be taken into account is the configuration of soil or surface. Several kinds of carriage are used in road transport such as bicycles, bikes, Motor rickshaws, cars etc., but Road and Railways are considered two major land public transport system.

a) **Railway transport**: Railway transport refers to the movement of goods and persons through trains. It is the most important means of land transport and suitable for carrying heavy and bulky articles over long distances. In 1767 the first iron rails were laid at Coal brook dale and the first passenger railway start by Stockton to Darlington line, built by Stephenson in 1825. The line comprised 27 miles. Early railways were a combination of horse power, fixed steam engines and locomotives. The official opening of the first train was run between Liverpool to Manchester line in 1830. It is the world's fourth largest railway network after those of the United States, Russia and China.

b). **Road transport:** Road transport refers to the movement of goods and persons through motor vehicles on road. It is very oldest and most universal mode of transport and it is sustainable for short distance service and light articles. Every part of the country can be easily reached by road transport and it is less expensive when compared to rail and air transport. The expenditure involved in the construction and maintenance of road is comparatively lower than railways.

1.5 PUBLIC TRANSPORT IN INDIA

An important social role played by public transport is to ensure that all members of society are able to travel which include groups such as young, the old, the poor and rich, and other strata of the society. Public transport opens to its users the possibility of meeting other people. It is a location of inter social encounters across all boundaries of social, ethnic and other types of affiliation. It provides a good means of communication and breaks the isolation of cities and villages and facilitates the promotion of social awaking in the masses. Public transport maintains social contacts and act as an agent of transforming the culture from one place to another and from one society to another. It helps in cultural exchange, thoughts, ideas, knowledge of the people, and also builds the homogeneity among the people. Transport also helps in promoting the cause of education. Public transport comprises passengers' transportation services which are available for use by the general public. Public services are usually funded by fares charged to each passenger. Public transport consists of light rail, commuter train, buses, Metro, Mono rail etc. It is provided by a company or authority. Apart from all the means of transport road transport does occupy a pivotal role in the overall transport system in India. In the road transport service bus is one of the most popular modes of transport. In a country which has not been adequately served by advanced modes of transport, such as railways, airways and road transport, the road transport become most significant mode of transport. As one author puts it, "Undoubtedly, rail, shipping and air transport occupy an important place in our modern mode of transport in society, but the basic need is fulfilled by road transport alone. One can exist without rail, shipping or air transport but not without the roads. Even the rail, shipping and air depend upon the road for completing the transport service". The most important feature of road transport is its flexibility. Road transport can penetrate into the far corners of the country and can provide a door to door service. While other modes of transport are not economical over

shorter distances carrying fewer loads, road transport is ideally suited for this purpose. Without its complementary service, the other sophisticated modes will not be able to achieve the end purpose of transport. The route course and schedules in road transport need not be as rigid as in the case of the railways and air transport, and this gives the advantage of flexibility to satisfy a variety of transportation needs suitable for interior transportation. In terms of investment also, road transport has an edge over the modes of transport. The track cost in the case of railways and the very high cost of acquiring air-planes or ships require very heavy investments. Road transport has a low cost technology and the costs of maintenance of vehicles, as well as roads are not as high in the case of other capital intensive modes of transport.

1.6 THE EMERGENCE OF METRO SYSTEM

With a rapidly growing population, problems related with traffic congestion, air pollution and traffic accidents have also been increasing. In order to find solutions to all these problems, it was needed to develop an effective public transportation mode which could deliver favourable environmental conditions, speedy and fast travel, better mobility and effective growth of the economy. The solution is Mass Rapid Transit System (MRTS) also called Metro Rail. It is a reliable means of public transport which has the capacity to carry equal amount of passengers as five lanes of bus traffic or twelve lanes of private two and four wheelers. After the success of the Delhi Metro, lots of Indian cities are exploring the option of implementing metro rail networks. The Ministry of Urban Development (MoUD) estimates that there is approximately 316km of metro lines currently in operation and more than 500km of metro lines under construction across the country. This includes metro/mono rail systems promoted by state governments and private bodies.

Delhi Metro is the largest metro system with a total length of 213 km, carrying 2.8 million passengers a day. Some of the new metro systems are still facing issues with building ridership; for example, Jaipur Metro carries only 20,000 passengers per day, incurring a loss of INR 30 million (US$ 500,000) every month.

Most of the systems are developed by public authorities with external funding and support from federal government. However, some of the cities have developed the system in partnership with private players e.g. Gurgaon (operated by IL&FS), Mumbai

(operated by RATP) and Hyderabad (operated by Keolis – under development). In the Union Budget 2014-2015, the government emphasised that the planning of metro projects must begin now. The federal government has earmarked INR 100 billion (US$ 1.5 billion) for metro projects in the fiscal budget 2016-2017.

Advantages and Disadvantages of Metro

Advantages:

- The Metro Rail System is the most efficient in terms of energy consumption, space occupancy and number of passengers transported.
- It has greater traffic capacity in terms of carrying as much traffic as 7 lanes of bus traffic or 24 lanes of car traffic.
- Metro Rail fleets are managed by state of the art systems therefore, are punctual and efficient during peak hours.
- It is a comfortable mode of travelling and thus improves a traveller's efficiency at her workplace or education.
- It does not occupy road space so traffic does not get blocked in any way.
- It is environment friendly and does not deteriorate the air quality.
- It is a very safe system and hardly any fatalities in accidents have been observed since its inception in India.
- High Economic Rate of Return contributes to the economy of a city.

Disadvantages:

- It requires one time huge capital investment.
- Operation & Management Cost are high.

- This alternative seems to be the most effective for managing large scale transit problem

1.7 PRESENT SCENARIO OF PUBLIC TRANSPORT SECTOR AND GOVERNMENT INITIATIVES

As per the data collected from different Media Reports, Press Releases, Ministry of Road Transport and Highways, NHAI website, Press Information Bureau (PIB), Department of Industrial Policy and Promotion, Railways Budget 2016-17, Indian Railways, internet sources, following section describes the present status of public transport sector in India.

1.7.1 ROAD TRANSPORT

Present Status

According to Ministry of Road Transport and Highways, India has one of the largest road networks across the world which spreads over a total of 5.5 million km. About 64.5 per cent of all goods are transported through this network in the country and among total passengers 90 per cent traffic uses road network to commute. The use of road transportation has increased progressively over the years because of improved connectivity between different parts of the country. Now transportation of heavy vehicles and other freight is also done rapidly through roads.

The private sector has emerged as a key player in the development of road infrastructure in India. Increased industrial activities, along with increasing number of two and four wheelers have supported the growth in the road transport infrastructure projects. The government's policy to increase private sector participation has proved to be a boon for the infrastructure industry with a large number of private players entering the business through the public-private partnership (PPP) model.

As per the report published by the concerned ministry, during FY18 the construction of highways reached to 9,829 km thus, total national highways touched length of 122,434 kms till FY18. The Government of India has set a target for construction of 10,000 km national highway in FY19. Total length of roads constructed under Prime Minister's Gram Sadak Yojana (PMGSY) was 47,447 km in 2017-18.

Recent Developments

In order to boost corporate investment in roads sector, business-friendly strategies are being introduced by the government that will balance profitability with effective project execution. According to data released by the Department of Industrial Policy and Promotion (DIPP), construction development including Townships, housing, built-up infrastructure and construction-development projects attracted Foreign Direct Investment (FDI) worth US$ 24.87 billion between April 2000 and June 2018 (www.ibef.com).

With the Government permitting 100 per cent foreign direct investment (FDI) in the road sector, several foreign companies have formed partnerships with Indian players to capitalise on the sector's growth. MAIF 2 became the first largest foreign investment in Indian roads sector under TOT mode worth Rs 9,681.5 crore (US$ 1.50 billion). In May 2018, the Government of India signed US$ 500 million loan agreement with World Bank to provide additional funding for construction of 7,000 km climate resilient roads out of which 3,500 km will be built using green technologies under Pradhan Mantri Gram Sadak Yojna (PMGDY).

Government Plans

As per the data released by the ministry, Government plans pertaining to road transport are as under:

- As of October 2018, total length of projects awarded was 6,400 kms under Bharatmala Pariyojana (including residual NHDP works).
- As of August 2018, a total length of 34,800 km road projects have been proposed to be constructed, under Bharatmala Pariyojana Phase-I.
- As of August 2018, Government of India has approved highway projects worth Rs 2 billion (US$ 29.83 million) to improve connectivity among Gujarat, Maharashtra, Rajasthan, Madhya Pradesh and Diu.

Future Prospects

The government, through a series of initiatives, is working on policies to attract significant investor interest. A total of 200,000 km national highways are expected to be completed by 2022. The Ministry of Road Transport and Highways has fixed an overall target to award 15,000 km projects and construction of 10,000 km national highways in FY19. A total of about 295 major projects including bridges and roads are expected to be completed during the same period.

1.7.2 RAIL TRANSPORT

Present Status

The Indian Railways is one of largest rail networks in the world. The spread of the Indian Railways network is over 115,000 km, with 12,617 passenger trains and 7,421 freight trains. On an average it carries load of nearly 23 million travellers and 3 million tonnes (MT) of freight daily. It is recognised as one of the largest railway systems in the world under single management.

It is the most suitable mode of transportation used for long distance travel and transportation of bulk commodities, along with being energy efficient and cost-effective. The Government of India has focused on investing on railway infrastructure by making investor-friendly policies. It has framed policies to attract Foreign Direct Investment (FDI) in railways to improve infrastructure for freight and high-speed trains. At present, several domestic and foreign companies are also looking to invest in Indian rail projects.

Recent Developments

- Foreign Direct Investment (FDI) inflows into Railways Related Components from April 2000 to June 2018 stood at US$ 920.21 million.

- France-based Alstom announced plans in December 2018 to enhance its coach production capacity in Sri City from 20 cars per month to 24 cars. There are plans to set up a new production line to increase capacity to 44 cars per month by the end of 2019.

- In December 2018, the Prime Minister of India laid the foundation stone for the third phase of the Pune metro.

Government Plans

Few recent initiatives taken up by the Government are:

- A High Speed Rail Corridor project between Mumbai and Nagpur has been projected by the Government of India.
- Indian Railways is planning to come out with a new export policy for railways.
- The Government of India is planning to launch a 'National Rail Plan' which will enable the country to integrate its rail network with other modes of transport and develop a multi-modal transportation network.
- In order to have digital and transparent systems and procedures, a 'New Online Vendor Registration System' has been launched by the Research Designs & Standards Organisation (RDSO), the research arm of Indian Railways.
- The Government of India has signed an agreement with the Government of Japan under which Japan will help India in the implementation of the Mumbai-Ahmedabad high speed rail corridor along with a financial assistance that would cover 81 per cent of the total project cost. (www.ibef.com)

Future Prospects

In the next five years, the Indian railway market will be the third largest, accounting for 10 per cent of the global market. Indian Railways is focusing to raise its freight traffic to 3.3 billion tonnes by 2030 from 1.1 billion tonnes in 2017. It is projected that freight traffic via the Dedicated Freight Corridors will increase at a CAGR of 5.4 per cent to 182 MT in 2021–22 from 140 MT in 2016–17.

1.8 CONCLUSION

The Indian public transport sector plays a significant role in providing quality and affordable services to the public. Currently, in addition to the public and organised segment, unorganised segment is also growing to cater to the demand in the form of

personal modes such as cars and taxi aggregators. However, the opportunity is now available to leap frog the development of the sector through adopting new technologies in transport and IT as well as revenue mobilisation using innovative means. By providing a deep and sharp shift in policies and adopting new ideas can be considered to take a generational leap and transform the public transport services and radically improve user experience. With the right enabling environment and proper structuring, private sector investment, innovation and efficiency can be brought onto a common platform to plug gaps in service delivery. The opportunity is now to make our cities more mobile, enhance the infrastructure of our public transport and boost its customer experience.

REFERENCES

- Acharya, R., 2000. Indian Railways: where the commuter is king. Japan Railways and Transport Review 25, 34–45.

- Badami, M., Tiwari, G., Mohan, D., 2004. Access and mobility for the urban poor in India: bridging the gap between policy and needs. Paper presented at the Forum on Urban Infrastructure and Public Service Delivery for the Urban Poor, July 24–25, 2004. National Institute of Urban Affairs, Delhi, India.

- Gakenheimer, R., 1999. Urban mobility in the developing world. Transportation Research 33A, 671–690.

- Gakenheimer, R., 2002. Planning Transportation and Land Use for Cities in India. Massachusetts Institute of Technology, Cambridge, MA.

- Gakenheimer, R., Zegras, C., 2003. Travel Demand Drivers: Mumbai and Chennai, India. World Business Council for Sustainable Development, Geneva, Switzerland.

- https://en.wikipedia.org/wiki/Urban_rail_transit_in_India

- https://shodhganga.inflibnet.ac.in › jspui › bitstream

- Padam, S., Singh, S.K., 2001. Urbanization and Urban Transport in India: The Sketch for a Policy. Transport Asia Project Workshop, Pune, India. Accessible at: http://www.deas.harvard.edu/TransportAsia/workshop_ papers/Padam-Singh.pdf.

- Pucher, J., Korattyswaroopam, N., Ittyerah, N., 2004. The crisis of public transport in India: overwhelming needs but limited resources. Journal of Public Transportation 7 (3), 95–113.

- Sreedharan, E., 2003. Need for Urban Mass Transport System for Our Cities. Press Information Bureau, Government of India, New Delhi, India.

- Tiwari, G., Mohan, D., 1999. Sustainable transport systems: linkages between environmental issues, public transport, non-motorized transport, and safety. Economic and Political Weekly 34 (25), 1589–1596.
- www.britannica.com
- Padam, S., Singh, S.K., 2001. Urbanization and Urban Transport in India: The Sketch for a Policy. Transport Asia Project Workshop, Pune, India. Accessible at: http://www.deas.harvard.edu/TransportAsia/workshop_ papers/Padam-Singh.pdf.
-
- Pucher, J., Korattyswaroopam, N., Ittyerah, N., 2004. The crisis of public transport in India: overwhelming needs but limited resources. Journal of Public Transportation 7 (3), 95–113.
- Sreedharan, E., 2003. Need for Urban Mass Transport System for Our Cities. Press Information Bureau, Government of India, New Delhi, India.

- Tiwari, G., Mohan, D., 1999. Sustainable transport systems: linkages between environmental issues, public transport, non-motorized transport, and safety. Economic and Political Weekly 34 (25), 1589–1596.
- www.britannica.com

- www.ibef.org
- www. historyhome.com

CHAPTER 2

CONCEPTUAL FRAMEWORK

CHAPTER-II

CONCEPTUAL FRAMEWORK

2.1 INTRODUCTION

Railway system occupies a significant position in the transportation industry. Comparing with other means of transportation, this particular mode has grater advantages as it can carry a large number of passenger and large & heavy loads to long distances. Further, it helps in reducing traffic congestion. Since its launch in transportation field, railway underwent tremendous changes in respect of shape, speed, mode of running, distance of whatever field human mind can imagine. Among those changes, the most important one is considered to be the emergence and spread of metro rail system. It is of utmost importance in city areas which are mostly congested and densely populated which creates severe challenges to regulate normal traffic poses due to major commercial markets, heavy traffic and residential areas. It is a reliable means of public transport which has the capacity to carry equal amount of passengers as five lanes of bus traffic or twelve lanes of private two and four wheelers.

Due to steady increase in population, globalization and rapid urbanization over the last decade, transport infrastructure in Jaipur City of Rajasthan has got badly affected. The development in the city has been in an imbalanced manner. While most of the economic activities run in the “Walled City”, the residential colonies and industrial hubs have been developed in the western and southern parts. As a result, the demand for travel has also increased and due to large geographical spread between the residential and commercial centres, the trip lengths are also increasing. Hence there was a serious need to have mass transit system for the city for faster and efficient movement of commuters. Delhi Metro Rail Corporation decided to bring Jaipur on the map of the cities that would be served with metro. Thus, Jaipur Metro came into existence.

2.2 ORIGIN & DEVELOPMENT OF METRO SYSTEM

The word metro actually comes from an abbreviation from of 'Paris Metropolitan'. That was quickly abbreviated into metro, which become common word used to designate all subway network. In some cases metro is regarded as rapid transits train system. In the following paragraph, the researcher has attempted to put some light on the origin and history of metro system in world.

World's first urban underground railway was Metropolitan railway which began its operation on January 10, 1863. It was built largely in shallow tunnels and is now part of London underground. It was worked by steamed trains, and despite the creating of numerous vents, was unhealthy and uncomfortable for passengers and operating staff. The idea of an underground railway terminus in its urban centre was proposed in the 1830s, and the Metropolitan build such a line in 1854. It opened January 1863 between Paddington and Farrington using gas lit wooden carriages hauled by steam locomotives. It was hailed as a success, carrying 38,000 passengers on its opening day, and borrowing trains from other railway to supplement the services.

Followed by this historical beginning on transportation system, on July 1872 British company "The Metropolitan Railway of Constantinople to Galata Pera" was registered. On December 5, 1874 the construction was completed and it started carrying people on January 17, 1875.

The United States has been using the oldest subway tunnel in Boston that is still in use till dating from 1897. Later subway lines to carry heavy rail trains were built. The New York city has world's largest 4-track line, stretching 9 miles (14.5kms). The oldest subway in Southern Hemisphere, Subterraneos de Buenos Aries, opened in1913 in Argentina. It used to carry 190,000 passengers daily and is a tourist attraction as well.

On October 17, 1919 the Madrid Metro was opened, which today is one of the longest metro system in the world. In 1924, Barcelona Metro came into existence.

First underground metro in USSR was opened in 1935 in Moscow. Moscow Metro is one of the most elaborated decorated underground of the worlds, with its station

often being called as underground palace. As of 2012, Moscow metro had 308 kms of railway and 186 stations and is one of the busiest metro systems in the world. In later late 20th century, many European metros, some driver less and rubber tired, appeared in medium sized cities, especially in Spain, France and Italy. Meanwhile the Toronto Subway was opened in 1954. The Montreal Metro was second subway system in Canada and was inaugurated in 1966. The first underground system in Brazil was opened in 1974 in nation's largest city. Metro de Santiago is the metro system serving Santiago in Chile. It is a network of 5 lines with a total of 85 stations, and the only South American rubber tired Metro. In Colombia the Metro de Medellin Company operates in elevated infrastructure in downtown area and on-level parallel to river. The construction of the system had astronomical cost overrun that lead to a great public debt. Cairo become first African country with Metro system, partly converted from railway line since 1987.

Asia's first cities to have subway lines were Tokyo in 1927 and Osaka in 1933. Beijing subway, the first in China began operations. Since 1974, a number of cities in South Korea have developed modern and extensive subway system.

Singapore developed Mass Rapid Transits in 1987 which was world's first heavy rail system to feature platform screen doors. Metros were built in Taiwan in 1996, Iran in 1999, UAE in 2009, Saudi Arabia in 2011 and the list continues.

As of December 2017, 178 cities in 56 countries host approximately 180 metro systems around the world. Of which, Tokyo has the busiest metro system in the world.

Chart 2.1

Top 10 busiest Metros (annual ridership in millions)

1	TOKYO	3,463
2	MOSCOW	2,369
3	SHANGHAI	2,044
4	BEIJING	1,988
5	SEOUL	1,885
6	NEW YORK CITY	1,806
7	NEW DELHI	1,789
8	GUANGZHOU	1,730
9	MEXICO CITY	1,678
10	HONG KONG	1,600

Source: www.uitp.org

Asia is home to no less than seven of the top 10 busiest metros. Compared to the 2015 UITP Metro Statistics Brief, New Delhi joined the Top 10 group, replacing Paris. Beijing, Shanghai, Seoul, Guangzhou and Mexico moved down in the ranking while Moscow climbed up to number two.

Indeed, development of metro systems across the globe itself an interested journey. In this great journey, we can find several milestones. The Hong Kong metro service is equipped with 3G cell phone service, the Copenhagen metro is 24/7 driver less electric system, the Arsenalna metro station in Kiev, Ukraine, is the world deepest (346 feet underground) metro, the Moscow metro is commonly regarded as having the most beautiful stations in the world, the New York City subway (with 468 stations) is the largest subway etc, this is not the end. Many more wonders in metro world are yet to come.

2.3 METRO RAIL IN INDIA

Rapid transits in India consist of Metro, Monorails and light rail system. The first rapid transits system in India was Kolkata Metro, which started operations in 1984. 'Elattuvalapil Sreedharan', popularly known as Metro Man was behind this great effort. The metro rail system in India is popularized and developed due to his amazing efforts and hard work.

Delhi Metro was India's first modern metro which began its operation in 2002. In 2006, the National Urban Transport Policy proposed the construction of a metro rail system in every city with a population of 20 lakh. On 11 August 2014, Union Government announced that it would provide financial assistance, for the implementation of a metro rail system, to all Indian cities having a population of more than 1 million. In May 2015, the Union Government approved the Union Urban Development Ministry's proposal to implement metro rail systems in 50 cities. In a new draft policy unveiled in March 2017, the Central Government stated that it wanted state governments to consider metro rail as the "last option" and implement it only after considering all other possible mass rapid transit systems. The decision was taken due to the high cost of constructing metro rail systems. In August 2017, the Union Government announced that it would not provide financial assistance to new metro rail project, unless some sort of private partnership is involved.

Apart from the Kolkata metro (which forms its own zone of Indian Railways), these rapid transit metro lines are not operated by Indian Railways but by separate local authorities. In addition to their metro systems, the cities of Chennai and Hyderabad have mass transit systems operated by the Indian Railways, known as the Chennai MRTS and the Hyderabad MMTS, respectively. Rapid Metro Rail Gurgaon, which started operations in November 2013, is India's first privately owned & operated metro.

Metro rail lines in India are composed of both standard gauges and broad gauges. Project likes in Delhi Metro used broad gauges for their earliest lines but most of the new project in India are on Standard gauges as rolling stock is imported from Europe is on Standard Gauges. One exception is Ahemdabad Metro, which has planned to use broad gauges, as there is more space available inside the coaches.

2.4 JAIPUR METRO RAIL CORPORATION (A GOVERNMENT OF RAJASTHAN UNDERTAKING

Jaipur Municipal Region had a population of 30.73 lakh in 2011 which is projected to grow to 81.1 lakh in 2031. Jaipur Region, with its present estimated population of 4.45 million and employment of 15.55 lakh has a travel demand of 36 lakh passenger trips every day with 3.6 lakh trips performed during peak hour. With the growing economy and inadequate public transport services, the passengers shall shift to private modes, which is already evident from the high vehicle ownership trends in the region. This would not only aggravate the congestion on streets but also increase the pollution. Hence, it is essential to plan and provide a Metro Rail System in Jaipur.

As a result, the government mulled over establishment of Jaipur Metro on the lines of Delhi Metro which had proved to be a great success. **Jaipur Metro** is a rapid transit system in the city of Jaipur, Rajasthan, India. Construction on the mostly elevated part of the first line, called Phase 1A, comprising 9.63 kilometres of route from Mansarovar to Chandpole Bazaar, started on 13 November 2010, and was completed in 2014. The project's commercial run was delayed to December 2014, and then to April 2015. After receiving safety clearance from Commissioner of Metro Rail Safety (CMRS) in May 2015, Jaipur Metro began commercial service between Chandpole and Mansarovar on 3 June 2015. The Jaipur Metro Rail system is India's sixth metro rail system after those in Kolkata, Delhi NCR, Bangalore, Gurgaon and Mumbai. Jaipur Metro is the first metro in India to run on double-storey elevated road and metro track.

2.4.1 INSTITUTIONAL ARRANGEMENTS

To enable Jaipur Metro project to be implemented without any loss of time and cost over-run, following institutional arrangements have been set up. Experience of implementing Delhi Metro project has shown that a Special Purpose Vehicle (SPV), vested with adequate powers, is an effective organizational arrangement to implement and subsequently operate and maintain a metro project.

Jaipur Metro Rail Corporation was established under the Companies Act, 1956. This SPV is a Public Sector undertaking (PSU) of the State Government. Since the equity for the project will be contributed by the State and the Central Governments, both these Governments should have Directors on its Board. The Managing Director of JMRC is the nominee of the State Government. In order to avoid delays usually associated with bureaucratic process of decision- making, the Board of Directors (BOD) of JMRC have been vested with full powers needed to implement the project. Empowered Committee The Government of Rajasthan has already set up an 'Empowered committee' under the Chairmanship of its Chief Secretary to monitor the project, before whom problems and obstacles encountered during execution of the project will be placed by JMRC duly assisted by Project Director for quick redressal through the Board of the JMRC, in case the board of JMRC is not authorized to address Current Structure of the Project.

Organization Structure of JMRC

Board of Director			
Chairman & Managing Directors			
Director (Project)	**Director (O & S)**	**Director (Finance)**	**Director (Corporate Affairs)**
Executive Director (civil)	Executive Director(Operations)	General Manager(Finance)	Executive Director (Corporate Affairs)
General Manager (PPP)	Executive Director (Rolling Stock)	Company Secretary	Jt. General Manager (Administration)
General Manager (S&T)	Executive Director (Traction &EM)	Sr. Exec.Officer	Jt. General Manager (Revenue)
General Manager (Traction&EM)	Executive Director (S&T)		Dy. General Manager (HR)
Jt. General Manager (Civil)	General Manager (Rolling Stock)		Dy. General Manager (Law)
Dy. General Manager (C&M)	General Manager (Operations)		
Dy. General Manager(Town Planning)	General Manager (Civil)		
	General Manager (Rolling Stock)		
	General Manager (Traction &EM)		
	General Manager (S&T and AFC)		

Source: adapted from www.transport.rajasthan.gov.in

2.4.2 PHASES OF THE PROJECT

- PHASE-I (MANSAROVAR TO BADI CHAUPAR-11.979 KMS) (EPC MODE)

i. Phase-I-A (Mansarovar to Chandpole)- The Jaipur Metro Rail Corporation has entered into an agreement (05.08.2010) with the Delhi Metro Rail Corporation (DMRC) for development of Phase-I-A from Mansarovar to Chandpole on 'deposit work' basis covering a length of 9.63 kms. The Phase-I-A from Mansarovar to Chandpole commenced on 24th February 2011 and completed and opened for commercial operation on 3rd June 2015. It is one of the fastest implemented metro projects. Jaipur Metro has been attracting decent ridership since the day of commercial opening and crossed ridership of 1 lakh on 7th June 2015. Jaipur Metro has received a good response and daily average ridership of 21464 has been achieved in the first thirty one months.

ii. Phase-I-B (Chandpole to Badi Chaupar) – The civil work of Phase I-B (Chandpole to Badi Chaupar) has been assigned to M/s. CEC (Taiwan). This work has been started by M/s. CEC as per agreement done on 5th October 2013. This phase is entirely underground and located in the heritage city. It is being directly executed by JMRC, with DMRC acting as General Consultant.

- **PHASE- II (AMBABARI TO SITAPURA -23.099 KMS) (PPP MODE)**

Government of Rajasthan has decided to develop Phase-II on PPP Mode. In 2020, when the population of Jaipur city would have crossed 5 million mark and PHPDT of Tonk Road would have risen to 17875, this major artery will badly require a rail-based mass transit system, i.e., Phase-II of Jaipur Metro.

The process of reviewing the DPR of Phase-II, prepared by DMRC in 2014 by an international consultant is undergoing.

2.4.3 PROJECT GROWTH AND UNCERTAINTIES

In August 2009, Rajasthan government announced that work on Jaipur metro would commence by March 2010 and the metro would be made operational by 2013. The Jaipur Metro Rail Corporation Limited (JMRC) was constituted in October 2009. The

state cabinet approved of the public private partnership (PPP) model for the whole Jaipur Metro project in 2010. The decision came as a setback for the Delhi Metro Railway Corporation (DMRC), which had been eyeing the Rs 7,500- crore mega project. DMRC had already submitted a detailed project report (DPR) costing Rs 7500 crore. However, DMRC strongly said no to PPP model and advocated uninterrupted state funding. Unfazed by DMRC's suggestion, the state government ratified the PPP model for the project. On the other hand, Planning Commission expressed its reservations about feasibility of the project as Metro trains may not find the required passenger load. Uncertainty also prevailed about potential partners in PPP model as they have their own doubts about the viability of the project. According to an expert involved in project conceptualization exercise, "the doubts about passenger load are based on the fact that only 19% of Jaipur population is dependent on public transport system and possibility of people switching over to public transport overnight is remote". The state government was initially not sure of the PPP model to be followed for Jaipur Metro and urban development department sent teams to Hyderabad and Mumbai to study the private-partnership process being implemented in the cities. The teams were assigned to draft a model in accordance to needs of Jaipur. Global tenders were to be floated for the project and future progress of the project to be decided according to the proposals. Discussions on funding of the project were held by the then Chief Minister at a meeting with the Planning Commission advisor. During the meet, it was decided to include provisions like advertising and real estate revenue to make the project economically viable. With the DMRC already denying the possibility of development of the Jaipur Metro on the PPP model, the state government decided to have the initial phase I of Jaipur Metro developed by the DMRC. The first phase is meant to involve an east-west corridor from Mansarovar to Badi Chaupar. But as tunneling through the congested old city would have delayed the project, it was subdivided into phases 1(a) and (b).

(a) Phase IA progressed satisfactorily despite a few hiccups relating to land acquisition. Four new coaches from Bharat Earth Movers Limited (BEML) were also received in May 2013. These however could not be put to use immediately as trial runs took some time. In a recent letter to the Railway Board, the JMRC has sought permission to allow the coaches borrowed from Delhi Metro to run at a maximum 45 kph. It has informed the Railway Board

that new rolling stock procured from BEML, Bangalore, is expected to be commissioned by December after trials and approval. The JMRC has maintained that if the borrowed coaches were not deployed, the start of revenue operations would likely to be delayed almost six months. The new rolling stock was used when the second phase was launched. Phase IB with construction of Phase IA nearing completion as per schedule, efforts were now on to focus on funding Phase IB. There was sufficient arrangement of funds to construct the project from Mansarovar to Chandpole. However, the state government was not in a position to fund the entire project till Badi Chaupar. The estimated cost to construct the line from Mansarovar to Chandpole is Rs 2,000 crore. If it was extended to Badi Chaupar, the cost would go up to around Rs 3,149 crore. To seek funds for construction of underground Metro from Chandpole to Badi Chaupar, Phase- I (B), senior officials of JMRC recently met representatives of Asian Development Bank (ADB) in New Delhi. The Planning Commission had forwarded the proposal to the ADB after the JMRC sought the requirement of loan for the project.

(b) Phase I (B). Sources in the department claimed that ADB has given in principal approval to provide a loan of Rs 969 crore. Consultants from the ADB bank conducted a survey for the route and met senior JMRC officials and residents of the city. The highest number commuters coming to Walled City ply through this route. The state government plans to lay foundation before next state elections, and the JMRC is gearing up to initiate the tender process in July for construction of Metro project phase I (B), based on an engineering-procurement-construction (EPC) model. JMRC is simultaneously looking at getting financial assistance from the Central government in the form of equity for the Metro phase I (B). As part of a joint venture, the Centre is expected to fund 20% of the project in the form of equity. On JMRC's request, the Union ministry of urban development recently forwarded the proposal to the Planning Commission for its comments. The Central government will provide Rs 627 crore in the form of equity.

2.4.4 OPPOSITION TO PPP IN PHASE II

The Delhi airport Metro express line was the first project (in Metro) under public private partnership (PPP) and had a sordid fate, and this has, led to opposition on mode of implementation of phase-II of Jaipur Metro which was also planned under the PPP mode. However, the state government refused to backtrack and plans to go ahead with the PPP. It has been pointed out that Metro projects initiated under PPP mode in India or elsewhere has either been delayed or have failed miserably. In Mumbai, phase I started in 2006 and still is far from completion. Phase II was supposed to start in 2008 but extended to 2013. Similarly, Hyderabad Metro was expected to be operational by 2017, three years after the initial 2014 deadline, though the project had PPP from the word go. However, the state government said they would go ahead with the PPP mode for phase II. "We stand by our decision. Many big companies have shown interest in the project and so far response has been very positive," said the then minister, urban development and housing. Experts believe that the state government's decision will be suicidal. "The Metro project under PPP mode is just not viable. They are cost intensive projects and it is hard for the concessionaire to recover the money invested. They will not come in the first place. If they take up the project it is likely that it will meet the same fate," said an expert. He added "Phase I will be complete on time because state government is undertaking it". Similar views were echoed by the report published by the ministry of urban development on Innovative Financing of Metro Rail projects on April 16, 2012 to the state government. Report reads "In 113 cities having metro rails across the world, 88% have been developed and are being operated in public sector mode whereas in only 12% cities some form of PPP exists." It's also mentioned in the report outside India, no city anywhere in the world (expect the failed experiment of STAR and PUTRA Metro rail in Kuala Lumpur in Malaysia) has attempted provisioning of Metro rail in full city on PPP in the last few decades. Sources believe that the construction cost of the Jaipur and Mumbai Metro is almost similar. But the possibility of returns is depressing in Jaipur. "The citizens have to develop Metro culture and by the time they are acclimatized to it, the losses will run into crores," said the sources. Some industry views are encouraging. "Taking up the phase-I work, the state has brought clarity to the whole process and project. Private players look for certainty, which is there in the Metro rail project now. This model of PPP will encourage private companies to

participate," said Sailesh Pathak, president, SREI infrastructure project, at the 'Infra Conclave Rajasthan 2012' organised by CII and department of urban development, housing & local self government. Government Policy document issued by Ministry of Urban Development in January 2013 discourages PPP in metro railways as metros are believed to be inherently unviable and rely heavily on real estate development in the PPP mode. This leads to the transport project getting converted to a real estate project with its associated risks. Further, these projects invariably require Viability Gap Funding (VGF) from both Central and state governments. If VGF of 40-50% is to be given, it is better to take Govt. funding route since private parties have tendency to escalate project cost estimates (e.g. Mumbai & Hyderabad Metros) and would like to front load profit. Further, cost of capital is much higher to a private player than to government. In view of this, Government believes that PPP in metros should not be considered and can be supported only in exceptional cases where corridor is elevated and ridership is high. Also, fully private metros like the one proposed as DLF Gurgaon Metro can be accepted where govt.'s role is limited to regulation and fare fixation. This change in government policy, although applicable for future metros, has put a question mark over the implementation of Phase II of Jaipur Metro in the PPP mode.

2.4.5 PASSENGER FACILITIES AT JAIPUR METRO RAIL STATIONS

The underground and elevated stations offer a range of facilities for the passengers using Jaipur Metro Rail services. The stations are equipped with escalators and ramp facilities, shopping areas and recreation spaces. Passengers can access the stations using feeder bus services. Each station also offers parking facilities for the commuters.

2.4.6 ROLLING STOCK FOR JAIPUR METRO

Bharat Earth Movers Limited (BEML) was awarded an INR3.18bn ($57m) contract in December 2011 to deliver ten four-car train-sets for the Phase 1 of Jaipur Metro. The first train-set was rolled out at BEML's factory in Bangalore in April 2013. It is the first indigenously designed and manufactured electric multiple unit by an Indian company.

The electric multiple units of BEML are offered in two configurations including driving trailer (DT) car and motor (M) car. A four car train composition includes two DT cars and two M cars. The DT car can carry 361 passengers, while an M car can accommodate 392 personnel. Each train, using the supply voltage of 25kV AC Single Phase 50Hz, can run at a maximum operating speed of 80km/h.

2.4.7 CONTRACTORS INVOLVED WITH JAIPUR METRO RAIL PROJECT

DMRC issued a request for quotation (RFQ) to shortlist the companies for PPP mode in March 2011. Four consortiums including Gammon Infrastructures – Irridium, Soma-I.C.F., Reliance Infrastructure, and Essar Projects-Samsung C.N.T were selected in January 2012 for participation in the request for proposal (RFP) process.

"Jaipur Metro will become one of the largest metro rail systems in India when fully operational by 2017." Alstom was awarded a contract by DMRC in April 2012, to supply Urbalis train control system to EW-A section of the new Jaipur metro Phase I. Alstom is responsible for the design, production, installation, testing and commissioning of entire train control, traffic management and signalling systems under the contract. Urbalis is an automated train operation and traffic management system allowing safe and energy-efficient train services on the metro rail network.

Thales received a contract from DMRC in April 2013, to supply an advanced passenger information system for the Jaipur Metro. The Thales passenger information system can be integrated with the traffic management system and will deliver accurate visual and audio information to passengers.

2.4.8 EXPANSION PLANNING OF JAIPUR METRO ROUTES

While the ruling party BJP continues to sit over the Jaipur Metro Phase-II project for over four years, 67% residents of Jaipur have shown interest to shift to Metro Transport if corridor is constructed on Tonk Road. With the city having 470 cars per thousand people, the need for Metro train on this route is increasing. This was revealed in a report submitted by a French Company EGIS Rail SA hired by Jaipur Metro Rail Corporation (JMRC) to revise its existing detailed project report (DPR).

As vehicles have increased manifold, the roads in the city are becoming congested and the average travel speed has dropped to less than 20kmph in 2009 to 18kmph in 2018.

About 890 vehicles are added to city roads every day. In absence of efficient public transport system, thousands of office-goers and residents have switched to other means of transport, resulting in a cascading drop in public transport share in the city. The public transport share that was around 31% in 2009 has fallen to 18% in 2018.

As the city's arterial route 'Tonk Road' continues to face unprecedented traffic chaos, French firm EGIS Rail SA that recently conducted a traffic study of the city has recommend to extend the proposed Jaipur Metro Phase-II corridor by nearly 8 kilometres.

As per the new proposal, the total length of the corridor will be 31km proposed from Sitapura to Vishwakarma Industrial Area. In the existing DPR the corridor length is 23 km (Sitapura to Ambabari). However, after witnessing the increase in vehicular congestion on the route, the firm has proposed an increase in length of the corridor.

2.5 PRESENT STATUS OF JAIPUR METRO

2.5.1 STATUS OF THE PROJECT

Construction of underground Metro line from Chandpole to Badi Chaupar (Phase 1B) is under progress and work on phase II i.e. Sitapura to Ambabari will start soon.

2.5.2 FINANCIAL RESULTS

As per applicable Indian Accounting Standard, financial results of Jaipur Metro Rail Corporation Ltd. for the year 2017-18 are as shown in the below mentioned table. Heavy Operating Losses are visible in the accounts that aroused mainly due to low ridership, fixed expenses on salary and allowances, administrative expenses, depreciation etc.

Table 2.1

Financial Results (for the year ended on 31.03.18)

(Rs. in Lakhs)

Particulars	For the year ended on 31st March, 2018	For the year ended on 31st March, 2017
Revenue from Operations	1159.04	984.44
Other Income (including interest)	333.55	447.36
RTIDF Grant-in-aid	7056.75	4769.72
Deferred Capital Grant Amortized	766.83	1135.54
Total Income	**9316.19**	**7337.05**
Revenue Expenses for the year	4592.04	4505.63
Depreciation and Amortization	7328.81	7299.21
Finance Cost (Interest)	2543.70	2435.08
Total Expenses	**14464.54**	**14239.93**
Profit/(Loss) before Tax	**(5148.30)**	**(6902.88)**
Tax Expenses (Net)	20.39	2026.28
Profit/(Loss) after Tax	**(5168.75)**	**(8929.61)**

Source: 9th Annual Report, Jaipur Metro Rail Corporation Limited

2.5.3 AVERAGE DAILY RIDERSHIP AND EARNINGS

Jaipur Metro has done very well in terms of its average daily ridership during first few years of commencing its operation. In the first 39 months, i.e., upto 31st August 2018, more than 245 lakh passengers travelled in Metro with earnings of nearly Rs. 28.23 crores.

The following table shows the data pertaining to passenger ridership and earnings of Jaipur Metro during 39 months ending on August 2018.

Table 2.2

Passenger Ridership and Earning

Period	Ridership (Nos.)	Earning (Rs.)
2015-16	8245890	82885103
2016-17	7222871	79038369
2017-18	6164850	79043748
2018-19 (upto August, 2018)	2962088	37288113
First 39 months Total	**24595699**	**278255333**

Source: 9th Annual Report, Jaipur Metro Rail Corporation Limited

As the whole planned network of phase1 & 2 is completed and commissioned, it is expected that projected level of ridership and revenues would be achievable. It is envisaged that Jaipur metro would be proved as a rapid transit solution to ensure reduction in traffic congestion, better connectivity, and better services to passengers.

2.6 CONCEPTUAL FRAMEWORK OF THE STUDY

Transport plays an essential role in catering to the needs of the people. Among the various modes of transport, Metro provides more facilities and comforts to the passengers within the city. The main purpose behind running Metro in a city is to provide the passengers a rapid transit solution to ensure reduction in commute time, improved connectivity, and better travel experience. The level of satisfaction of Metro passengers largely depends on the extent to which their needs and expectations are being fulfilled. It is necessary for the authorities to assess the level of satisfaction of its passengers in order to attract more number of people so that the dependence on private vehicles can be reduced. An efficient transport policy is understood as the one that not only decongests the roads but reduces the air and noise pollution, and the risk of accidents ("Urban Transport and Public Health", 2009).

Besides having many advantages to have Metro in the city, switching passengers towards Metro may seriously affect the livelihood of other means of transport in the long run. By considering these aspects, this study is an attempt to measure the level of

satisfaction of Metro users about the services offered by Jaipur Metro. Since, the overall experience of a customer with a product or a service determines customer satisfaction, the study covers various aspects pertaining to customer satisfaction and service quality of Jaipur Metro. Service Quality is the totality of features and characteristics that a product or service possesses to satisfy stated and implied expectations and needs of customers.

In this study, an attempt has been made to judge the overall satisfaction that customers are deriving from using Metro by considering all the components of its Marketing Mix. Since service marketing mix consists of 7Ps, including, product, price, place, promotion, people, physical evidences and process, a user survey based on these attributes of Metro may help to explore the satisfaction level of its users. Further, in order to assess the impact of Metro on other means of transport, an assessment of their present status by contacting them directly can strengthen the outcome of the study. It includes a pre-post analysis of factors that have affected their livelihood, including, trips taken by them, time taken to run a trip, their daily earnings, and demand for para-transport in Metro Corridor etc.

Knowledge and understanding these factors would certainly help to fulfil the purpose of the study. The outcomes may also attract the attention of Metro authorities and operators towards improving the passenger experience. It is necessary to enhance user satisfaction through improving the public transport system in Jaipur, in order to reduce the use of private vehicles in the future and to make the city decongested.

REFERENCES

- 9th Annual Report (2017-18). Jaipur Metro Rail Corporation Limited

- Delhi Metro Rail Corporation Ltd., 2003a. History of the Delhi Metro, http://www.delhimetrorail.com/home/history.htm

- Detailed Project Report (2012). Jaipur Metro Phase I- Mansarovar to Badi Chaupar, Delhi Metro rail Corporation, Delhi, 1

- Environmental Assessment Report (2013). India: Jaipur Metro Rail Project, Phase I-B, Jaipur Metro Rail Corporation, Jaipur,88-90

- https://en.wikipedia.org/wiki/Urban_rail_transit_in_India

- https://www.uitp.org/sites/default/files/cck-focus-papers-files/Statistics%20Brief%20-%20World%20metro%20figures%202018V4_WEB.pdf

- Kuma, A. (2013). Project Report on Jaipur Metro. Indian Railway Institute of Transportation Management, Lucknow, U.P,5-8

- Sreedharan E. (2003). Need for Urban Mass Transport System for Our Cities. Press Information Bureau, Government of India, New Delhi, India

- www.jaipurmetrorail.in

CHAPTER 3

REVIEW OF LITERATURE

CHAPTER III

REVIEW OF LITERATURE

3.1 INTRODUCTION

An effective research cannot be accomplished without studying available literature pertaining to the study. In order to gather the existing literature in the area of the present study, an extensive search was done. Previously published studies on growth and development of railway transportation services particularly Metro services in India and abroad have been comprehensively studied in this chapter. It facilitated to develop a theoretical background for the study. Moreover, it brought clarity and more focus on the research problem. It further helped in identifying the research gap. The literature review has been classified into two parts:

3.2 STUDIES UNDERTAKEN ABROAD

Zhang Ning (1996) in his article titled, "Railway Service Close to People's Lives" has pointed out the Railway service in Japan is very close to people's lives. In addition to providing safe, timely and speedy transportation, railways offer communities quick accessibility to shopping, entertainment, information, cultural activities and community services. This undoubtedly increases the competitiveness of rail to roads.

Jonathan Cowie and Geoff Reddington (1996) conducted a research study on "Measuring efficiency of European railways". The study examines the methods of assessing rail efficiency. The results suggest that the Danish railway is particularly efficient whereas the British system is one of the less efficient. The final conclusion is that efficiency on the railway is a product primarily of good management.

Glines de Rus, Vicente Inglada (1997) undertook a study on "Cost-benefit analysis of the high-speed train (HST) in Spain". In this study, an ex-post cost-benefit analysis was carries out. The first high-speed link in Spain was launched in April 1992, with the high success according to occupancy rates and public opinion of its quality, safety, and impact on regional development. The main benefit obtained from HST are time savings

obtained when users shift from slower transport modes and total gains from namely generated traffic. The study revealed that, in order to estimate the demand increase, it has been assumed the GDP grows at a 2.5 per year during the lifetime of the project. Estimated benefits have been tested with a sensitivity analysis extending the life span of the GDP growth rate to 3%, using shadow prices for labour and increasing generalized costs of train, car and bus in a 25% to allow for differences in quality. The study also revealed that the introduction of HST in Spain was not justified in economics terms in 1987 in the chosen corridor.

Luisa Affuso, Jullien Masson and David Newbery (2000) conducted a study on "Comparing investments on new transport infrastructure Roads vs. Railways". This paper contributes to the debate on investment in transport infrastructure and the allocation of public funds for road and railway projects. By using consistent social cost-benefit methodology to appraise investment in typical new inter urban road and rail projects. From the research they suggest that road improvements have substantially higher returns than railway schemes, these findings cast doubt on the rationale of the new transport policy for the UK which proposes to allocate more public funds to the (private) railways than total new investment in strategic roads.

Pedro Cantos Sanchez (2000) conducted a study titled "A sub additivity test for the cost function of the principal European Railways". The objective of the study was the comparison of the efficiency levels for a set of European rail companies in monopoly situations with respect to hypothetical duopoly situation and to test whether the operating costs function of such companies is sub additive. The study revealed that at least for the companies of a greater size, an efficiency increase would be obtained from the separation of current companies in two different companies of a lower size. Besides, these efficiency gains are greater when the two new companies specialize their production either; on passenger or on freight traffic. The study also revealed that the separated supply of passengers and freight transportation by different firms, at least for the European biggest companies would prove significant increases in the efficiency levels of rail industry. The results seem to confirm that the current trend in the European rail policy based on the separation of the different rail services must be favoured.

Jon Shaw (2001) made a study on "Competition in the UK passenger railway industry: Prospects and Problems". The purpose of the study was to examine the promotion of

competition in the passenger rail industry. Although there is little on-rail competition at present, the relaxation of regulatory and operational restrictions over the coming five years will present a number of new opportunities for market liberalization. Significantly, the regulator and franchising director have recently relaxed the two mechanisms used to limit inter Train Operating Companies (TCO) rivalry, 'moderation of competition' (MOC) and 'compulsory intervailability' (CI). In terms of competition for the market some commentators have argued that rail is very much in the ascendancy with unprecedented levels of growth expected. Such growth would impact very positively upon the outcome of future franchising rounds, the study revealed that, while on-rail completion has led to service innovations on certain lines, most improvements since privatization have had little to do with direct inter-TOC rivalry; rail tracks' station regeneration programme, rolling stock replacement and or refurbishment schemes and increases in train frequencies were all enacted during stage one of moderation of companies.

Koichi Goto (2001) in his article, "Passenger Service Technologies" has described the trends in seat reservation systems, automatic ticket machines in stations, automatic fare collection systems, automatic ticket checking machines, revolutionizing ticket systems using contact less IC cards and a guide system for visually impaired people is currently being developed. With this system IC chips programmed with location information are embedded in tactile used to mark paths for visually impaired people; this is read by a pocket-sized portable machine. The machine will guide him or her to the right platform by voice machines.

Freling, Lentink and Wagelmans (2001) analyzed in their study about "Decision Support System for crew planning in passenger transportation using a flexible branch-and price algorithm" a decision support system for airline and railway crew planning. The system is a state-of-the-art branch-and-price solver that is used for crew scheduling is crew planning for one or a few days that results in crew duties or pairings and crew rostering is crew planning for at least one week for individual crew members. the study revealed that the comparison with the integrated scheduling and rostering, that the way duties are built can have a huge impact on the quality of the rosters at the cost of a huge increase in computing time.

Hadi Baaj (2002) undertook a study on "Restructuring the Lebanese Railway and Public Transport Authority (RPTA) from losing operator to effective regulator". The purpose of the study was to develop options for the restructuring of the RPTA including the corporations of its bus operations. The study revealed that the restructuring of the RPTA to became planner and regulator of the sector, the regulatory plan allocating the private sector service providers into service areas by concession service via competitive tendering and the corporation of the RPTA's bus operations.

Michiel Vromans, Rommert Dekkar and Jeo Kroon (2003) made a study on "Reliability and Heterogeneity of Railway Services in Netherlands". The purpose of the study was to examine reliability in public railway system. Reliability is one of the key factors in transportation both for passengers and for cargo. Reliability of railway services is a complex matter, since there are many causes for disruption and at least as many causes for delays to spread around in spare and time. One way to increase the reliability is to reduce the propagation of delays due to the interdependencies between trains. In this study, the Sum of Shortest Headway Reciprocals (SSHR) and Sum of Arrival Headway Reciprocals (SAHR) were described. These measures are used for evaluating the heterogeneity of the time table and for predication of the reliability. The study revealed that the heterogeneity resulting from the line plan and the time table has a negative influence on the punctuality and the reliability of a railway system. In other words, when the SSHR and SAHR show large decreases, then there are usually also large decreases in delay propagation. Therefore, a relatively simple rule of thumb for timetable design is to minimize the SSHR and SAHR. This may improve the reliability of the offered services.

Kiyohoto Utsunomiya (2004) analyzed about "CPI quality adjustments and productivity growth: Railway services in Japan". The purpose of the study was to estimate CPI (Consumer Price Index) railway fares, taking into account the improvement in the services provided by the railway industry; it also measures the real productivity growth of the railway industry in Japan. The study revealed that the improvements in the quality of the product offered by railway service companies suggested that there may be a significant degree of upward bias in the current CPI. This will lead to improve the measurement of price indices and productivity in service sectors. Although the analysis in this study was limited to railways, the approach shown in this study could be applicable to other transport modes.

Jain Beko (2004) undertook a study on "Some Evidence on Elasticity of Demand for Services of Public Railway Passenger Transportation in Slovenia". The objective of this study was to present estimates of responsiveness of demand for service of railway passenger transportation with respect to chosen price and income elements using Slovenian data. Previous work on Slovenian railway transport has focused on analyzing management, infrastructure re-organization and ownership transformation to speed up Slovenia's integration into the European transport system and on methods of sales promotion. In estimating the demand functions for services of public railway passenger transportation within the country, the authors usually include five groups of explanatory variables, which can be divided into two classes. The first class comprises of the variables with which we are trying to capture socio-economic factors. It is possible to distinguish among four groups of variables and price variables, income variables, seasonal factors and other socio-economic factors. In the second class we place the group of variables that express qualitative components of the demand factors like frequency of arrivals and departures, saved travelling time in comparison, with alternative mode of travel and quality of services supplementing basic service. When analyzing passenger railway transportation, it is reasonable to expect seasonal influences. Simple graphical analysis of time dynamics of the number of transported passengers showed that the number substantially declines in the summer months of June, July, and August or in the second and third quarters. This study revealed that taking into account the estimates of demand functions for services of railway passenger transportation in Slovenia. In the case of increased average rail fares the number of passengers transported by rail decreases percentage terms by less than the fare increases in percentage terms. This findings suggested that increasing fares are likely to allow lower transportation subsidy and consequently also a reduction in financial supports from the state-budget to the railway sector.

Bard Cole and Christine Cooper (2005) analyzed about "Making the Trains run on time: the Tyranny of Performance Indicators". The purpose of the study was to analyze the uses of performance indicators in the newly privatized British rail industry and to consider whether the information that these indicators transmit to the public gives a realistic impression of the quality of service provided to rail users. The study revealed that reliability and punctuality are the main concerns of rail users; the department for transport (DIT) concentrates on these issues, setting the train operating companies'

targets which reflect one part of state's role in maintaining the overall condition for capital accumulation; that is in any capitalist system. The DIT also produces performance indicators which relate to safety. The study also revealed that these indicators cast into darkness other safety issues which are of great concern to the public; track maintenance, increasing of crime levels at the unmanned station and phasing out and deskilling of train crew staff in SPAD (Signal Passed at Danger). This performance indicator does little to gain the trust of rail users.

Erhan Kozan and Robert Burdett (2005) conducted a study titled "A Railway capacity Determination Model and Rail Access Charging Methodologies". The purpose of the study was concerned with the determination of capacity levels of railway lines. The study revealed that sectional running time (SRT) has a major effect on any analysis of capacity because a small increase or decrease in this value can affect the level of capacity significantly. The percentage of total traffic that consists of each train and the percentage of travel in each direction are included in the SRT calculation because the capacity of a corridor is different for every distinct proportional and directional distribution. The acceleration and deceleration protocols of trains entering or leaving a section also influence the SRT. If the maximum allowable velocity of the next section is higher than the limit of the current section then trains change speed after entering the new section; otherwise, trains change speed prior to entering a new section.

Dennis Huisman, Leo Kroon, Ramon Lentink and Michiel Vromans (2005) studied about "Operations Research in passenger railway transportation in Netherlands Railways. The purpose of the study was to analyze the models and techniques used in railway transportation by passenger operators. In this study, the global planning problems occurring at the strategic, tactical, operational and short term planning level were discussed. The study revealed that in the coming years there will be less focus on the classical problems and more focus on some promising fields like reliability of timetables. In the rest of the operation research (OR) world, there will be research on real-time control. A combination of these two could significantly improve the performance of the railway operators and can lead to a successful third century of railway transport.

Lena Wins Lott Hiselius (2005) made a study on using choice experiments to assess people's preferences for railway transports of hazardous materials. This study

investigated whether the choice experiment (CE) approach can be used to assess people's preferences and the determinants of these preferences in order to estimate the costs and benefits of different configurations of the transport of hazardous materials by rail. The transport of hazardous materials is an economic activity of concern to society. In decisions concerning transports there is an interest in the value of a marginal change in the risk of an accident, and this value may be obtained by studying individuals' preference towards changes in accident risk. The main purpose of this study was to investigate the potential of CE for modelling preferences for changes in the exposure to hazmat transported by rail in order to assess the costs and benefits of different transport configurations. To the best knowledge of the author, this is the first time a CE study, using exposure as a proxy for probabilities and accident out-comes, has been carried out. Due to the novelty of the activity studied, special attention is given to the viability of the approach. The multi nominal logic model [MNL] is frequently used to estimate the utility function. Violations of the HA hypothesis are often observed, resulting in the need for more complex statistical models. This study suggested that the CE approach can be used to estimate people's preferences for different configurations of transport of hazmat by rail despite the complexity in the activity studied and in the CE method seems applicable even in this kind of setting with numerous difficulties. Furthermore, the analysis revealed that the CE approach may provide a rich description of people's preferences and the determinants of their preferences.

Marc Ivaldi and Catherine Vibes (2005) made a study about the "Intermodel and Intramodel Competition in Passenger Rail Transport" competition. The objective of this study was to analyze inter and intramodel competition in the transport industry. This model allowed evaluating the effects of both structured and regulatory changes on a particular market, to measure the impacts of either entry by a new rail operator or a change in the regulatory framework with the introduction of a kerosene tax and to measure the effectiveness of competition on a relevant market or to design marketing strategies. Three main passenger travel modes are available on this link: rail, road and air. Consumers choose a mode and an operator to travel on a given city-pair and firms decide on service quality and prices. The study considered three standard dimensions of transport service quality: speed, frequency and capacity. The study revealed that leisure passengers are more attracted to train or car services than to airlines. The increase in airlines costs induces an increase in their prices by nearly 10%. Expecting these higher

prices the railway company anticipates a gain in traffic and increases its fares by a small amount to make more profit. The study also revealed that the effectiveness of competition on a particular market of transport services, need to account for all potential travellers, all modes and all firms and a small number of competitors is enough to create a high degree of the impacts of HST (High Speed Train) services.

Moshe Givoni (2006) analyzed the development and impact of the modern high speed train. The purpose of the study was to analyze on the link cologue Berlin in Germany. The main technical challenges in the development of commercial HSTs were to develop a train and track that could maintain stability and the comfort of passengers, maintain the ability to stop safely, avoid a sharp increase in operating cost and maintenance costs and avoid an increase in noise and vibration to areas adjacent to the line. The study revealed that the modern HST is best designed to substitute conventional railway services on routes where much higher capacity is required and to reduce travel time, further improving rail service also against other modes, therefore leading to mode substitution. However the high investment in HST infrastructure could not be justified based on its economic development benefits since these are not certain. Finally, the following definition for HST services was suggested high capacity and frequency railway services achieving an average speed of over 200kmph.

Akiko Sakanishi (2006) attempted a study on commuting patterns in the Osaka Metropolitan area of commuter rail passengers. The purpose of the study was to analyze the factors responsible for the decline in demand for rail service by analyzing the changes in population and analyzing the spatial distribution of rail commuters, to analyze the change in the number of commuters with respect to travel time to the Central Business Districts (CBD) and to analyze the cause of this sharp decline linked with the urban spatial structure and also to analyze the implications of the transportation policy and land-use planning the metropolitan area geared towards predicted future population shrinkage. Geographical Information System (GIS) has been widely used for urban transportation planning. GIS provides transportation planners, policy makers and researchers with new platforms for analysis and visualization. The decline in the number of rail commuters can be primarily attributed to the decreasing proportion of rail use for commuting due to the decentralization of jobs and partially attributed to the low employment growth rate during the period of the economic slump, and to net out-

migration. Modes of transport are categorised as walking, use of rail, bus, private car, motor cycle, and bicycle. Commuting time to the CBDs is calculated as travel time by rail from a station in the suburbs to the terminal stations in the CBDs. Commuting time includes the transform time and is computed for morning commuter. The study revealed that the estimation of age-specific net migration indicates that net out-migration took place in the ranges below a commuting time of 30 minutes, which partially accounts for a decline in the number of commuters. The analysis indicates that, overall, low fertility rates scarcely had any negative effects on the working age population between 1990 and 2000.

Karst Geirs, Rinus Haaijer and Bert Van Wee (2006) analyzed in their study the option value of public transport methodology and measurement for regional rail links in the Netherlands. This study has three objectives. First it provides a definition and classification of economic-benefit categories for public transport services and a review of existing applications of the option value of public transport services. Second, a survey instrument was developed that included stated choice experiments to elicit the willingness-to-pay (WTP) values for public transport of different qualities. Third, it applies the methodology in case studies to derive a first of WTP estimates for the option case of public transport services in the Netherlands. Public transport serves a number of public interests associated with the actual use of the services. The study revealed that most train users were infrequent travellers about 70% used the train less than once per month only 7% were frequent users, with a frequency of four to five times per week, about 25% of the train users in the past year. The frequency of option use was relatively low; about 45% used the train once or twice per year as option user 30% three to five times; 10% six to ten times, and 15% more than 11 times. Furthermore, more than 75% of car users in the sample are “Possible option users’, they consider using the rail services in unexpected situations when their car is not available. The study also revealed that option values may form a potentially relevant benefit category in public transport policy appraisal, additional to the use and non-use benefit categories typically included.

Leo kroon, Ramon Lentink and Alexandar Schrijver (2006) in their study analyzed the shunting of passenger train units in Netherlands railways. A model for the train units shunting problem was described in this study. The mode incorporates complicating details from practice, such as trains composed of several train units and tracks that can

be approached from two sides. Computational results are presented for the real –life cases of NS reizigers, the main Dutch passenger railway operator is typically operating the timetable or it is in maintenance. However, outside the rush hours and operator usually has a surplus of rolling stock. In order to able to fully exploit the main railway infrastructure, the idle rolling stock is parked at a shunt yard. Since only a few passenger night services exist in the Netherlands, most rolling stock has to be parked during the night. The study provides a model for solving this shunting problem for general shunt track configuration, where train may consists of several units. The study revealed that the model is able to produce high quality solutions usually under reasonable amounts of computation time.

Rainald Borck and Matthias Wrede (2007) in their study analyzed the commuting subsidies with two transport modes. The purpose of the study was to analyze the redistributive effect of commuting subsidies in a monocentric city with two income groups and two transport modes. City residents choose where to live and to use which transport mode. The study revealed that with resident landownership, subsidies always redistribute between city resident and therefore one group gains and other losses. With absentee landownership city residents as a group generally benefit from commuting subsidies at the expenses of landowners. When the poor live in the city center and use public transport while the rich live in the suburbs and use cars and subsidies to public transport benefit the poor, while the rich may benefit from the subsidies to cars. The study also revealed that with the three distinct areas, where the rich use public transport in the centre and cars in the suburbs, while the poor live between those groups and use public transport.

Jamie Dallen (2007) made an attempt in his study about sustainable transport, market segmentation and tourism in the Looe Valley branch line railway, Cornwall, UK. The objectives of the research were to increase passenger volume, freight usage and income to manage down the units of running the lines, and to involve the local community more closely in the development of its railway. The study discussed the implications of this survey finding for attracting more people to use the looe valley line. This study applies cluster analysis to LVL users in order to develop a greater understanding of travel attitudes. This will enable a more in-depth knowledge of the types of travellers using the line, as well as allowing a greater understanding of how service improvements could be

targeted to develop particular market segment. The analysis should also contribute to the development of more customer focused marketing strategies that can potentially be used to increase usage of the branch line. This research finding highlighted the complex mix of attitudes and desires of users across LVL users profile and although the findings are only representative of a one-week profile of train users during July, they serve to highlight the complexity of attitudes amongst users. They show the differences between types of tourist and recreational users in terms of attitudes, perception and visitor activities, and that user profiles are clearly more complex than a dichotomous division of local and tourist users. This research provided a first stage towards building a more detailed understanding of branch line railway passenger markets. This study also considered the diverse market segments with in a sample of current users and commented on how segments might be more effectively targeted through particular marketing and management decisions.

Jaspe Dekkers and Piet Rietveld (2007), in their study evaluate the "Electronic Ticketing in Public Transport in Netherlands". The purpose of the study was to describe the innovative aspects and customer expectations of the services offered in electronic ticketing in public transport. The Nodded Mobile ticketing services (M-Ticketing) is an example of electronic ticketing in the Netherlands. People can book M-Tickets through the internet or by calling a voice response system and receive their M-ticket on their mobile phone through the Short Message Service (SMS). The study revealed that the consumers were satisfied with the service of M-tickets. The users found the M-ticket services very convenient and easy to use; no more queuing and waiting of the participants, 68% stated they should stop using the M-ticket service if it cost 25 eurocents per call. The share using the internet as a means to order electronic tickets was about 30%. Thus, the overall WTP (Willingness Top Pay) of customers for M-ticket services must be considered as low. An ordinary least squares regression analysis of the WTP for real-time travel information revealed that it increases with income and with the frequency of mobile phone use. The WTP also depends on travel behaviour and the complexity of the journey.

3.3 STUDIES CONDUCTED IN INDIA

3.3.1 STUDIES ON INDIAN RAILWAYS

Promila Sharma and Harpreet Duggal (1989), in their article titled, "Grievance Redressal in Indian Railways" reported that most of the passengers were dissatisfied with the railway service on different grounds namely catering, cleanliness and enquiry service. Most of the complainants did not use the redressal service provided by the Railway department because they did not expect any effective measures from Railways.

Nalini Devi (1996) in her study titled "A Study of Personal Management Practices in South Central Railway (SCR) and the Perceived Effectiveness of Its Operations by the Passengers" revealed that both the categories of employees have regular meetings with their subordinates, which is important to improve the performance of the subordinates. The regularity of the superiors meeting the subordinates depends on span of control. It is observed that the span of control is sufficient as expressed by majority of the employees. The recent observation that the expenditure incurred by SCR has increased from the year of inception to terminal year drastically indicates that SCR is becoming more quality conscious and seeks to provide comfort and security to its passengers.

Bansal and Sharma (1997) analysed in their study titled "Study on some observations on the catering services in the Indian Railways" about the catering services in the Indian Railways, the objective of this study was to observe and analyse the catering service of the dining cars and to correlate it to the hazards that may accrue with consumption of contaminated food. The study revealed that the infrastructure of the railway dining cars, the hygienic practices observed by the food handled and the entire catering process from storage of unsatisfactory and fraught with health hazards. Almost all the model regulations for food safety had been flouted. The study also revealed that there is no detailed 'modus operandi' for the monitoring and surveillance of the catering operations of the dining cars, which were potentially conducive to the transmission of food-borne infections.

Fareed, Karim and Chandrasekhar analyzed in their study about "Characteristics of non-bulk commodity transport and shipper's Perception – A model share prospective". Freight transportation becomes imminent because the production and consumption

centres are spatially separated. At present, it is found that railways are catering for the domestic freight in any country with marginal share by other modes. In India, Road and Rail are the main modes for commodity movement with marginal shares by sea and air. It is generally observed that railways are suitable for moving bulk traffic while roadways are preferred for high valued packages for short and medium distances. Only small percentage of the freight carried by the railway is non-bulk commodities. The non-bulk commodities which are small percentage generally consist of small weight shipments and parcel services of individual shippers, these shippers have the mode of choice between the roadways and railways and hence they are considered for modelling. Bulk or non-bulk commodities moved through transport companies constitute the road share. These transport companies carry bulk commodities as per contracts and tenders from big industries and companies on yearly basis. These industries and companies ship their commodities only through these transport companies, and hence have no other mode as choice. The study revealed that 75% of the shippers are road shippers and remaining 25% are rail shippers. It also revealed that the total number of shipment km of both the modes are almost same, even though road mode caters to more number of shipments and the average length haul for rail is 820km and for road 375km. The study also revealed that road shippers give transit time, reliability of schedules, availability of capacity, frequency of service, and freight rate, more weights than rail shippers.

Ramamoorthy & Ponnuraj (2001) in their study aim at "Passenger perception of Omnibus services –An analysis". The study indicates that an efficient transport system is essential for the movement of both goods and passengers. The omnibuses are however a refreshing contrasts to the government-owned buses. The omnibus operators constantly endeavour to improve the quality of their services. They aim at passenger comforts and keep their buses clean and well-maintained. Breakdowns are very rare in their operations. Above all they are time-conscious. Though they charge higher fare, the public patronize them as their service is much better than the ones provided by the state owned buses. In this direction, the prescribed criteria with some of the proven methods of analysis are brought forward through this article.

Jeganathan (2002) in his study, "Commuters of Railways-An Attitude Study with Special Reference to Thirunelveli- Nagercoil Section" has found that if season ticket fares are reduced for long distance travel, it will be an added attraction to the commuters.

Rama Prasad (2002) in his article, "A Study on Passenger Amenities in Railways" has found that more general compartments will be required for short distance travellers and it has been found that most of the passengers are not happy particularly with the quality of food. Quality of food should be improved and variety of items should be introduced.

Makesh (2002) conducted a study on "A study on Job satisfaction of employees of Indian Railways: The case study of Southern Railway with particular reference to the front line staff". The objectives of the study were to measure the level of job satisfaction of employees of Indian Railways and to study the working conditions in the Southern Railways. He suggested the following: As promotion chances are very remote in Railways, periodic promotion should be given to the staff to make them evince interest in their jobs. The participation of more employees must be encouraged while making decisions. Relationship between officers and employees in lower cadre must be smooth and harmonious. Performance be recognized and appreciated with good incentives. installation of equipments of the latest technology in enquiry counters like overhead microphone to answer on-line queries should be done; works like chart enquiry, phone enquiry, personal enquiry, manning of gate should be divided among the staff. Canteen facilities should be improved; Crèches must be in operation for the women staff to enable them to leave their babies while working. Grievance cell should be opened to redress the grievance of the employees. Union activities should be regulated.

Pucher John and Korattysawaropam Nisha (2004), "The Crisis of Public Transport in India: overwhelming needs but limited resources". The authors in their paper find that the rapid growth of India's urban population has put enormous strains on all transport systems service.

Public transport, in particular, has been completely overwhelmed. Most bus and train services are overcrowded, undependable, slow, inconvenient, uncoordinated and dangerous. Moreover, the public over ship and the operation of the most public transport services has greatly reduced productivity service. Unfortunately, meager government

financial assistance and the complete lack of any supportive policies, such as traffic priority for buses, place public transport are in an almost impossible situation.

Sarkar P.K., Bose Saikal and Ghosh Pritha (2004) opines in "A Critical Appraisal of Traffic & Transportation Sector in Delhi and Possible Solutions". The authors jointly said that Delhi is the fast growing city, which over the years has undergone landmark change in the characteristic of its transportation sector. The city with the largest number of registered vehicles in the country has well developed road, rail and air network, which provide it with high connectivity, not only within the city but also with various important centres, both within and outside the country. Despite this, the city's transport system is under tremendous pressure for augmentation of its capacity and improvement in its overall structure and functioning. This Paper attempts to appreciate the problems the critical issues in the traffic and transportation sector of the city. Further it attempts at proposing solution to improve and manage the system in the coming years. This paper highlights the role of new systems like MRTS, especially in light of the high energy demands created by the existing transport system and the expected demand for alternate system for the upcoming "Common Wealth Games".

John Gabriel and Suresh Babu (2005) undertook a study about "passenger reservation system in the Indian railways". The objectives of the study were to determine the efficiency of passenger reservation services in the Indian railways system and to examine whether the existing system of railway reservation is really efficient in satisfying the needs of the travelling public, and whether any change or alteration in the existing system could bring about a perceptible improvement of the services. The study revealed that railways are setting up the computerized reservation centres and have authorized out-agency bookings and hence all these facilities reveal the efficiency of reservation services of the railways and the study also revealed that the railways is the only organization providing maximum passenger reservation services to the travelling public most efficiently and effectively.

Sumathy (2005) in her project titled" history of Southern Railways", has pointed out that South India is noted for the large number of important Hindu festivals. Not less than 175 festivals are held annually at southern part of India. Special trains were operated during festival time. Temporary waiting halls, latrines etc., were provided at Kumbakonam and seventeen other stations on festival occasions. Special arrangements were made at

Kumbakonam in 1933. Six sheds each containing a booking office were provided for pilgrim passengers. Each shed was for a group of stations and special timetables were drawn out and issued well in time. About 46,000 passengers were transported.

Vijay Durga Prasad (2005) conducted research under the title, "A study of Passenger amenities in Indian Railways with reference to Vijayawada Division". In his research various amenities provided by Indian railways at stations and on board are analysed. He suggested the measures and strategies that would go a long way for improvement of passenger amenities in Vijayawada Division in particular and Indian railways in general are, the authorities have to take suitable steps to enhance the quality of fast food items sold in the pantry car and at refreshment stalls on platforms; the design of the iron shutters of the window should be modified. Strong mesh-type window shutters with bigger holes or shutters with a provision to see through the window without opening should be provided; fire extinguishers must be provided in each compartment and coach attendant and TTEs have to be trained to use them; Public Address System can be provided in all express trains, the same should be used for playing music for entertainment on board

Mathur (2005) had made a study on "Human resource management in Indian railways – A study of recruitment, training and motivation". In his study men, machines, materials and money are the most important factors essential for the development and growth of industries. Of these the human factor or man stands foremost and constitutes the basis for successful working of any undertaking. The overwhelming significance of this factor is due to its unique characteristics. First, man alone can produce through motivated creativity an output greater than the sum of his inputs. Second, this resource is animate, active and living. Third, human resource is most complex and unpredictable in its behaviour. Fourth, each individual has his or her own distinct background. Finally, it is only this resource which appreciates in value with the passage of time. So the Indian railway has set up a separate department for human resource to advise, guide, and serve in matters connected with human resource management.

Sudip Roy and Datta (2005) undertook a case study on "Ranking of public transport modes according to the characteristics of abstract nature in Kolkata", and discussed that the identification of model attributes is a complicated task as most of them are interrelated to each other. In the present study seven model attributes are chosen viz,

fare, and travel speed, waiting time, comfort, reliability, availability and safety feeling. All the attributes assumed here are of abstract in nature and have their numerical values in ordinal scale and are to be determined through users' assessments. The study revealed that respectively and with regards to travel speed attribute the special bus has been ranked as the most satisfying mode. The study also revealed that the waiting time for ordinary buses has been considered to be the minimum and that auto-rickshaw being third in position and the reliability of a transit mode depends upon the degree of deviation of actual journey time from schedule time.

Srivastava, Sharat S Mathur and Thompson SH Teo aimed to give "Modernization of Passenger Reservation System: Indian Railways' dilemma". This teaching case discusses the challenges being faced by the technology managers at Indian railways in the current scenario of a resurgent national economy coupled with increasing customer expectations. In the face of growing competition from road and low cost airlines, to retain its customers, IR has responded by changing its business rules. The current scenario needs to change the programming logic of PRS has been making maintenance together for CRIS officials, they have realized that PRS is a time-tested, proven, and reliable technology and they would be happy to replace the old PRS with a new state-of-art system that would provide them greater maintenance flexibility, the repercussions associated with possible failure of the new system are far too serious.

Mudit Kulsreshtha and Barnali Nag (2005) has presented a paper on "Structure and dynamics of non-suburban passenger travel demand in Indian railway" to Kulwer Academic Publishers, Netherlands. In this paper they derived that long run structural relationships for all the three classes, viz,. upper, second and ordinary second class, of nonsuburban long distance passenger transport demand for Indian Railways using annual time series data for 1970-1995. The demand systems are found to be stable for all the classes in the long run and they converge to equilibrium in a period. Any disequilibrium in the long-run with adjustments in passenger transport demand and the price variable, i.e. real rate charged per passenger kilometer. Results show that travel demand in all classes would rise with income, although the rise is less than proportionate in the case of ordinary class. High price elasticity in long-run and short-run impulse responses indicate that passenger fare hike could lead to substantial decline in travel demand leading to decline in revenue earnings of the railways.

Chinmoy Kumar (2006) undertook a study titled "Indian Railways-IT Innovations in passenger services". The purpose of the study was to provide an insight into the various cost saving innovations that were adopted by the Indian Railways in improving and advancing their passengers' services. The progressive implementation of information technology served as a thrust towards better responsiveness to the raising passenger demands. The study revealed that the on-line reservation system was launched in August 2002 under the aegis of IRCTC (Indian Railway Catering and Tourism Corporation). The on-line reservation system was an extension of the passenger reservation system (PRS) and served as an interface between the uses and the passenger reservation system. Another innovations of the Indian Railways were integrated voice response system (IVRS) unreserved ticketing system, National train enquiry system (NTES), tele-booking services and wireless services. The study revealed that the cost of maintenance and expansion of the railway infrastructure was enormous. The study also revealed that the progressive implementation served as a thrust towards better responsiveness to the rising passenger demands.

Madhavaiah and Durga Rao (2007) undertook a comparative study of service Quality perceptions in public sector transport corporations. The objectives of the study were to examine customer perceptions of services provided by public sector road transport corporations of two south Indian states and to assess the effectiveness of existing measures of service quality in predicting customer satisfaction and intention to re-patronize the services. The analysis dealt with how well the service perception (SERVPERF) measures exhibited reliability when used in passenger road transport services of Andhra Pradesh passengers and Tamilnadu. The study revealed the Andhra Pradesh passengers are generally more satisfied with their public sector road transport service than Tamilnadu customers on most of the SERPERF dimension. Tamilnadu passengers are generally more satisfied with "knowing when the buses arrive and depart" as well as the information provided by the transport corporation at the bus stop, whereas Andhra Pradesh respondents were generally satisfied with their transport corporation's frequency of service, cleanliness of the bus interior and safety at bus stops. The results indicated that Andhra Pradesh customers think of service reliability and ease of using the service as the key factors determining the passenger road transport service quality. The study pointed out several key variables that determine customer intention to repatronize the transport corporations. Those variables are reliability and empathy for

Andhra Pradesh passengers and reliability of Tamil Nadu passengers. The results of this study suggest implementing service standardization across different states can be risky while operating inter-state services.

Raja (2007) analyzed an empirical study about "Consumer Image of Indian Railways-An Empirical Analysis", the objectives of this study were to study the general image of the Indian railways and to study the specific image of the Indian railways related to the services before travel, services during the travel and services after the travel. The study revealed that regarding general performance of the Indian railways, out of 200 respondents, 83 have expressed a positive attitude, 17 per cent remained neutral and none has recorded a negative attitude and as regards the level of satisfaction, 80 per cent have stated the level of satisfaction as 'below100 per cent', while 20 per cent have given the level as 'above 100 per cent'. As such, the Indian railways offer more than what is expected of it by the passengers. The study also revealed that out of 200 respondents, 97 per cent have expressed positive feeling that it is safe to travel by train, while 96 per cent have got positive opinion about comfortability of journey. 90 per cent have stated that it is economical to travel. Of them 78 per cent are of the opinion that there is courteous service by the employees, while 90per cent have expressed that the Indian railways has been functioning efficiently.

Vijay Durga Prasad (2007) undertook a study about "Passenger amenities of Indian Railways in Guntur division of South Central Railway". The objectives of the study were to analyze the passenger amenities provided by Indian railways at stations and on board the train in India in general and in Guntur division in particular and to analyze opinion of selected sample passengers of Guntur railway division on various amenities provided by Indian Railways and also to suggest such measures and strategies that would go a long way for improvement of passenger amenities in Guntur division in particular and Indian railways in general. The study revealed that around 48% of the respondents have poor opinion on the supply of water in trains. Some of the passenger opined that the water supply is not continuous. Some opined that water has some foul smell thereby becoming useless for utilization. A large group of respondents opined that the cleanliness of train compartments is poor. The passengers expressed that the compartments are not cleaned and maintained properly and regularly. It causes discomfort to passengers while on travel. The respondents are asked to opine on the

privatization of catering, sanitation and pantry car facilities. A considerable group of passengers opined that security arrangements have to be improved at station, on train and particularly during night times. The study also revealed that a very large group of respondents (74%) expressed that they are satisfied with the amenities provided by Indian railways.

Ghate Akshima T. (2012) wrote a paper on "Life Cycle Analysis of Transport Modes''. The author said that environmental impacts assessment exercises carried out to support decision making in transport sector do not consider the full life cycle energy and CO2 impacts of transports modes and focus on the tail pipe impacts only. It is, however, necessary that a holistic approach is adopted while analyzing the impacts of the sector. Different transport modes involve varying degrees of construction and maintenance activities; while some modes may be highly material and energy intensive, the others may be comparably low intensive. Material and energy consumption at various stages of a transport project i.e. construction, operations and maintenance needs to be examined in order to fully understand its impact on environment. Life Cycle Analyses (LCA) are typically used to assess such Holistic/fill-life impacts of various products, systems, projects, etc. ISO 14042 defines LCA as a systematic way of evaluating the environmental impacts of products or activities by following a 'cradle to grave' approach. It involves identification and quantification of material and energy consumption and emissions which affect the environment at all stages of the entire product life cycle.

3.3.2 STUDIES ON METRO RAIL

Advani and Tiwari (2005) in the paper " Evaluation of Public Transport System: Case Study of Delhi Metro" describes that the growing number of vehicular trips by cars and two wheelers which result in traffic congestion, air pollution and traffic accidents has become a major concern in urban areas. Investments in high capacity rail based mass transit systems are being promoted to arrest this trend. In the last two decades Kolkata, Chennai and Delhi have invested in MRTS: Metro Rail Transport Service systems. This paper analyses the methodology and arguments used to justify these systems. The paper presents evaluation of Delhi metro in terms of capacity, travel time and accessibility to the system and evaluation indices reflecting commuter's perspective. Metro systems have been planned to reduce congestion on the roads. However systems planned in India

show that cost overrunning and under utilization of capacity. Methodology and arguments used to justify these systems needs careful analysis. High capacity system does not necessarily generate high demand. Estimation of passenger demand for transit service should consider complete journey of commuters including access time.

Murty, Kishore Kumar Dhavala, Meenakshi Ghosh and Rashmi Singh (2006) presented a working paper on "Social costs benefit analysis of Delhi Metro". In this paper the growing demand for public transport in mega cities has serious effects on urban eco-system especially due to the increased; atmospheric pollution and changes in land use pattern. The introduction of CNG in certain vehicles and switching over of some portion of the transport demand to the metro rail has resulted in a significant reduction of atmospheric pollution in Delhi. The Delhi metro provides multiple benefits: Reduction in air pollution, Time saving to passengers, Reduction in accidents, Reduction in Traffic, Reduction in congestion and fuel savings. There are incremental benefits and costs to number of agents.

Debabrata Das, Subhash Datta and Sharfuddin (2007) conducted a study on "Importance of Metro Rail in Public Transport Network: A case study of Delhi". The researcher attempts to devise a model to map a few of the most strategic location of Delhi using the available modes of public transportation i.e. bus and metro rail, based on distance, time and cost constraints. The Floyds' algorithm determines the most optimum mode of travel between any two locations. In the research they found to avoid congestion, best possible alternative route that should be taken as metro route at peak hours, and in case of travel cost consideration, metro route has higher travelling cost in comparison to bus route. The cost minimization can be possible by reducing waiting time and restructuring the travelling cost in case of metro rail.

Sreenvas Ashok (2011) in his paper "Lessons in Urban Transport Planning and Governance: Based on the Proposed Metro Rail System in Pune". This paper critically analyzes the decision making Systems behind the proposed Pune metro rail system and its detailed project report and exposes many weaknesses in both. The decision making system is seen to be ad-hoc and not sufficiently transparent or participative. The detailed project report suffers from many serious methodological and analytical errors. This analysis and experience from other cities suggests that cities are increasingly seeking single large, big-budget solution to their urban transport problems without exploring the

many simpler, cheaper and more effective options that are available. DPR prepared by DMRC for Pune has many serious analytical and methodological flaws, making the proposal highly questionable. Therefore, there is an urgent need to revisit all proposed metro rail projects and critically review them. An independent expert group should conduct the review based on clear, objective criteria and examine all aspect such as their justification, governance, accountability, viability and integration with other modes, and the review findings should be publicly debated.

Bag & Sen (2012) revealed in their study on "Kolkata Metro Railway and Customer Satisfaction: An Empirical Study" that majority of respondents avail the Metro as mode of transportation for ticketing i.e., promotional offer. Inside atmosphere attract the customer for select Metro as a mode of communication neglecting the other obstacles. Extended Multi Ride scheme helps to secure the cost minimum journey. Management attitude is also important to increase the customer satisfaction.

Goel Deepti and Gupta Sonam (2012) described "The Effect of Metro Rail on Air Pollution in Delhi". Delhi Metro (DM) was introduced in 2002. The authors quantity the effect of the DM on air pollution in the city, uses hourly data on four criteria pollutants for the years 2004 through 2006. The estimates showed that each extension of the metro rail resulted in a decline in nitrogen dioxide and carbon monoxide in Delhi. The estimates for nitrogen dioxide reductions range from 3 to 47 percent, while those for carbon monoxide range from 31 to 100 percent. For ITO, a major traffic intersection in Delhi, the cumulative effect of multiple extensions, is a net decline in carbon monoxide of 35 percent. The findings suggest that the DM has encouraged people to switch from private to public mode of travel resulting in positive externalities for air quality in the city. The paper provides a rationale for encouraging metro expansion in other cities that face similar challenges in terms of vehicular congestion and health costs due to pollution.

Subash, Chandra Bose, Uma Maheshwari & Maharajan (2013) concluded in their study titled "Feasibility Study of Metro Transport: Case Study Madurai**"** that on account of the high costs involved and the need to maintain a fare structure within the affordable reach of ordinary citizens, metro projects are not ordinarily financially viable. But considering the overwhelming economic gains to the society and fact that cities with population of more than five million cannot just survive without an efficient metro

system, it is strongly recommend that the Madurai Metro system be taken up for implementation in the financial year 2011-2012 itself. Madurai being one of the fastest growing urban agglomerations of the country will need a bigger metro network. The corridors proposed in phase- I will require to be extended when the phase I become fully operational.

Goel Rahul and Tiwari Geetam (2014) described, "promoting low carbon transport in India: case study of metro rails in Indian cities". This study is based on the premise that metro rail projects in cities are considered inevitable for efficient urban transport by many planners and policy makers, however, these projects have major implications for achieving inclusive sustainable low-carbon development goals. The focus of the study is not whether or not to undertake the metro project, but rather explicitly discuss the costs and benefits to different stakeholders. The broad purpose of this study is to examine the costs and benefits of metro rail projects for achieving the twin goals of inclusive and sustainable development and low-carbon growth. The main goals of sustainable development are economic efficiency, sustainable growth, conserving resources, energy security, and energy efficiency and inclusiveness. The major goal for low-carbon growth is to reduce emissions in order to achieve global targets for minimizing threats of climate change. This study aims to provide a framework for short and long term assessment of costs and benefits of transport infrastructure projects like the metro rail projects in cities. This case study is broadly conceived to assess the potential of the Delhi metro rail. In addition to this, metro rails are perceived to have higher levels of comfort, speed, and efficiency as compared to bus systems. However, no explicit analysis of these considerations is available and more elaborate studies would be required to understand each of these dimensions.

Deulkar W. N. and Sheikh A. F. (2015) in a study "Metro Rail Project: A Review"; the authors find that the increasing levels of congestion on Pune road network coupled with high private vehicle usage prompted the planners and the implementing agencies to go for transportation infrastructure improvements. The planners have realized the fact that there should be a phenomenal change in the exiting transporting system that would investigate a substantial shift from private vehicles to public transit. Thus a need for an appropriate mass transit system was felt and Delhi metro rail corporation (DMRC) was entrusted with preparation of detailed project report (DPR) for identifying the potential

corridors for implementing of metro rail system in Pune. This paper critically reviews and analyzes the decision making systems behind the proposed Pune metro rail system and its detailed project report, and exposes many weaknesses in both. The decision making system is seen to be ad hoc, and not sufficiently transparent or participative. The detailed project report suffers from many serious methodological and analytical errors. This analysis and experience from other cities suggests that cities are increasingly seeking single large, big budget solutions to their urban transport problems without exploring the many simpler, cheaper and more effective options that are available.

Thanai & Chugh (2017) conducted a study on "Customer Satisfaction towards Delhi Metro Rail Corporation". The study aimed to examine the level of customer satisfaction towards Delhi Metro Rail Corporation, to identify the various factors influencing customer satisfaction towards Delhi Metro Rail Corporation and to explore the most influencing factor of customer satisfaction towards Delhi Metro Rail Corporation. The sample had 40 respondents who were using the services of DMRC. In their study they found that there existed a positive relationship between reliability with customer satisfaction. Similarly, the other attributes, such as assurances, tangibles, empathy and responsiveness all had positive relationship with customer satisfaction. It was not easy to measure the level of performance and satisfaction when it comes to the intangible expectations. The study recommended that in order to obtain loyal customers metro must have products and services that are so good that there is very little chance that the customer requirements would not be met.

Vislavath (2018) did a study on "Impact of Metro Rail on Para Transport System of Urban Commutation-A Study on Hyderabad". The study revealed that the major problem with respect to rapid transport system in India lies in the policy framework itself which advocates that, only cities having one million and above population is eligible to have rapid transport mechanism like metro rail. It is the reason why only nine cities of the country are presently equipped with metro rail system of which Hyderabad occupies an important space not only due to demographic divergence, but also due to the public private partnership (ppp) mode of building and operating 72 km of metro rail in important corridors impacting the existing transport modes like state transport corporation buses and Para transit vehicles like Autos or simply auto rickshaws which are widely effected with the commencement of metro operations, because there are 1.6

lakh registered auto rickshaws providing livelihood to equal number of families transporting 15 lakh commuters a day therefore it is felt important to study the impact of metro rail on Para transport system with the core objectives of understanding the nitty-gritty of metro rail operations in Hyderabad and accessing the perceptions of Para transport stakeholders on metro operations.

In a nutshell, this chapter narrates various studies undertaken in Indian as well as foreign context. These studies dealt with various aspects of Railways like, Traffic system, Personnel Management Practices, Speed of the train, Passenger Ticket reservation system, Commuting Patterns in Metropolitan area, Success of Metro projects in different cities etc. No Comprehensive study has been done on Passenger amenities provided by Jaipur Metro. This research gap has been identified by the researcher and undertook a detailed study on this vital theme.

REFERENCES

- Advani & Tiwari (2005). Evaluation of Public Transport Systems: Case Study of Delhi Metro. Proceeding in START-2005 Conference held at IIT Kharagpur, India

- Akiko Sakanishi (2006). Commuting Patterns in the Osaka Metropolitan Area: A GIS-based Analysis of commuter Rail Passengers. RURDS, Vol.18, No.1., pp 45-48

- Akiko Sakanishi (2006). Commuting Patterns in the Osaka Metropolitan Area: A GIS-based Analysis of commuter Rail Passengers. RURDS, Vol.18, No.1., pp 45-48

- BAG & SEN (2012). Kolkata Metro Railway and Customer Satisfaction: An Empirical Study. International Journal of Multidisciplinary Research Vol.2 Issue 3, March 2012, ISSN 2231 5780 www.zenithresearch.org.in

- Bansal R.K., Sharma V. (1997). Study on some observations on the catering services in the Indian Railways. Indian Journal of Community Medicine, Vol.22, No.2, pp 82 to 85

- Bard Cole & Christine Cooper (2005). Making the trains run on time: the tyranny of Performance indicators. Production , Planning and Control, vol-16, No.2, pp 199-207

- C Srivastava, Sharat S Mathur & Thompson SH Teo (2007). Modernization of Passenger Reservation System: Indian Railwas. Journal of Information Technology,Vol.22, p.432-439

- Chinmoy Kumar (2006). Indian Railway; IT Innovations in Passenger Services. The ICFAI Journal of Service Marketing , Vol.4, No.1., pp 64-71.

- D.V. Nalini Devi (1996). A Study of Personal Management Practices in South Central Railway and the Perceived Effectiveness of Its Operations by the Passengers. Dissertation submitted to Osmania University

- Debabrata Das, Subhash Datta & A.Sharfuddin (2007). Importance of Metro Rail in Public Transport Network: A case study of Delhi. Indian Journal of Transport Management, p.no. 223.

- Dennis Huisman, Leo Kroon, Ramon Lentink & Michiel Vromans (2005). Operations Research in Passenger Railway Transportation. Statistica. Nedherladica, Vol.59, pp 467-497.

- Erhan Kozan & Robert Burdett (2005). A Railway capacity Determination Model and Rail Access Charging methodologies. Transport Planning and Technology, vol.28, No.1, pp 27-45.

- Fareed, Karim & Chandrasekhar. Characteristics of non-bulk commodity transport and shipper's Perception – A model share prospective. Indian Journal of Transport Management, vol.28, No.2, pp 232-242.

- G. Jeganathan (2002). Commuters of Railways-An Attitude Study with Special Reference to Thirunelveli- Nagercoil Section. Ph.D. thesis submitted to Manonmaniam Sundaranar University.

- Glines de Rus, Vicente Inglada (1997). Cost – benefit analysis of the high speed train in Spain. The annals of Regional Sciences, Vol 31, January, pp 175 – 188.

- Hadi Baaj (2002). Restructuring the Lebanese Railway and Public Transport Authority (RPTA) from losing operator to effective regulator. Transport Review, Vol.22,No.1, pp 103-113 41

- Mathur (2005). Human resource management in Indian railways – A study of recruitment, training and motivation. Southern Economist, pp 23-25.

- Jain Beko (2004). Some evidence on elasticity's of demand for services of public railway passenger transportation in Slovenia. Eastern European Economics, vol.42, No.2, pp 63-85.

- Jamie Dallen (2007). Sustainable Transport, Market Segmentation and Tourism: The Looe Valley Branch Line Railway, Cornwall, UK. Journal of Sustainable Tourism, vol.15, No.2, pp 180-197.

- Jaspe Dekkers & Piet (2007). Electronic ticketing in public transport: A field Study in a rural Area. Journal of Intelligent Transportation systems,vol.11, No.2, pp 69-78

- Gabriel & Babu (2005). Passenger Reservation System in the Indian Railways. The Journal of institute of Public Enterprise, vol.28, No .1&2.

- Jon Shaw (2001). Competition In the UK Passenger Railway Industry: Prospects and Problems. Transport Reviews, Vol.21, No.2, pp 195-216.

- Jonathan Cowie & Geoff Reddington (1996). Measuring eth efficiency of European railways. Applied Economics, Vol 28, pp 1027-1035.

- K.Ramamoorthy & S.Ponnuraj (2001). Passenger perception of Omnibus services –An analysis. Indian Journal of Transport Management.

- Karst Geirs, Rinus Haaijer & Bert Van Wee (2006).“Opinion Value Of Public Transport” Meth for measurement and case study for Regional Rail links in Netherlands. Transport Reviews, vol.26, No.5, pp 613-643

- Kiyohoto Utsunomiya (2004). CPI quality adjustments and productivity growth: Railway services in Japan. Review of income and wealth, series 50, No.3, pp 411-428

- Koichi Goto (2001). Passenger Service Technologies. Japan Railway and transport Review.

- Lena Wins Lott Hiselius (2005) .Using Choice Experiments to Assess People's Preferences for Railway Transports of Hazardous Materials. Risk Analysis, Vol.25, No.5, pp 1199-1213.

- Leo Kroon, Ramon Lentink & Alexandar Schrijver (2006). Shunting of passenger Train Units: An Integrated Approach. Transportation Science, pp 1-29.

- Luisa Affuso, Jullien Masson & David Newbery (2000). Comparing investments on new transport infrastructure Roads Vs. Railways? University of Cambridge, Working paper -16185.

- M.V.Rama Prasad (2002). A Study on Passenger Amenities in Railways. Indian Journal of Marketing.

- Madhavaiah. C. & Durga Rao .S. (2007). Public Sector Road Transport Corporations: A Comparative Study of Service Quality Perceptions. The ICFAI Journal of Service Marketing, Vol.5, No.1, pp31-41.

- Marc Ivaldi & Catherine Vibes (2005). Intermodal and Intramodel Competition in Passenger Rail Transport. Transportation Science, pp 1-15.

- Vromans, Dekkar & Kroon (2003). Reliability and Heterogeneity of Railway Services. ERIM report series research in Management, pp 1-23

- Moshe Givoni (2006). Development and Impact of the Modern High Speed Train. Risk Analysis, vol.26, No.5, pp593-611

- Kulsreshtha & Nag (2005). Structure and dynamics of non-suburban passenger travel demand in Indian railway. Transportation. Kluwer Academic Publishers, Netherlands, pp.221-241.

- Murty, Dhavala, Ghosh & Singh (2006). Social costs benefit analysis of Delhi Metro – 2006. Institute of Economic growth, working paper.

- N.Makesh (2002). A study on job satisfaction of employees of Indian railways: the case of southern railway with particular reference to the Front Line Staff. M.Phil dissertation to Madurai Kamaraj University

- Patrick Dawson & Ian Mcloughlin. Computer Technology and the Redefinition of Supervision: A Study of the effects of computerization on Railway freight Supervisors. Journal of Management Studies, vol.23, No.1, pp 116-130

- Pedro Cantos Sanchez (2000). A Sub additivity test for the cost function of the principal European Reviews, vol 26, No.3, pp275-296.

- Sharma & Duggal (1989). Grievance Redressal in Indian Railways. Consumer Confrontation, CERC, pp.5-7.

- Borck & Wrede (2007). Commuting Subsidies with Two Transport Modes. Transport Reviews, pp 1-13.

- Raja.S. (2007). Consumer Image of Indian railways – An Empirical Analysis. SMART Journal of Business Management, Vol.3, No2, pp 59-63.

- Freling, Lentink & Wagelmans (2001). A Decision support system for crew planning in passenger transportation using a flexible branch and price algorithm.

- S.Sumathy (2005). History of Southern Railways. M.Phil. Dissertation submitted to Bharathidasan University.

- Subash, Chandrabose, Umamaheshwari & Maharajan (2013). Feasibility Study of Metro Transport: Case Study Madurai. International Journal of Civil Engineering and Technology (IJCIET), Volume 4, Issue 4

- Roy & Datta (2005). Ranking of public transport Modes According to the characteristics of abstract nature in Kolkata. Indian journal of Transport Management, Vol.29, No2, pp 136-143.

- Thanai & Chugh (2017). Customer Satisfaction towards Delhi Metro Rail Corporation. *XVIII* Annual International Conference Proceedings, http://www.internationalseminar.org/XVIII_AIC/INDEX.HTM Page

- V.Vijay Durga Prasad (2005). A study of Passenger amenities in Indian Railways with reference to Vijayawada Division. Indian Journal of Marketing, p.no. 15-21.

- Vislavath (2018). Impact of Metro Rail on Para Transport System of Urban Commutation-A Study on Hyderabad. International Journal of Management Studies. http://www.researchersworld.com/ijms

- Zhang Ning (1996). Railway Service Close to People's Lives. Japan Railway and Transport Review.

  http://shodhganga.inflibnet.ac.in/bitstream/10603/54213/8/08chapter%202.pdf

CHAPTER 4

RESEARCH METHODOLOGY & DESIGN

CHAPTER IV

RESEARCH METHODOLOGY

4.1 INTRODUCTION

Research means search for knowledge to obtain solution to a problem. It is a scientific and systematic process in which a series of activities are being performed to develop knowledge about the reality. “The process of research is concerned with identifying a problem or opportunity; translating that problem or opportunity into a research problem; and collecting, analyzing, and reporting the information specified in the research problem” (Kervin, 2004).

According to Grinnel Richard Jr. (1993), “Research is a structured inquiry that utilizes acceptable scientific methodology to solve problems and create new knowledge that is generally applicable”.

Research methodology involves a procedure which researchers follow in their work of describing, explaining and predicting phenomena pertaining to a problem under study. It develops the work plan of research. Research methodology covers various phases including, initiation, execution and reporting of a research study. It involves formulating a research problem, framing the research design, developing valid and reliable instruments for data collection, designing sampling process, and collecting, processing, analyzing and interpreting data, drawing conclusions and writing the research report.

The main purpose of any research is to explore and analyze existing unknown problems of any subject area, find out suitable solution for those problems and suggest scope of further studies. The present study has been conducted to study the level of satisfaction that customers have been deriving from using Jaipur Metro and its impact on other means of transport viz., auto-rickshaws, taxies, buses etc. It is a very important and attractive field of research which needs to be studied in depth and to search various issues pertaining to the subject since a lot of other cities in India are on a way to adopt it

as an alternative mode of transport. Switching passengers towards Metro has affected the livelihood of other means of transport or not is the prime concern of the study.

The present chapter details the research design applied for the study including research objectives and a suitable methodology to fulfill those objectives. An intensive research was done during the year 2018-19 analyzing all possible factors pertaining to the problem under study. The methodology used for the research has been presented under following headings:

1. Research Problem
2. Main Objectives of the Research Work
3. Hypothesis of the study
4. Research Design
5. Sampling Design
6. Data collection
7. Statistical techniques
8. Limitations of the methodology
9. Presentation of Research Report

4.2 RESEARCH PROBLEM

Jaipur is the capital of Rajasthan covers an area of 474 km and has population around 3.07 million as per census 2011. Due to rapid industrialization, increasing tourism and intense commercial development, a steep rise in travel demand was being observed. Moreover, the existing public transport infrastructure in the city was inadequate in terms of capacity, safety and service. Although private and public buses are available in the city but these are not enough to meet the demand and do not connect all areas in the city. Certain routes have too many buses while other routes have very less frequency. Other available transportation facilities available in city area are taxi, cycle rickshaw and auto rickshaw. Public transportation share has reduced from 26% to 19% in last few years

due to unavailability of suitable mode of transport. It has forced passengers to use personalized transport. As a result, congestion on roads has become intense leading to increased air pollution, more number of road accidents and longer time for travel.

In order to improve the system state government of Rajasthan started development of mass rapid transit system. The metro project is envisaged to provide a safe and reliable rapid transport system in Jaipur, improving general mobility, enhancing the quality of life and making city more pleasant to live and work.

Introducing Metro in Jaipur has both positive and negative impacts. Jaipur Metro is expected to extend the advantages like reduced congestion on roads, save time for millions of commuters, rapid means of travelling, less environmentally polluted, enhance social integrity, reduced accidental rates in the city and a good means for revenue. On the other side of the coin Jaipur Metro runs on the fixed lines and with fixed schedule, so passengers need to be particular to catch Metro, heavy cost of infrastructural investment, unnecessary tax burden on citizen, threats to other means of transport, social and economic effects on the people whose livelihood depends on other means of transport. The current research will try to apprehend and make a close study on the impact of Jaipur Metro on other means of transport.

To determine the level of satisfaction consumers are deriving using Metro in Jaipur and its impact on other means of transport, the topic of the study was identified and titled as,

"A Critical Evaluation of Impact of Jaipur Metro on Means of Transport"

4.3 MAIN OBJECTIVES OF THE RESEARCH WORK

The main objectives of the present research work are as follows:

1. To find out the importance attached to the various aspects of Jaipur Metro by passengers.

2. To know about services delivered by Jaipur Metro and their capability to meet passengers' expectations.

3. To examine how Metro manages its physical evidences including facilities inside Metro and at stations.

4. To identify the level of passenger satisfaction towards the behaviour of employees of Jaipur Metro.
5. To identify the impact of various demographic variables on passengers' perceptions about performance of Metro.
6. To study the impact of Jaipur Metro on the performance, productivity and status of other means of transport.
7. To find out the problem pertaining to the Jaipur Metro and other means of transport and thereafter suggest the remedial measures.

4.4 HYPOTHESES OF THE STUDY

H_{01} Metro is not delivering services as per the expectations of the passengers. (time, cost, availability, safety)

H_{11} Metro is delivering services as per the expectations of the passengers. (time, cost, availability, safety)

H_{02} Metro is not managing well its physical evidences.

H_{12} Metro is managing well its physical evidences.

H_{03} Passengers are not satisfied with the behavior of Metro's employees.

H_{13} Passengers are satisfied with the behavior of Metro's employees.

H_{04} There is no significant association between various independent variables (Gender, Age, Occupational and Purpose of travel) of the sample passengers and their satisfaction level.

H_{14} There is a significant association between various independent variables (Gender, Age, Occupational and Purpose of travel) of the sample passengers and their satisfaction level.

H_{05} There is no significant impact of Metro on other means of transport.

H_{15} There is a significant impact of Metro on other means of transport.

4.5 RESEARCH DESIGN

"A research design is the detailed blueprint used to guide a research study toward its objectives. The process of designing a research study involves many interrelated decisions" (Minocha, 2006). An effective research design represents the blueprint for collection, measurement and analysis of data and ensures that the research is conducted within the conceptual structure. The research design used by the researcher is in accordance with the empirical study requirements. As such, it covers the following sub-sections-

4.5.1 POPULATION OF THE STUDY

The population of the study covers people travelling in Jaipur Metro.

4.5.2 TYPE OF THE STUDY

The researcher has adopted descriptive research design for the present study. It is also known as statistical research that describes characteristics of the population or the phenomenon under study. The researcher has tried to study the existing perceptions of Metro users in Jaipur and the owners of other modes of transport who got affected by switching of customers towards Metro; without manipulating in anyway the scenario as it stands presently. Thus the study is largely empirical in approach.

4.5.3 NATURE OF THE STUDY

Since the population of the study is very large, therefore after considering the limitations of efforts, money and time, the researcher has used sampling method instead of census method of enquiry and it was found fit for the study. Still, due care has been taken to ensure that the selected sample would be representative of the entire population under study.

4.6 SAMPLING DESIGN

A sample is a pre-determined portion of the entire population under study which is selected to collect information about a given problem. A right sampling method ensures the accuracy of results of a research.

In this study, Purposive Random Sampling has been used to collect data relevant to solve the problem under study. Sampling units i.e. respondents have been selected from various metro stations located in Jaipur.

Sample size – The sample size of the present research work comprises of 415 passengers and 50 para transport operators.

4.7 DATA COLLECTION

In order to fulfill the objectives of the study, data was collected using primary as well as secondary sources. Being empirical study, it is largely based on primary data collected by the researcher through well designed, structured and comprehensive questionnaires designed by the researcher keeping in view the available theoretical literature and the objectives of the study. The questionnaires contain dichotomous questions, multiple choice questions, scaling questions and ranking questions too.

Since the respondents of the present study covers passengers of Jaipur Metro, data collection was done by visiting at Metro stations. They were approached while travelling in Metro and were provided the details of objectives and scope of the study. A friendly environment was created by giving introduction about the researcher and the purpose of visit, importance of their responses for the study and likely benefits available to them to get their true responses. After getting their willingness for participation, the researcher helped them to complete the scales in one session. They were made confident by assuring the confidentiality of the information collected. Apart from passengers, para-transport operators were also contacted to get their responses about impact of Metro on their daily operations.

Secondary data have been collected from various sources such as Media Reports, Press Releases, Ministry of Railways, Press Information Bureau (PIB), Department of Industrial Policy and Promotion, Railways Budget 2017-18, JMRC, internet sources, Official Publications such as Economic Survey, Economic Review, Statistics for Planning, other published books, official and reliable websites, various periodicals, newspapers etc.

4.8 STATISTICAL TECHNIQUES

The researcher has used following statistical techniques to analyze the data such as -

- Self administered questionnaire includes both scale and open-ended questions.
- Five-point Likert type numerical scales were used.
- A variety of statistical techniques has been applied to the data to test stated hypotheses, including Percentage analysis, Chi- square test (goodness of fit), One Way ANOVA and Z- test for two sample proportion.

The brief description of the test is as follows:

A **chi-square goodness of fit test** determines if a sample data matches a population. In this study it was used to test whether there is any significant difference between distributions of a single variable into different categories of responses. It was assumed that each category of response was distributed equally. It is applied to test whether the responses vary due to chance or is there any significant difference among the opinion of respondents.

One Way ANOVA ("analysis of variance") is used to compare the means of two or more independent groups in order to determine whether there is statistical evidence that the associated population means are significantly different. Also, it is important to realize that the one-way ANOVA is an omnibus test statistic and cannot tell which specific groups are statistically significantly different from each other; it only tells that at least two groups are different. Since the study design has more than two groups, determining which of these groups differ from each other is important. Thus post hoc test has also been used.

Z- test for two sample proportion is used to know whether two population or groups (in the present study pre and post commencing of Metro comparison) differ significantly on some single characteristic.

Online statistical software was used for data analysis. Statistical significance was set at .05. A statistical analyst was referred to get help on statistical analysis procedures and interpreting outcomes of the study.

4.9 LIMITATIONS OF THE STUDY

The proposed study has the following limitations:-

1. It is restricted to a particular location (Jaipur).Hence the results may not be same for other cities having Metro.
2. Time and cost involved are the major constraint of this research.
3. The study confines to the present status of transportation industry in Jaipur local.
4. The study is limited to identifying the impact of metro on other means of transport in Jaipur.
5. The accuracy of the data depends largely on the correctness of the information provided by the respondents. Thus, analysis done and interference drawn by the researcher is based on the responses given by the respondents, estimates, assumption, observations and informal discussions.

4.10 PRESENTATION OF RESEARCH REPORT

The entire thesis has been prepared and presented under the sequentially arranged chapters with the following details:

- **Chapter - I : PROFILE OF TRANSPORT SECTOR IN INDIA**

  This chapter covers overview of transportation Service, history of transportation, modes of transportation in India, public transport in India and present scenario of public transport sector and Government initiatives

- **Chapter -II : CONCEPTUAL FRAMEWORK**

  This chapter presents origin & development of Metro system, origin of Metro in India, growth and development of Jaipur Metro and related aspects.

- **Chapter- III: REVIEW OF LITERATURE**

  This chapter presents the findings of the studies which have been undertaken in India as well as abroad on the topic chosen for the study.

- **Chapter- IV: RESEARCH METHODOLOGY**

  This chapter discusses about the methodology adopted for the study including objectives and hypotheses of the study, type of research, sampling design, data collection tools, statistical tools used and lastly limitations of the study.

- **Chapter- V: DATA ANALYSIS & INTERPRETATION**

  This chapter is completely based on primary information collected through the questionnaires from the passengers of Jaipur Metro and some operators of para transit modes. The chapter covers data analysis and interpretation and hypotheses testing using statistical techniques also.

- **Chapter – VI: MAJOR FINDINGS & CONCLUSION**

  In this chapter, major findings of the study have been discussed and overall conclusions have been drawn on the basis of findings.

- **Chapter- VII: RECOMMENDATIONS**

  It presents recommendations and future scope of the study.

REFERENCES

- C. R. Kothari (2004). Research Methodology: Methods & Techniques. New Age International (P) Ltd.

- Crimp M. and Wright L. T. (1995). The Marketing Research Process, (4th ed.). Prentice Hall, London.

- Donald R. Cooper and Pamela S. Schindler. (2006). Business Research Methods, (9th ed.). Tata McGraw-Hill, New Delhi.

- Environmental Assessment Report (2013). India: Jaipur Metro Rail Project, Phase I-B, Jaipur Metro Rail Corporation, Jaipur

- Kerlinger Fred N. (1986). Foundations of Behavioural Research, (3rd ed.). Holt, Rinehart and Winston, New York.

- Ranjit Kumar. (2009). Research Methodology – A step by step guide for beg inners, (2nded.). Dorling Kindersley India Pvt. Ltd., New Delhi

CHAPTER 5

DATA ANALYSIS AND INTERPRETATION

CHAPTER V

DATA ANALYSIS AND INTERPRETATION

5.1 INTRODUCTION

In the previous chapter the research methodology applied for the present study have been discussed. This chapter presents the demographic profile of users of Jaipur Metro and the outcomes of the study that helps to assess whether commuters in Jaipur have been shifting towards Metro and the level of satisfaction they derived from travelling in Metro. This research analyzes the perception of users on services provided by Metro and other related dimensions which influence them to shift their mode of transport. Moreover, the main objective of the present research is to explore the impact of Metro on other means of transport. During the research it has been observed that the owners of other modes of transport like, auto rickshaws, buses, cycle rickshaws, taxies etc. have different views on the impact on Metro on their earning. The interpretation of respondents' profile was done by using charts and graphs. The association between variables was interpreted using Chi Square (Goodness of fit) test, One Way ANOVA and Z- test for two sample proportion.

The analysis was done to reveal the following:

- To compile the profile of respondents and examine the association of passengers' perception towards performance of Metro.

- To identify the differences between sample passengers' responses if any on the idea about various dimensions of Metro performance on the basis of demographic variables (age, gender, occupation and purpose of travelling).

- To examine the impact of Metro on other means of transport.

5.2 GRAPHICAL PRESENTATION OF DEMOGRAPHICAL PROFILE

In this section the researcher presented the collected demographic data in tabular manner with respective percentages and displayed them through suitable graphs.

5.2.1 AGE

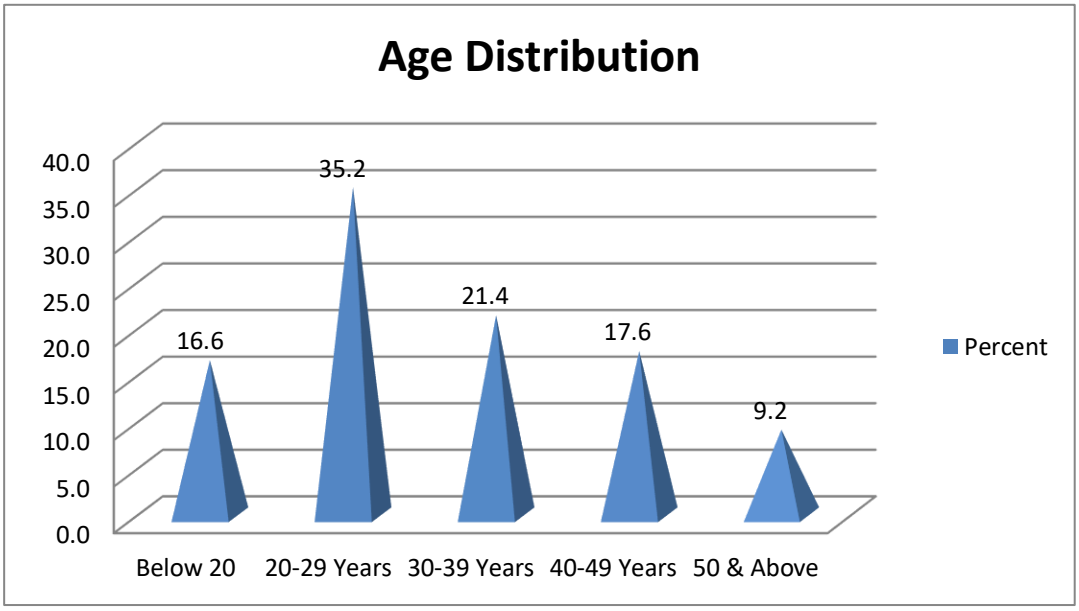
The total data of 415 respondents was segregated on the basis of Age as per the table shown below. The table and graph show the distribution of respondents according to their Age Group. Maximum number of sample passengers i.e. nearly 35 per cent falls under age group 20-29 years. About 21 per cent belonged to 30-39 years age group whilst nearly18 per cent were between ages 40-49, nearly 17 per cent were of ages below 20 years and only about 9 per cent was of more than 50 years of age.

Table 5.1

Age Distribution

Age	Frequency	Percent
Below 20	69	16.6
20-29 Years	146	35.2
30-39 Years	89	21.4
40-49 Years	73	17.6
50 & Above	38	9.2
Total	415	100.0

Chart 5.1



5.2.2 GENDER

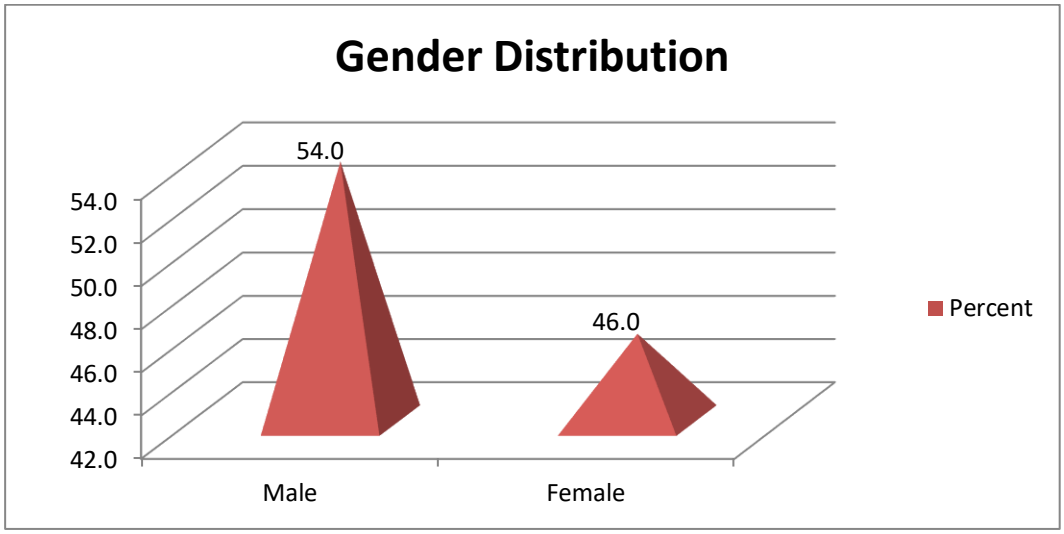
The respondents stated their gender as shown in the table and graph below. Majority of the sample passengers i.e. 54 per cent were male while only 46 per cent were female.

Table 5.2

Gender Distribution

Gender	Frequency	Percent
Male	224	54.0
Female	191	46.0
Total	415	100.0

Chart 5.2



5.2.3 OCCUPATION

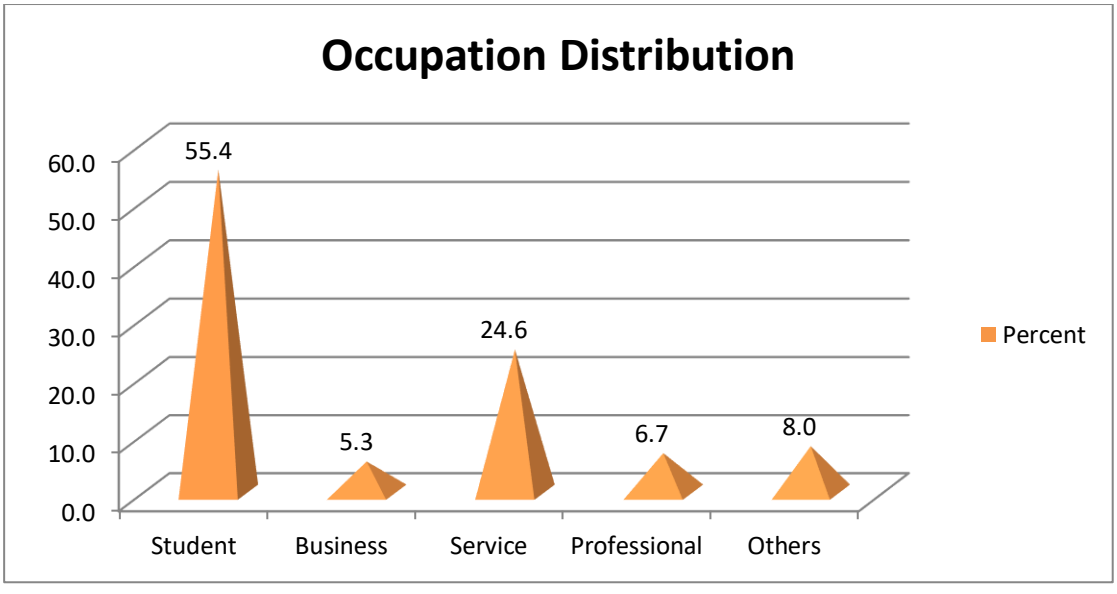
The sample passengers were asked to indicate their present occupation. As per the data, maximum number of respondents i.e. 55.4 per cent was students. About 25 per cent belonged to service class whilst 6.7 per cent were professionals and only 5.3 per cent was of business owners. Remaining 8 percent consists of others including house wives, retired people etc.

Table 5.3

Occupation Distribution

Occupation	Frequency	Percent
Student	230	55.4
Business	22	5.3
Service	102	24.6
Professional	28	6.7
Others	33	8.0
Total	**415**	**100**

Chart 5.3



5.2.4 PERSON WITH DISABILITY

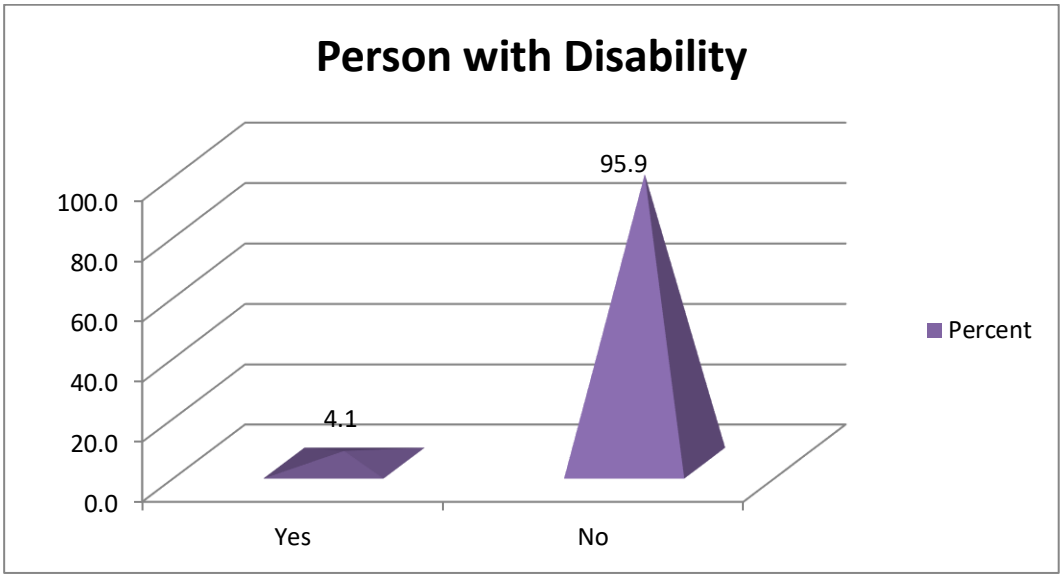
As per the table and graph presented below, majority of the sample passengers i.e. 95.9 per cent did not belong to disabled category while only 4.1 per cent were disabled.

Table 5.4

Person with Disability

Person with Disability	Frequency	Percent
Yes	17	4.1
No	398	95.9
Total	415	100.0

Chart 5.4



5.2.5 PLANNED PREFERRED MODE OF TRANSPORT

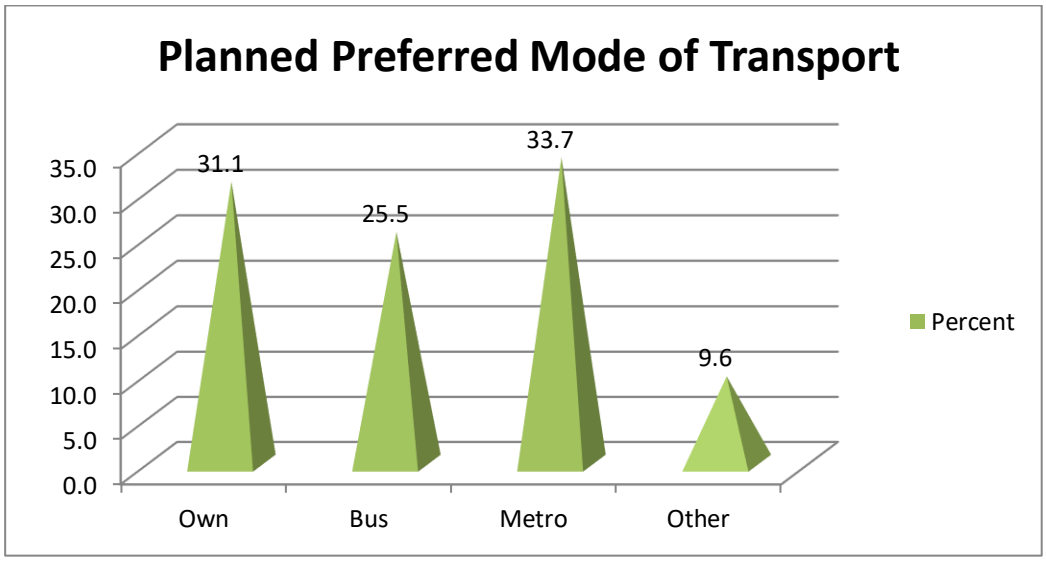
The respondents indicated their present mode of transport as mentioned in the table and graph shown below. Maximum number of sample passengers i.e. 33.7 per cent was using Metro as their preferred mode of transport. About 31.1 per cent usually travel by their own vehicles; nearly 25 per cent were using buses whilst only 9.6 per cent were travelling by other modes including taxies, auto rickshaw, cycle rickshaw etc.

Table 5.5

Planned Preferred Mode of Transport

Preferred Mode of Transport	Frequency	Percent
Own	129	31.1
Bus	106	25.5
Metro	140	33.7
Other	40	9.6
Total	415	100.0

Chart 5.5



5.2.6 FREQUENCY OF USING METRO

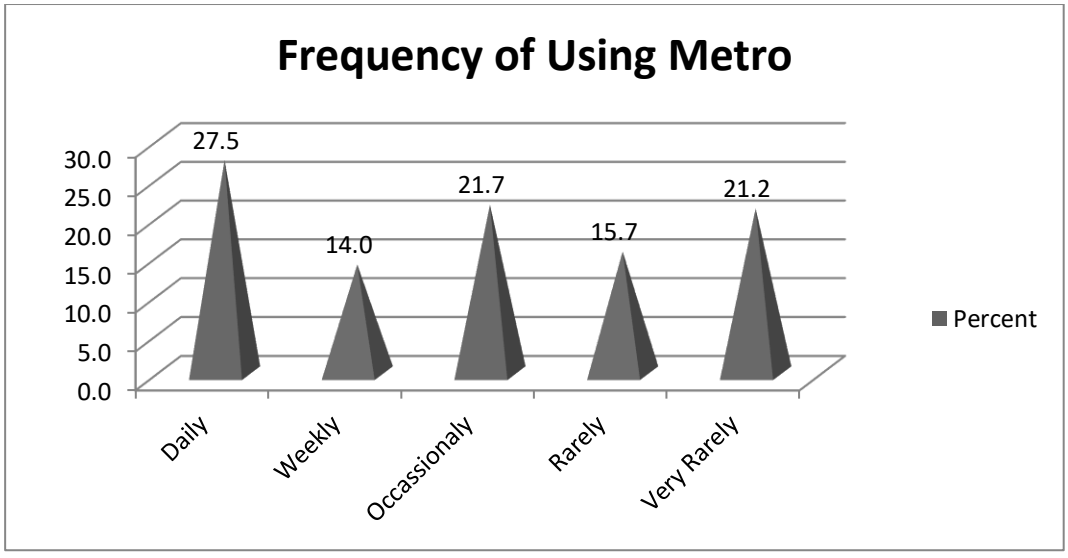
The respondents reported their frequency of travelling by Metro as mentioned in the table and graph shown below. The maximum number of sample passengers i.e. 27.5 per cent was travelling by Metro almost daily. About 21.7 per cent had been using Metro occasionally whilst 21.2 per cent were using very rarely, nearly 16 per cent rarely and only 14 per cent were weekly travelling by Metro.

Table 5.6

Frequency of Using Metro

Frequency of Using Metro	Frequency	Percent
Daily	114	27.5
Weekly	58	14.0
Occasionally	90	21.7
Rarely	65	15.7
Very Rarely	88	21.2
Total	**415**	**100**

Chart 5.6



5.2.7 PURPOSE OF JOURNEY

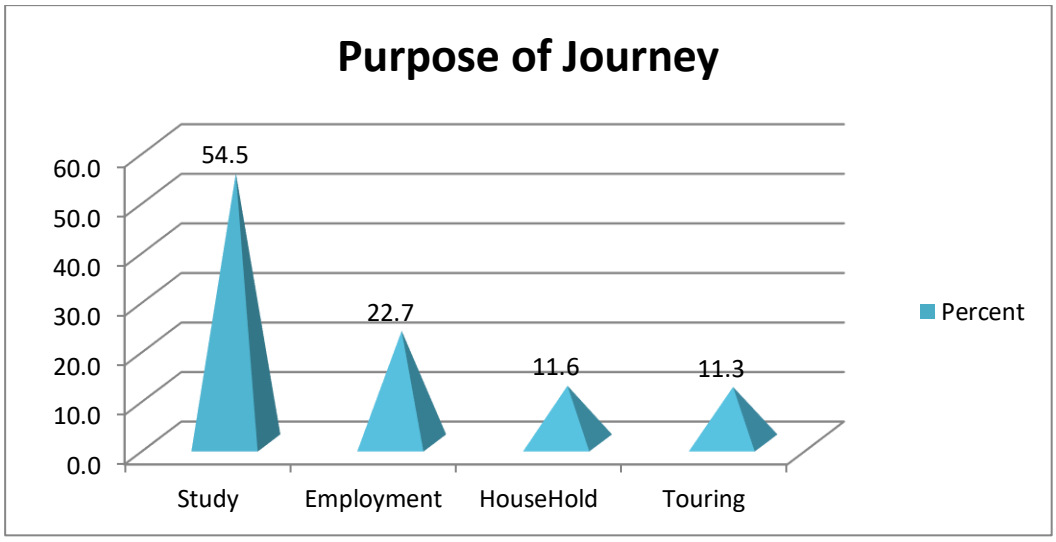
According to the table and graph shown below, respondents indicated their purpose of travelling by Metro. The maximum numbers of sample passengers, i.e., 54.5 per cent were travelling by Metro for the purpose of their study. About 23 per cent for employment purpose whilst 11.6 per cent for household purpose and only 11.3 per cent was travelling by Metro for touring purpose.

Table 5.7

Purpose of Journey

Purpose of Journey	Frequency	Percent
Study	226	54.5
Employment	94	22.7
House Hold	48	11.6
Touring	47	11.3
Total	415	100.0

Chart 5.7



5.2.8 PROBLEM FACED WHILE MOVING IN JAIPUR

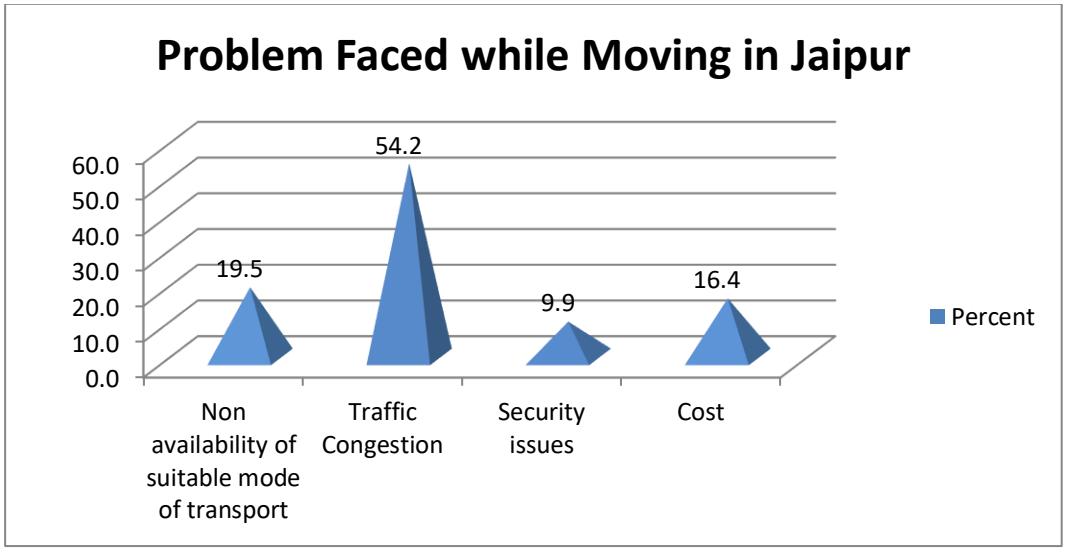
The respondents indicated the problems they usually face while moving in Jaipur as mentioned in the table and graph shown below. Maximum number of sample passengers i.e. 54.2 per cent stated traffic congestion as the most serious problem which they have to face while moving in the city. About 20 per cent reported that they do not get suitable mode of transport that can fulfill their requirements, nearly 16 per cent were not getting reasonable mode of transport whilst only 9.9 per cent were bothered with security issues prevalent in the present transportation system.

Table 5.8

Problem Faced while Moving in Jaipur

Problem Faced while Moving in Jaipur	Frequency	Percentage
Non availability of suitable mode of transport	81	19.5
Traffic Congestion	225	54.2
Security issues	41	9.9
Cost	68	16.4
Total	415	100.0

Chart 5.8



5.2.9 METRO AS A CHOICE TO RELIEF FROM TRAFFIC CONGESTION

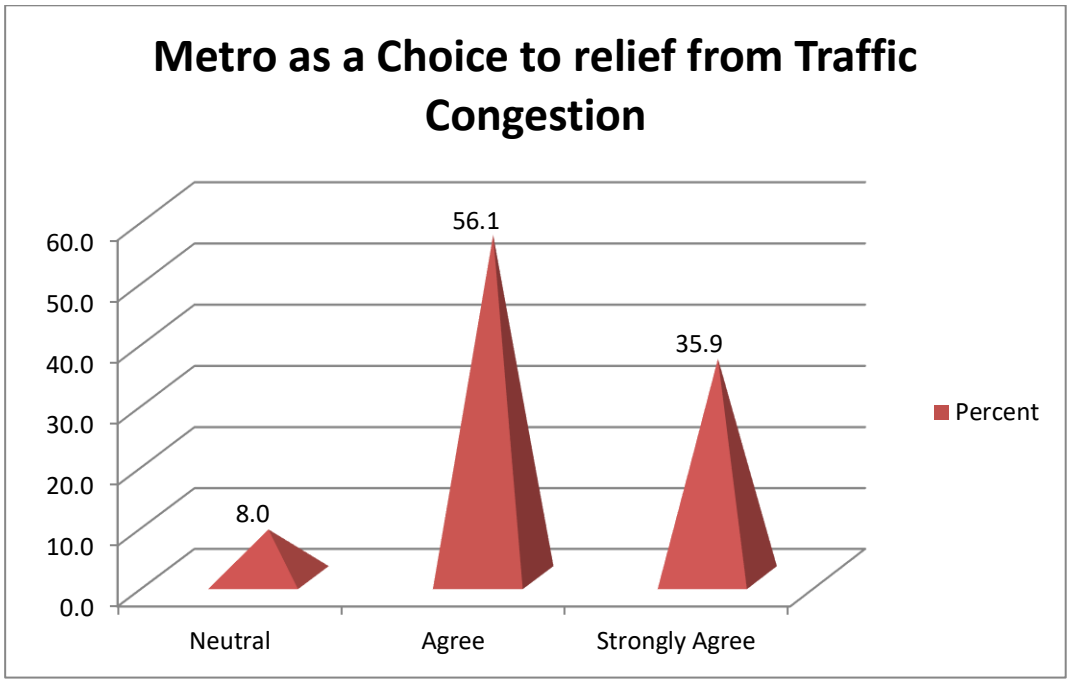
According to the table and graph shown below, the sample passengers indicated their response about the fact whether Metro is a suitable choice to relief from traffic congestion. The maximum numbers of sample passengers, i.e., 56.1 per cent have agreed that Metro can relieve from traffic congestion. About 36 per cent have strongly agreed whilst 8 per cent were neutral about the fact.

Table 5.9

Metro as a Choice to relief from Traffic Congestion

Choice to relief from the traffic Congestion	Frequency	Percent
Neutral	33	8.0
Agree	233	56.1
Strongly Agree	149	35.9
Total	415	100.0

Chart 5.9



5.2.10 NECESSITY OF METRO IN JAIPUR

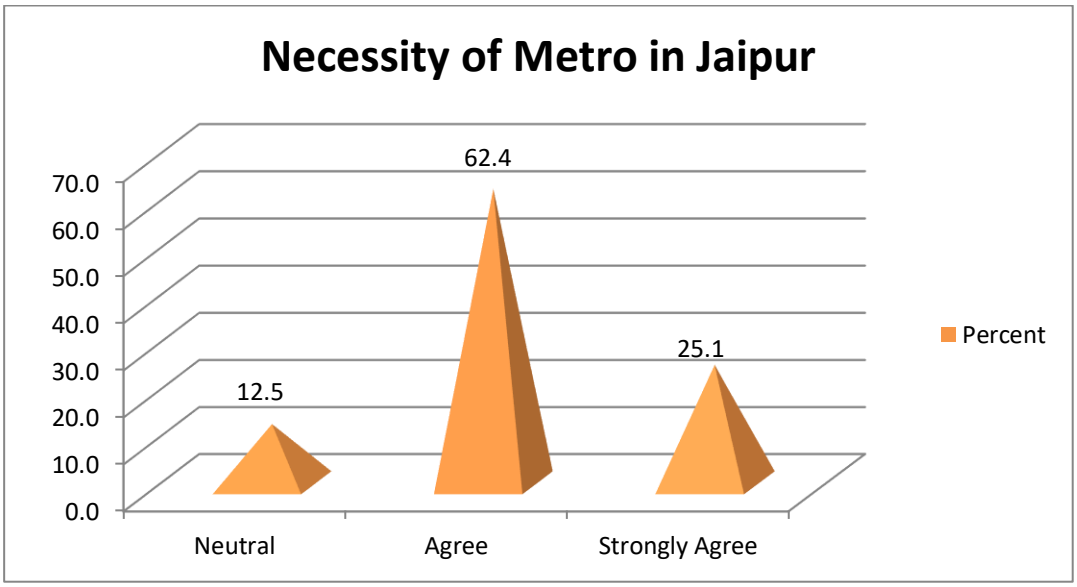
The sample passengers reported their responses about necessity of Metro in Jaipur as mentioned in the table and graph shown below. The maximum number of sample passengers i.e. 62.4 per cent has agreed about the necessity of Metro in Jaipur city. About 25.1 per cent have strongly agreed whilst 12.5 per cent were neutral about the above mentioned fact.

Table 5.10

Necessity of Metro in Jaipur

Response	Frequency	Percent
Neutral	52	12.5
Agree	259	62.4
Strongly Agree	104	25.1
Total	415	100.0

Chart 5.10



5.2.11 **ADVERSE EFFECT OF METRO ON OTHER MODE OF TRANSPORT**

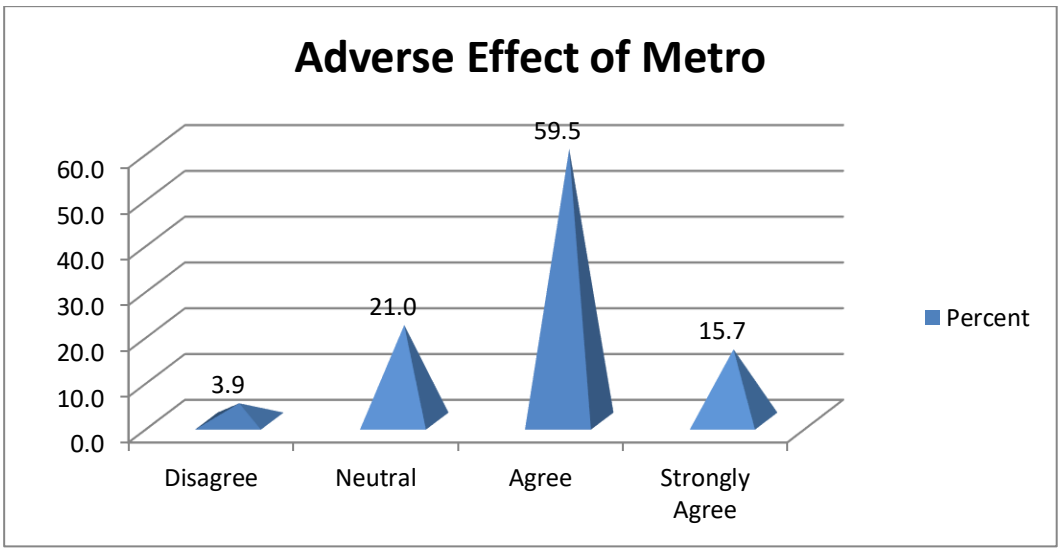
According to the table and graph shown below, the sample passengers indicated their response about adverse effect of Metro on other means of transport. The maximum numbers of sample passengers, i.e., 59.5 per cent have agreed that Metro has affected the demand of other means of transport. About 21 per cent were neutral to the fact, 16 per cent have strongly agreed whilst 4 per cent have disagreed about adverse effects of Metro on other means of transport.

Table 5.11

Adverse Effect of Metro on Other Mode of Transport

Adverse Effect on Other Mode of Transport	Frequency	Percent
Disagree	16	3.9
Neutral	87	21.0
Agree	247	59.5
Strongly Agree	65	15.7
Total	415	100.0

Chart 5.11



5.2.12 **SEPARATE LINES FOR WOMEN AND DISABLED**

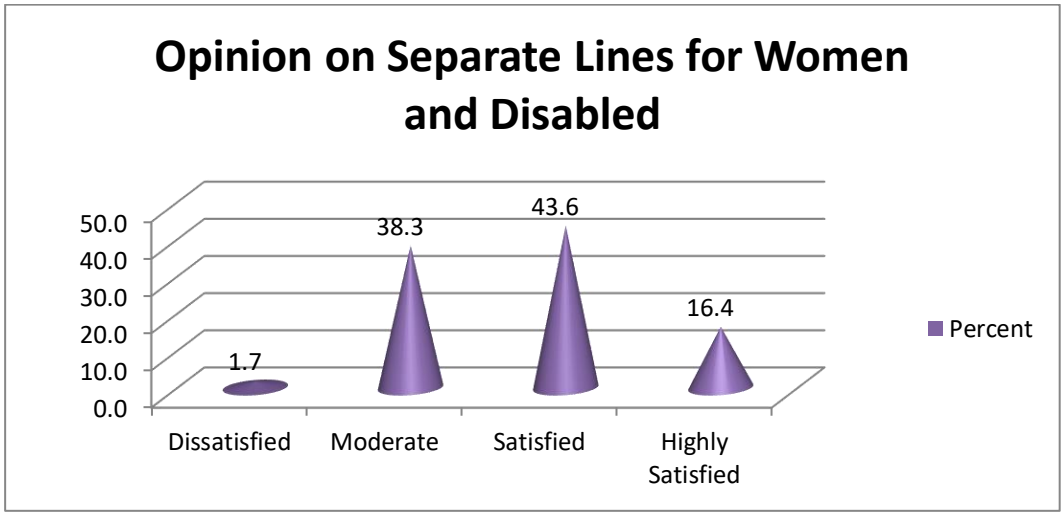
The sample passengers reported their opinions about facility of separate lines for women and disabled as indicated in the table and graph shown below. The maximum number of sample passengers i.e. 43.6 per cent was satisfied; about 38 per cent were neutral whilst 16.4 per cent were highly satisfied with the aforesaid facility. Only 1.7 per cent of the sample passengers were dissatisfied with the facility.

Table 5.12

Separate Lines for Women and Disabled

Separate Lines for Women and Disabled	Frequency	Percent
Dissatisfied	7	1.7
Moderate	159	38.3
Satisfied	181	43.6
Highly Satisfied	68	16.4
Total	415	100.0

Chart 5.12



5.2.13 **USE OF METRO MOBILE APP IN FUTURE**

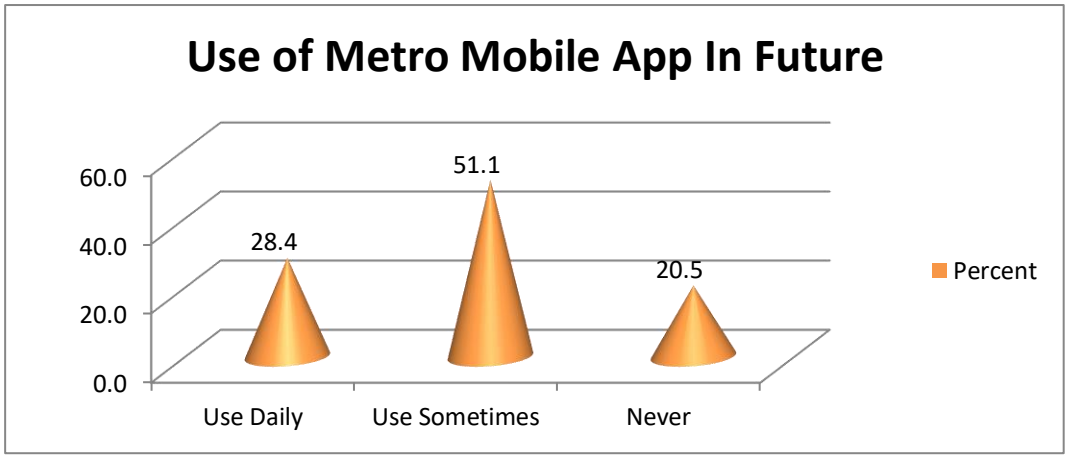
The sample passengers reported their responses about using Metro mobile app in future as indicated in the table and graph shown below. The maximum number of sample passengers i.e. 51.1 per cent has stated that they use the app sometimes. About 28 per cent have used it daily whilst 20.5 per cent have never used Metro mobile app.

Table 5.13

Use of Metro Mobile App

Use of Mobile App	Frequency	Percent
Use Daily	118	28.4
Use Sometimes	212	51.1
Never	85	20.5
Total	415	100.0

Chart 5.13



5.2.14 **PREFERRED MODE OF TICKETING**

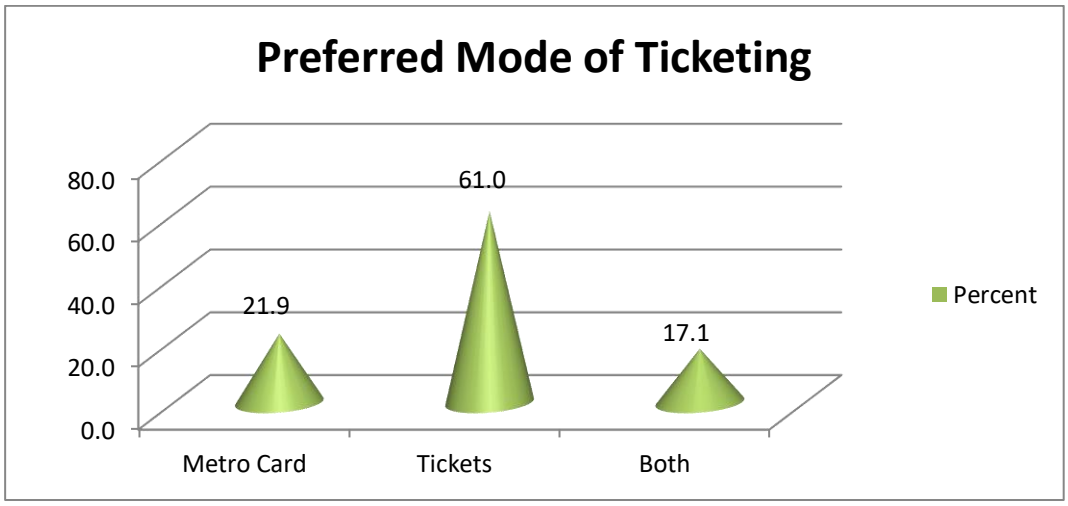
As per data mentioned in the table, a majority of the respondents i.e. 61 per cent have reported that they prefer buying tickets for travelling by Metro. About 22 per cent preferred metro card whilst nearly 17 per cent have no preference of any mode.

Table 5.14

Preferred Mode of Ticketing

Mode of Ticketing	Frequency	Percent
Metro Card	91	21.9
Tickets	253	61.0
Both	71	17.1
Total	415	100.0

Chart 5.14



5.2.15 **MODE OF PAYMENT**

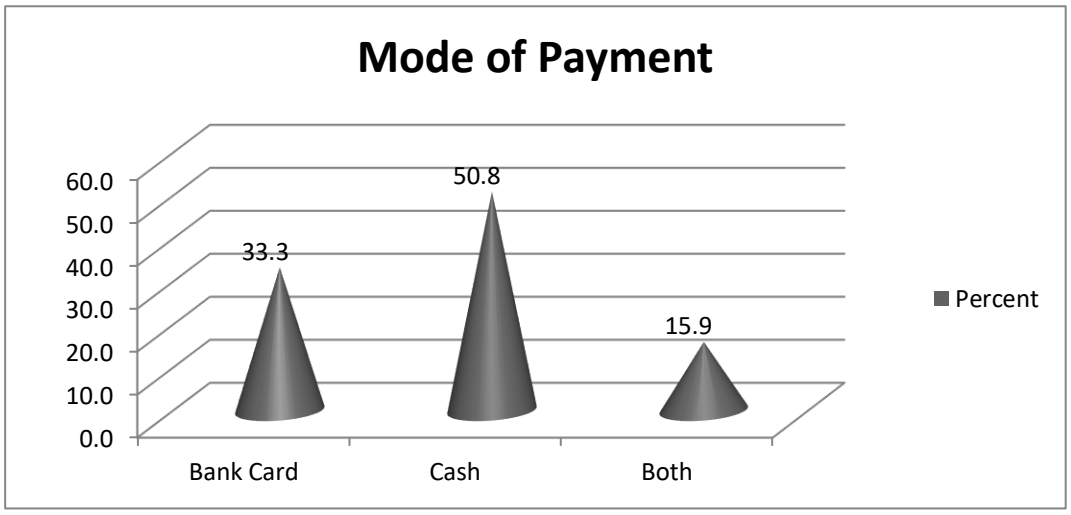
The sample passengers reported their responses about their preferred mode of payment for travelling in Metro as mentioned in the table and graph shown below. The maximum number of sample passengers i.e. 50.8 per cent has agreed about paying cash for buying tickets, about 33 per cent were using bank card whilst nearly 16 per cent were using both the modes to pay for the ticket.

Table 5.15

Mode of Payment

Mode of Payment	Frequency	Percent
Bank Card	138	33.3
Cash	211	50.8
Both	66	15.9
Total	415	100.0

Chart 5.15



5.3 HYPOTHESES VALIDATION

In this section an analysis of responses of the sample passengers was carried out to examine their views on the factors pertaining to services and facilities provided by Metro and related aspects. They were asked to give their opinion in appropriate columns of the Questionnaire. The options ranged from Strongly Disagree to Strongly Agree. In this section, the researcher applied Chi-Square (Goodness of Fit) Test, One Way Anova and z test for two sample proportion to prove stated hypotheses and to get outcomes of the study.

5.3.1 HYPOTHESIS- 1

H_{01} (Null Hypothesis): Metro is not delivering services as per the expectations of the passengers. (time, cost, availability, safety)

H_{11} (Alternate Hypothesis): Metro is delivering services as per the expectations of the passengers. (time, cost, availability, safety)

The above mentioned hypothesis covers variables related with –

5.3.1.1 Opinion regarding Reasonable Fare of Metro

Table 5.16

Opinion regarding Reasonable Fare of Metro

Response	Observed N	Expected N	Residual
Strongly Disagree	8	103.8	-95.8
Neutral	64	103.8	-39.8
Agree	254	103.8	150.3
Strongly Agree	89	103.8	-14.8
Total	415		

Chi Square (Goodness of Fit) = 323.284, df = 3 P value = 0.000

The above table shows the Chi square (Goodness of Fit) test value for the distribution of respondents' perception regarding reasonable fair of Metro.

A statistical significant difference was found in the opinions of the sample passengers and it was accepted that a majority of respondents have agreed the fact that Metro is charging reasonable fare.

5.3.1.2 Opinion regarding No Requirement to Revise Existing fares

Table 5.17

Opinion regarding No Requirement to Revise Existing fares

Response	Observed N	Expected N	Residual
Neutral	77	138.3	-61.3
Agree	251	138.3	112.7
Strongly Agree	87	138.3	-51.3
Total	415		

Chi Square (Goodness of Fit) = 138.005, df = 2, P Value = 0.000* Significant

Chi square test for goodness of fit was applied to determine the significant difference if any, between the opinions marked by respondents. For p value 0.000, the distribution was found to be statistically significant ($p < 0.05$).

It is evident from above table that most of the respondents have agreed about no requirement of any revision in existing fare of Metro. It implies that a majority of the sample passengers are satisfied with the existing fare.

5.3.1.3 Opinion regarding Adequate Frequency of Metro

Table 5.18

Opinion regarding Adequate Frequency of Metro

Response	Observed N	Expected N	Residual
Neutral	78	138.3	-60.3
Agree	241	138.3	102.7
Strongly Agree	96	138.3	-42.3
Total	415		

Chi Square (Goodness of Fit) = 115.465, df = 2, P Value = 0.000* Significant

The above mentioned table presents the distribution of respondents according to their opinion on frequency of Metro.

Chi square test for goodness of fit at 5 % significance level was applied to determine the significant difference if any, between the opinions marked by respondents. In can be inferred that for p value 0.000, the distribution was found to be statistically significant (p <0.05). According to this statistic, most of the respondents have agreed about the adequate frequency of Metro.

5.3.1.4 Opinion regarding Reach on Time by Metro

Table 5.19

Opinion regarding Reach on Time by Metro

Response	Observed N	Expected N	Residual
Agree	407	207.5	199.5
Disagree	8	207.5	-199.5
Total	415		

Chi Square (Goodness of Fit) = 383.617, df = 1, P Value = 0.000* Significant

The above mentioned table shows the distribution of respondents according to their opinion on reach on time by Metro.

Chi square test for goodness of fit at 5 % significance level was applied to determine the significant difference if any, between the opinions given by respondents. In can be inferred that for p value 0.000, the distribution was found to be statistically significant (p <0.05). According to this statistic, most of the respondents have agreed that they reach on time to the desired destination by Metro.

5.3.1.5 Opinion regarding Time Saving in Travelling by Metro

Table 5.20

Opinion regarding Time Saving in Travelling by Metro

Response	Observed N	Expected N	Residual
Disagree	7	103.8	-96.8
Neutral	61	103.8	-42.8
Agree	256	103.8	152.3
Strongly Agree	91	103.8	-12.8
Total	415		

Chi Square (Goodness of Fit) = 332.827, df = 3, P Value = 0.000* Significant

Chi square test for goodness of fit was applied to determine the significant difference if any, between the opinions marked by respondents. For p value 0.000, the distribution was found to be statistically significant ($p< 0.05$).

It is evident from above table that most of the respondents have agreed about saving in travel time using Metro.

5.3.1.6 Opinion regarding Security inside Metro

Table 5.21

Opinion regarding Security inside Metro

Response	Observed N	Expected N	Residual
Neutral	133	138.3	-5.3
Agree	192	138.3	53.7
Strongly Agree	90	138.3	-48.3
Total	415		

Chi Square (Goodness of Fit) = 37.913, df = 2, P Value = 0.000* Significant

The above mentioned table shows the distribution of respondents according to their opinion on Security inside Metro.

Chi square test for goodness of fit at 5 % significance level was applied to determine the significant difference if any, between the opinions given by respondents. In can be inferred that for p value 0.000, the distribution was found to be statistically significant ($p < 0.05$). According to this statistic, most of the sample passengers have agreed about the security aspects inside Metro.

5.3.1.7 Opinion regarding Security at Stations and Platforms

Table 5.22

Opinion regarding Security at Stations and Platforms

Response	Observed N	Expected N	Residual
Neutral	61	138.3	-77.3
Agree	268	138.3	129.7
Strongly Agree	86	138.3	-52.3
Total	415		

Chi Square (Goodness of Fit) = 184.573, df = 2, P Value = 0.000* Significant

The above table shows the Chi square (Goodness of Fit) test value for the distribution of respondents' perception regarding security at stations and platforms aspects of Metro.

A Statistical significant difference was found in the opinions of the respondents and it was accepted that a majority of the sample passengers have agreed about the adequacy of security provided by Metro authorities at stations and platforms.

Hypothesis Conclusion

As per above tables and comparing the opinion of the sample passengers it was found that there was a significant difference in their opinion regarding services provided by Metro, hence null hypothesis was rejected and it was accepted that Metro provides services as per the expectations of the passengers.

5.3.2 HYPOTHESIS- 2

H_{02} (Null Hypothesis): Metro is not managing well its physical evidences

H_{12} (Alternate Hypothesis): Metro is managing well its physical evidences

The above mentioned hypothesis covers variables related with –

5.3.2.1 Opinion regarding Cleanliness inside Metro

Table 5.23

Opinion regarding Cleanliness inside Metro

Response	Observed N	Expected N	Residual
Moderate	33	138.3	-105.3
Satisfied	232	138.3	93.7
Highly Satisfied	150	138.3	11.7
Total	415		

Chi Square (Goodness of Fit) = 144.612, df = 2, P Value = 0.000* Significant

Chi square test for goodness of fit was applied to determine the significant difference if any, between the opinions marked by respondents. For p value 0.000, the distribution was found to be statistically significant ($p< 0.05$).

It is evident from above table that most of the respondents were satisfied with the cleanliness evident inside Metro.

5.3.2.2 Opinion regarding Proper Maintenance of Coaches

Table 5.24

Opinion regarding Proper Maintenance of Coaches

Response	Observed N	Expected N	Residual
Moderate	38	138.3	-100.3
Satisfied	275	138.3	136.7
Highly Satisfied	102	138.3	-36.3
Total	415		

Chi Square (Goodness of Fit) = 217.335, df = 2, P Value = 0.000* Significant

The above mentioned table shows the distribution of respondents according to their opinion on proper maintenance of coaches.

Chi square test for goodness of fit at 5 % significance level was applied to determine the significant difference if any, between the opinions reported by respondents. In can be inferred that for p value 0.000, the distribution was found to be statistically significant ($p <0.05$). According to this statistic, most of the sample passengers were satisfied with the fact that Metro properly maintains its coaches.

5.3.2.3 Opinion regarding Watering Arrangements

Table 5.25

Opinion regarding Watering Arrangements

Response	Observed N	Expected N	Residual
Highly Dissatisfied	16	103.8	-87.8
Moderate	103	103.8	-.8
Satisfied	217	103.8	113.3
Highly Satisfied	79	103.8	-24.8
Total	415		

Chi Square (Goodness of Fit) = 203.747, df = 3, P Value = 0.000* Significant

The above table shows the Chi square (Goodness of Fit) test value for the distribution of respondents' perception regarding watering arrangements inside Metro.

A Statistical significant difference was found in the opinions of the respondents and it was accepted that a majority of the sample passengers were satisfied with the watering arrangements done by Metro inside the train.

5.3.2.4 Opinion regarding Availability of Ladies Coaches

Table 5.26

Opinion regarding Availability of Ladies Coaches

Response	Observed N	Expected N	Residual
Dissatisfied	16	103.8	-87.8
Moderate	57	103.8	-46.8
Satisfied	257	103.8	153.3
Highly Satisfied	85	103.8	-18.8
Total	415		

Chi Square (Goodness of Fit) = 325.039, df = 3, P Value = 0.000* Significant

Chi square test for goodness of fit was applied to determine the significant difference if any, between the opinions marked by respondents. For p value 0.000, the distribution was found to be statistically significant ($p< 0.05$).

It is evident from above table that most of the respondents were satisfied with availability of ladies coaches inside Metro.

5.3.2.5 Opinion regarding Medical Assistance during Emergencies

Table 5.27

Opinion regarding Medical Assistance during Emergencies

Response	Observed N	Expected N	Residual
Highly Dissatisfied	16	83.0	-67.0
Dissatisfied	16	83.0	-67.0
Moderate	98	83.0	15.0
Satisfied	216	83.0	133.0
Highly Satisfied	69	83.0	-14.0
Total	415		

Chi Square (Goodness of Fit) = 200.419, df = 4, P Value = 0.000* Significant

The above mentioned table shows the distribution of respondents according to their opinion on medical assistance provided by Metro during emergencies.

Chi square test for goodness of fit at 5 % significance level was applied to determine the significant difference if any, between the opinions reported by respondents. In can be inferred that for p value 0.000, the distribution was found to be statistically significant ($p <0.05$). According to this statistic, most of the sample passengers were satisfied with the fact that Metro provides medical assistance during emergencies.

5.3.2.6 Opinion regarding Mobile charging facilities

Table 5.28

Opinion regarding Mobile charging facilities

Response	Observed N	Expected N	Residual
Moderate	93	138.3	-45.3
Satisfied	272	138.3	133.7
Highly Satisfied	50	138.3	-88.3
Total	415		

Chi Square (Goodness of Fit) = 200.419, df = 2, P Value = 0.000* Significant

The above table shows the Chi square (Goodness of Fit) test value for the distribution of respondents' perception regarding provision of mobile charging facility inside Metro.

A Statistical significant difference was found in the opinions of the respondents and it was accepted that a majority of respondents were satisfied with mobile charging facility provided by Metro.

5.3.2.7 Opinion regarding Planned Recreation Facilities

Table 5.29

Opinion regarding Planned Recreation Facilities

Response	Observed N	Expected N	Residual
Highly Dissatisfied	7	83.0	-76.0
Dissatisfied	8	83.0	-75.0
Moderate	93	83.0	10.0
Satisfied	232	83.0	149.0
Highly Satisfied	75	83.0	-8.0
Total	415		

Chi Square (Goodness of Fit) = 406.819, df = 4, P Value = 0.000* Significant

Chi square test for goodness of fit was applied to determine the significant difference if any, between the opinions marked by respondents. For p value 0.000, the distribution was found to be statistically significant ($p< 0.05$).

It is evident from above table that most of the respondents were satisfied with the planned provision of recreation facilities inside Metro.

5.3.2.8 Opinion regarding Facilities for Physically Challenged Persons

Table 5.30

Opinion regarding Facilities for Physically Challenged Persons

Response	Observed N	Expected N	Residual
Highly Dissatisfied	16	103.8	-87.8
Moderate	87	103.8	-16.8
Satisfied	246	103.8	142.3
Highly Satisfied	66	103.8	-37.8
Total	415		

Chi Square (Goodness of Fit) = 285.694, df = 3, P Value = 0.000* Significant

The above mentioned table shows the distribution of respondents according to their opinion on facilities provided by Metro for physically challenged people.

Chi square test for goodness of fit at 5 % significance level was applied to determine the significant difference if any, between the opinions reported by respondents. In can be inferred that for p value 0.000, the distribution was found to be statistically significant ($p <0.05$). According to this statistic, most of the respondents were satisfied with the fact that Metro provides facilities for physically challenged people.

5.3.2.9 Opinion regarding Cleanliness on Platforms

Table 5.31

Opinion regarding Cleanliness on Platforms

Response	Observed N	Expected N	Residual
Highly Dissatisfied	7	103.8	-96.8
Moderate	60	103.8	-43.8
Satisfied	254	103.8	150.3
Highly Satisfied	94	103.8	-9.8
Total	415		

Chi Square (Goodness of Fit) = 327.178, df = 3, P Value = 0.000* Significant

The above table shows the Chi square (Goodness of Fit) test value for the distribution of respondents' perception regarding cleanliness at stations and platforms of Metro.

A Statistical significant difference was found in the opinions of the respondents and it was accepted that a majority of respondents were satisfied with the cleanliness exercised by Metro at stations and platforms.

5.3.2.10 Opinion regarding Drinking Water Arrangements at Platforms and Stations

Table 5.32

Opinion regarding Drinking Water Arrangements at Platforms and Stations

Response	Observed N	Expected N	Residual
Moderate	69	138.3	-69.3
Satisfied	259	138.3	120.7
Highly Satisfied	87	138.3	-51.3
Total	415		

Chi Square (Goodness of Fit) = 159.055, df = 2, P Value = 0.000* Significant

Chi square test for goodness of fit was applied to determine the significant difference if any, between the opinions marked by respondents. For p value 0.000, the distribution was found to be statistically significant ($p< 0.05$).

It is evident from above table that most of the sample passengers were satisfied with drinking water arrangements done at platforms and stations.

5.3.2.11 Opinion regarding Waiting area

Table 5.33

Opinion regarding Waiting area

Response	Observed N	Expected N	Residual
Dissatisfied	7	103.8	-96.8
Moderate	47	103.8	-56.8
Satisfied	280	103.8	176.3
Highly Satisfied	81	103.8	-22.8
Total	415		

Chi Square (Goodness of Fit) = 425.665, df = 3, P Value = 0.000* Significant

The above mentioned table shows the distribution of respondents according to their opinion on well maintained waiting area at Metro stations.

Chi square test for goodness of fit at 5 % significance level was applied to determine the significant difference if any, between the opinions reported by respondents. In can be inferred that for p value 0.000, the distribution was found to be statistically significant (p <0.05). According to this statistic, most of the sample passengers were satisfied with the fact that Metro properly maintains waiting areas at various stations.

5.3.2.12 Opinion regarding Seating, fans and lighting facility

Table 5.34

Opinion regarding Seating, fans and lighting facility

Response	Observed N	Expected N	Residual
Moderate	95	138.3	-43.3
Satisfied	236	138.3	97.7
Highly Satisfied	84	138.3	-54.3
Total	415		

Chi Square (Goodness of Fit) = 103.870, df = 2, P Value = 0.000* Significant

The above table shows the Chi square (Goodness of Fit) test value for the distribution of respondents' perception regarding seating, fans and lighting facilities at stations and platforms aspects of Metro.

A Statistical significant difference was found in the opinions of the respondents and it was accepted that a majority of respondents were satisfied with the seating, fans and lighting facilities provided by Metro at stations and platforms.

5.3.2.13 Opinion regarding Pay and Use Toilets

Table 5.35

Opinion regarding Pay and Use Toilets

Response	Observed N	Expected N	Residual
Moderate	94	138.3	-44.3
Satisfied	254	138.3	115.7
Highly Satisfied	67	138.3	-71.3
Total	415		

Chi Square (Goodness of Fit) = 147.706, df = 2, P Value = 0.000* Significant

Chi square test for goodness of fit was applied to determine the significant difference if any, between the opinions marked by respondents. For p value 0.000, the distribution was found to be statistically significant ($p< 0.05$).

It is evident from above table that most of the respondents were satisfied with pay and use toilets facility at Metro stations.

5.3.2.14 Opinion regarding ATM facility

Table 5.36

Opinion regarding ATM facility

Response	Observed N	Expected N	Residual
Dissatisfied	8	103.8	-95.8
Moderate	128	103.8	24.3
Satisfied	202	103.8	98.3
Highly Satisfied	77	103.8	-26.8
Total	415		

Chi Square (Goodness of Fit) = 193.973, df = 3, P Value = 0.000* Significant

The above mentioned table shows the distribution of respondents according to their opinion on ATM facility at Metro stations.

Chi square test for goodness of fit at 5 % significance level was applied to determine the significant difference if any, between the opinions reported by respondents. In can be inferred that for p value 0.000, the distribution was found to be statistically significant (p <0.05). According to this statistic, most of the respondents were satisfied with the fact that Metro provides ATM facility at stations.

5.3.2.15 Opinion regarding Planned Refreshment/food plazas

Table 5.37

Opinion regarding Planned Refreshment/food plazas

Response	Observed N	Expected N	Residual
Moderate	136	138.3	-2.3
Satisfied	208	138.3	69.7
Highly Satisfied	71	138.3	-67.3
Total	415		

Chi Square (Goodness of Fit) = 67.899, df = 3, P Value = 0.000* Significant

The above table shows the Chi square (Goodness of Fit) test value for the distribution of respondents' perception about planned provisions regarding Refreshment/food plazas facility at Metro stations.

A Statistical significant difference was found in the opinions of the respondents and it was accepted that a majority of respondents were satisfied with the planned refreshment/food plazas facility provided by Metro authorities at stations and platforms.

5.3.2.16 Touch Screen System

Table 5.38

Touch Screen System

Response	Observed N	Expected N	Residual
Dissatisfied	8	103.8	-95.8
Moderate	153	103.8	49.3
Satisfied	193	103.8	89.3
Highly Satisfied	61	103.8	-42.8
Total	415		

Chi Square (Goodness of Fit) = 206.137, df = 3, P Value = 0.000* Significant

Chi square test for goodness of fit was applied to determine the significant difference if any, between the opinions marked by respondents. For p value 0.000, the distribution was found to be statistically significant ($p< 0.05$).

It is evident from above table that most of the respondents were satisfied with touch screen system facility at Metro stations.

5.3.2.17 Opinion regarding Signage and Coach Indication Boards

Table 5.39

Opinion regarding Signage and Coach Indication Boards

Response	Observed N	Expected N	Residual
Dissatisfied	8	103.8	-95.8
Moderate	142	103.8	38.3
Satisfied	187	103.8	83.3
Highly Satisfied	78	103.8	-25.8
Total	415		

Chi Square (Goodness of Fit) = 175.660, df = 3, P Value = 0.000* Significant

The above mentioned table shows the distribution of respondents according to their opinion on provision of signage and coach indication boards at Metro stations.

Chi square test for goodness of fit at 5 % significance level was applied to determine the significant difference if any, between the opinions reported by respondents. In can be inferred that for p value 0.000, the distribution was found to be statistically significant (p <0.05). According to this statistic, most of the respondents were satisfied with the fact that Metro has signage and coach indication boards at its stations.

5.3.2.18 Opinion regarding Planned Television and Audio Systems

Table 5.40

Opinion regarding Planned Television and Audio Systems

Response	Observed N	Expected N	Residual
Highly Dissatisfied	8	83.0	-75.0
Dissatisfied	8	83.0	-75.0
Moderate	140	83.0	57.0
Satisfied	208	83.0	125.0
Highly Satisfied	51	83.0	-32.0
Total	415		

Chi Square (Goodness of Fit) = 375.277, df = 4, P Value = 0.000* Significant

The above table shows the Chi square (Goodness of Fit) test value for the distribution of respondents' perception regarding planning of providing Television and Audio systems at Metro stations.

A Statistical significant difference was found in the opinions of the respondents and it was accepted that a majority of respondents were satisfied with the provision of Television and Audio systems facility at Metro stations.

5.3.2.19 Opinion regarding Availability of Porters and Trolleys

Table 5.41

Opinion regarding Availability of Porters and Trolleys

Response	Observed N	Expected N	Residual
Highly Dissatisfied	16	83.0	-67.0
Dissatisfied	8	83.0	-75.0
Moderate	105	83.0	22.0
Satisfied	209	83.0	126.0
Highly Satisfied	77	83.0	-6.0
Total	415		

Chi Square (Goodness of Fit) = 319.398, df = 4, P Value = 0.000* Significant

Chi square test for goodness of fit was applied to determine the significant difference if any, between the opinions marked by respondents. For p value 0.000, the distribution was found to be statistically significant ($p< 0.05$).

It is evident from above table that most of the respondents were satisfied with the availability of porters and trolleys at Metro stations.

5.3.2.20 Opinion regarding Parking facility

Table 5.42

Opinion regarding Parking facility

Response	Observed N	Expected N	Residual
Highly Dissatisfied	16	103.8	-87.8
Moderate	73	103.8	-30.8
Satisfied	265	103.8	161.3
Highly Satisfied	61	103.8	-42.8
Total	415		

Chi Square (Goodness of Fit) = 351.564, df = 3, P Value = 0.000* Significant

The above mentioned table shows the distribution of respondents according to their opinion on provision of parking facility at Metro stations.

Chi square test for goodness of fit at 5 % significance level was applied to determine the significant difference if any, between the opinions reported by respondents. In can be inferred that for p value 0.000, the distribution was found to be statistically significant ($p < 0.05$). According to this statistic, most of the respondents were satisfied with the fact that Metro provides proper parking facility at its stations.

5.3.2.21 Opinion regarding Availability of Feeder Vehicles outside Metro

Table 5.43

Opinion regarding Availability of Feeder Vehicles outside Metro

Response	Observed N	Expected N	Residual
Highly Dissatisfied	16	103.8	-87.8
Moderate	106	103.8	2.3
Satisfied	241	103.8	137.3
Highly Satisfied	52	103.8	-51.8
Total	415		

Chi Square (Goodness of Fit) = 281.646, df = 3, P Value = 0.000* Significant

The above table shows the Chi square (Goodness of Fit) test value for the distribution of respondents' perception regarding availability of feeder vehicles outside Metro stations.

A Statistical significant difference was found in the opinions of the respondents and it was accepted that a majority of respondents were satisfied with the feeder vehicles provided by Metro outside stations.

Hypothesis Conclusion

As per above tables and comparing the opinion of the sample passengers it was found that there was a significant difference in their opinion regarding managing physical evidences by Metro, hence null hypothesis was rejected and it was accepted that Metro properly manages its physical evidences.

5.3.3 HYPOTHESIS- 3

H_{03} (Null Hypothesis): Passengers are not satisfied with the behaviour of Metro's employees

H_{13} (Alternate Hypothesis): Passengers are satisfied with the behaviour of Metro's employees

The above mentioned hypothesis covers variables related with –

5.3.3.1 Behaviour of Employees at the Counter

Table 5.44

Behaviour of Employees at the Counter

Response	Observed N	Expected N	Residual
Moderate	65	138.3	-73.3
Satisfied	272	138.3	133.7
Highly Satisfied	78	138.3	-60.3
Total	415		

Chi Square (Goodness of Fit) = 194.347, df = 2, P Value = 0.000* Significant

The above mentioned table shows the distribution of respondents according to their opinion on behaviour of Metro employees on the counter.

Chi square test for goodness of fit at 5 % significance level was applied to determine the significant difference if any, between the opinions reported by respondents. In can be inferred that for p value 0.000, the distribution was found to be statistically significant ($p < 0.05$). According to this statistic, most of the sample passengers were satisfied with the behaviour of Metro employees placed on the counter.

5.3.3.2 Behaviour of Metro Employees at the Station

Table 5.45

Behaviour of Metro Employees at the Station

Response	Observed N	Expected N	Residual
Moderate	16	138.3	-122.3
Satisfied	320	138.3	181.7
Highly Satisfied	79	138.3	-59.3
Total	415		

Chi Square (Goodness of Fit) = 372.207, df = 2, P Value = 0.000* Significant

The above mentioned table shows the distribution of respondents according to their opinion on behaviour of Metro employees at the station.

Chi square test for goodness of fit at 5 % significance level was applied to determine the significant difference if any, between the opinions reported by respondents. In can be inferred that for p value 0.000, the distribution was found to be statistically significant ($p < 0.05$). According to this statistic, most of the respondents were satisfied with the behaviour of Metro employees placed at the station.

5.3.3.3 Behaviour of Employees in the train

Table 5.46

Behaviour of Employees in the train

Response	Observed N	Expected N	Residual
Moderate	56	138.3	-82.3
Satisfied	298	138.3	159.7
Highly Satisfied	61	138.3	-77.3
Total	415		

Chi Square (Goodness of Fit) = 276.525, df = 2, P Value = 0.000* Significant

The above mentioned table shows the distribution of respondents according to their opinion on behaviour of Metro employees in the train.

Chi square test for goodness of fit at 5 % significance level was applied to determine the significant difference if any, between the opinions reported by respondents. In can be inferred that for p value 0.000, the distribution was found to be statistically significant (p <0.05). According to this statistic, most of the respondents were satisfied with the behaviour of Metro employees in the train.

5.3.3.4 Sincerity in Discharging their Duties

Table 5.47

Sincerity in Discharging their Duties

Response	Observed N	Expected N	Residual
Dissatisfied	8	103.8	-95.8
Moderate	64	103.8	-39.8
Satisfied	264	103.8	160.3
Highly Satisfied	79	103.8	-24.8
Total	415		

Chi Square (Goodness of Fit) = 357.019, df = 3, P Value = 0.000* Significant

The above mentioned table shows the distribution of respondents according to their opinion on sincerity of Metro employees in discharging their duties.

Chi square test for goodness of fit at 5 % significance level was applied to determine the significant difference if any, between the opinions reported by respondents. In can be inferred that for p value 0.000, the distribution was found to be statistically significant (p <0.05). According to this statistic, most of the respondents were satisfied with sincerity of Metro employees in discharging their duties.

Hypothesis Conclusion

As per above tables and comparing the opinion of the sample passengers it was found that there was a significant difference in their opinion regarding behaviour of Metro employees. Hence null hypothesis was rejected and it was accepted that passengers are satisfied with the behaviour of employees placed at counters, stations and inside Metro.

5.3.4 HYPOTHESIS- 4

H_{04} (Null Hypothesis): There is no significant association between various independent variables (Gender, Age, Occupational and Purpose of travel) of the sample passengers and their perception about Performance of Metro

H_{14} (Alternate Hypothesis): There is a significant association between various independent variables (Gender, Age, Occupational and Purpose of travel) of the sample passengers and their perception about Performance of Metro

An extensive review of literature suggests that there are many variables which directly or indirectly affect perceptions of passengers about performance of Metro. In this study, the researcher has identified only four independent variables that may have impact on the sample passengers' opinions. Further, performance of Metro has been analyzed by combining- perception about services delivered by Metro, perception about its physical evidences and perception about behaviour of Metro employees. One Way ANOVA was applied to test the aforesaid hypothesis.

5.3.4.1 Association of Respondents' Perception about Services delivered by Metro with their Age

Table 5.48

Comparison of Mean Score of Perception about Services delivered by Metro on Basis of Age Group

Age Group	N	Mean	Std. Deviation	F Value	P Value
Below 20	69	43.290	5.094	23.199	0.000*
20-29 Years	146	41.267	3.447		
30-39 Years	89	47.011	5.234		
40-49 Years	73	43.890	4.733		
50 & Above	38	44.132	4.275		
Total	415	43.559	4.925		

One Way ANOVA Applied, P<0.05 *Significant

The above table shows the comparison of services delivered by Metro on the basis of their Age groups.

The difference among the five groups was found to be statistically significant (P<0.05), showing that mean score of perception about metro services changes with age group. The mean score is higher for age group 30-39 Years and shows the lowest value for 20-29 Years age group. It implies that respondents' age has a significant influence upon their perceptions regarding services delivered by Metro.

To find out pair wise comparison the Post hoc Tukey was applied.

Post Hoc Tukey Test - Individual Group Comparison

Pair wise Comparison		Mean Difference	Std. Error	Sig.
Below 20	20-29 Years	2.023	0.653	0.018*
	30-39 Years	-3.721	0.717	0.000*
	40-49 Years	-0.601	0.750	0.930
	50 & Above	-0.842	0.903	0.884
20-29 Years	30-39 Years	-5.744	0.601	0.000*
	40-49 Years	-2.623	0.641	0.000*
	50 & Above	-2.864	0.814	0.004*
30-39 Years	40-49 Years	3.121	0.706	0.000*
	50 & Above	2.880	0.866	0.008*
40-49 Years	50 & Above	-0.241	0.894	0.999

P Value < 0.05 *Significant

Based on the test, a statistically significant difference was seen between all the groups except between below 20years & 40-49 Years, below 20years & above 50Years age groups and 40-49 Years & 50Years & above age groups. ($P<0.05$), showing that mean scores between the pairs differ with age of the respondents.

5.3.4.2 Association of Respondents' perception about Managing Physical Evidences by Metro with their Age

Table 5.49

Comparison of Mean Score of Perception about Managing Physical Evidences by Metro on Basis of Age Group

Age Group	N	Mean	Std. Deviation	F Value	P Value
Below 20	69	88.014	8.798	25.792	0.000
20-29 Years	146	85.699	7.859		
30-39 Years	89	97.820	10.768		
40-49 Years	73	89.918	9.961		
50 & Above	38	90.684	7.226		
Total	415	89.882	10.063		

One Way ANOVA Applied, P<0 .05 *Significant

The above table shows the comparison of mean scores of perception about managing physical evidences by Metro on the basis of their Age groups.

The difference among the five groups was found to be statistically significant (P<0.05), showing that mean score of perception about managing physical evidences by Metro changes with age group. The mean score is higher for age group 30-39 Years and shows the lowest value for 20-29 Years age group. It implies that respondents' age has a significant influence upon their perceptions regarding managing physical evidences by Metro.

To find out pair wise comparison the Post hoc Tukey was applied.

Post Hoc Tukey Test - Individual Group Comparison

Pair wise Comparison		Mean Difference	Std. Error	Sig.
Below 20	20-29 Years	2.316	1.320	0.402
	30-39 Years	-9.806	1.450	0.000*
	40-49 Years	-1.903	1.518	0.719
	50 & Above	-2.670	1.826	0.588
20-29 Years	30-39 Years	-12.122	1.216	0.000*
	40-49 Years	-4.219	1.296	0.011*
	50 & Above	-4.986	1.646	0.022*
30-39 Years	40-49 Years	7.902	1.427	0.000*
	50 & Above	7.136	1.752	0.001*
40-49 Years	50 & Above	-0.766	1.808	0.993

P Value < 0.05 *Significant

Based on the test, a statistically significant difference was seen between all the groups except between below 20years & 20-29 Years, below 20years & 40-49, below 20years & 50&Above and 40-49 years & 50 Years &Above age groups. ($P<0.05$), showing that mean scores between the pairs differ with age of the respondents.

5.3.4.3 Association of Respondents' perception about Metro Staff Behaviour with their Age

Table 5.50

Comparison of Mean Score of Perception about Metro Staff Behaviour on Basis of Age Group

Age Group	N	Mean	Std. Deviation	F Value	P Value
Below 20	69	15.464	1.558	8.222	0.000
20-29 Years	146	16.014	1.726		
30-39 Years	89	16.506	1.407		
40-49 Years	73	16.260	1.795		
50 & Above	38	17.342	2.602		
Total	415	16.193	1.809		

One Way ANOVA Applied, P<.05 *Significant

The above table shows the comparison of perception about Metro staff behaviour on the basis of their Age groups.

The difference among the five groups was found to be statistically significant (P<0.05), showing that mean score of perception about metro staff behaviour changes with age group. The mean score is higher for age group 50Years & above and shows the lowest value for below 20 Years age group.

To find out pair wise comparison the Post hoc Tukey was applied.

Post Hoc Tukey Test - Individual Group Comparison

Pair wise Comparison		Mean Difference	Std. Error	Sig.
Below 20	20-29 Years	-0.550	0.255	0.200
	30-39 Years	-1.042	0.281	0.002*
	40-49 Years	-0.797	0.294	0.054
	50 & Above	-1.878	0.353	0.000*
20-29 Years	30-39 Years	-0.492	0.235	0.226
	40-49 Years	-0.247	0.251	0.863
	50 & Above	-1.328	0.318	0.000*
30-39 Years	40-49 Years	0.245	0.276	0.901
	50 & Above	-0.836	0.339	0.100
40-49 Years	50 & Above	-1.082	0.350	0.018*

P Value < 0.05 *Significant

Based on the test, a statistically non-significant difference was seen between all the groups except between below 20years & 30-39 Years, below 20years & 50&above, 20-29years & 50&above and 40-49 years & 50&above age groups. (P>0.05), showing that mean scores between the pairs do not differ with age of the respondents.

5.3.4.4 Association of Respondents' perception about Services delivered by Metro with their Gender

Table 5.51

Comparison of Mean Score of Perception about Services delivered by Metro on Basis of Gender

Gender	N	Mean	Std. Deviation	T Value	P Value
Male	224	43.165	5.091	1.770	0.078
Female	191	44.021	4.694		
Total	415	43.559	4.925		

The above table shows the comparison of mean scores of perception about services delivered by Metro on the basis of their Gender.

The difference between the groups was found to be statistically non-significant (P>0.05), showing that mean score does not vary with gender of respondents. The mean score is slightly higher for females as compared to males.

5.3.4.5 Association of Respondents' perception about Managing Physical Evidences by Metro with their Gender

Table 5.52

Comparison of Mean Score of Perception about Managing Physical Evidences by Metro on Basis of Gender

Gender	N	Mean	Std. Deviation	T Value	P Value
Male	224	89.464	10.463	0.915	0.361
Female	191	90.372	9.577		
Total	415	89.882	10.063		

The above table shows the comparison of mean scores of perception about managing physical evidences by Metro on the basis of their Gender.

The difference between the groups was found to be statistically non-significant (P>0.05), showing that mean score does not vary with gender of respondents. The mean score is slightly higher for females as compared to males.

5.3.4.6 Association of Respondents' perception about Metro Staff Behaviour with their Gender

Table 5.53

Comparison of Mean Score of Perception about Metro Staff Behaviour on Basis of Gender

Gender	N	Mean	Std. Deviation	T Value	P Value
Male	224	16.469	1.826	3.410	0.001
Female	191	15.869	1.738		
Total	415	16.193	1.809		

The above table shows the comparison of mean scores of perception about Metro Staff Behaviour on the basis of their Gender.

The difference between the groups was found to be statistically significant (P<0.05), showing that mean score varies with gender of respondents. The mean score is significantly higher for males as compared to females.

5.3.4.7 Association of Respondents' perception about Services delivered by Metro with their Occupation

Table 5.54

Comparison of Mean Score of Perception about Services delivered by Metro on Basis of Occupation

Occupation	N	Mean	Std. Deviation	F Value	P Value
Student	230	42.583	3.993	10.691	0.000
Business	22	44.545	3.501		
Service	102	45.765	6.586		
Professional	28	41.214	3.655		
Others	33	44.879	3.714		
Total	415	43.559	4.925		

One Way ANOVA Applied, P< .05 *Significant

The above table shows the comparison of mean scores of perception about services delivered by Metro on the basis of their Occupation.

The difference among the five groups was found to be statistically significant (P<0.05), showing that mean score of perception about metro services changes with occupation of respondents. The mean score is higher for service class commuters and shows the lowest value for professionals.

To find out pair wise comparison the Post hoc Tukey was applied.

Post Hoc Tukey Test - Individual Group Comparison

Pair wise Comparison		Mean Difference	Std. Error	Sig.
Student	Business	-1.963	1.051	0.336
	Service	-3.182*	0.560	0.000*
	Professional	1.368	0.943	0.595
	Others	-2.296	0.877	0.069
Business	Service	-1.219	1.107	0.806
	Professional	3.331	1.342	0.096
	Others	-0.333	1.296	0.999
Service	Professional	4.550*	1.005	0.000*
	Others	0.886	0.943	0.881
Professional	Others	-3.665*	1.210	0.022*

P Value < 0.05 *Significant

Based on the test, a statistically non-significant difference was seen between all the groups except between students & servicemen, servicemen & professionals, and professionals & others. (P>0.05), showing that mean scores between the pairs do not differ with occupation of the respondents.

5.3.4.8 Association of Respondents' perception about Managing Physical Evidences by Metro with their Occupation

Occupation

Table 5.55

Comparison of Mean Score of Perception about Managing Physical Evidences by Metro on Basis of Occupation

Occupation	N	Mean	Std. Deviation	F Value	P Value
Student	230	87.617	7.879	12.838	0.000
Business	22	91.955	6.615		
Service	102	95.216	13.750		
Professional	28	85.929	8.322		
Others	33	91.152	6.016		
Total	415	89.882	10.063		

One Way ANOVA Applied, P<.05 *Significant

The above table shows the comparison of mean scores of perception about managing physical evidences by Metro on the basis of their Occupation.

The difference among the five groups was found to be statistically significant (P<0.05), showing that mean score of perception about metro facilities changes with occupation of respondents. The mean score is higher for service class commuters and shows the lowest value for professionals.

To find out pair wise comparison the Post hoc Tukey was applied.

Post Hoc Tukey Test - Individual Group Comparison

Pair wise Comparison		Mean Difference	Std. Error	Sig.
Student	Business	-4.337	2.127	0.249
	Service	-7.598*	1.134	0.000*
	Professional	1.689	1.908	0.902
	Others	-3.534	1.775	0.272
Business	Service	-3.261	2.241	0.592
	Professional	6.026	2.716	0.175
	Others	0.803	2.624	0.998
Service	Professional	9.287*	2.034	0.000*
	Others	4.064	1.909	0.210
Professional	Others	-5.223	2.449	0.208

P Value < 0.05 *Significant

Based on the test, a statistically non-significant difference was seen between all the groups except between students & servicemen, and servicemen & professionals. (P>0.05), showing that mean scores between the pairs do not differ with occupation of the respondents.

5.3.4.9 Association of Respondents' perception about Metro Staff Behaviour with their Occupation

Table 5.56

Comparison of Mean Score of Perception about Metro Staff Behaviour on Basis of Occupation

Occupation	N	Mean	Std. Deviation	F Value	P Value
Student	230	15.878	1.810	6.276	0.000
Business	22	16.682	2.033		
Service	102	16.412	1.498		
Professional	28	16.214	1.931		
Others	33	17.364	1.868		
Total	415	16.193	1.809		

One Way ANOVA Applied, P<0.05 *Significant

The above table shows the comparison of mean scores of perception about Metro staff behaviour on the basis of their occupation.

The difference among the five groups was found to be statistically significant (P<0.05), showing that mean score of perception about metro staff behaviour changes with occupation of respondents. The mean score is higher for others (housewives, tourists, labours etc.) and shows the lowest value for students.

To find out pair wise comparison the Post hoc Tukey was applied.

Post Hoc Tukey Test - Individual Group Comparison

Pair wise Comparison		Mean Difference	Std. Error	Sig.
Student	Business	-0.804	0.394	0.248
	Service	-0.534	0.210	0.084
	Professional	-0.336	0.353	0.876
	Others	-1.485*	0.328	0.000*
Business	Service	0.270	0.415	0.966
	Professional	0.468	0.503	0.885
	Others	-0.682	0.486	0.625
Service	Professional	0.197	0.376	0.985
	Others	-0.952	0.353	0.057
Professional	Others	-1.149	0.453	0.085

P Value < 0.05 *Significant

Based on the test, a statistically significant difference was seen between only one pair i.e. between Servicemen & Others. (P>0.05), showing that mean scores between the pairs do not differ with occupation of the respondents.

5.3.4.10 Association of Respondents' perception about Services delivered by Metro with Purpose of Travel

Table 5.57

Comparison of Mean Score of Perception about Services delivered by Metro on Basis of Purpose of Travel

Purpose of Travel	N	Mean	Std. Deviation	F Value	P Value
Study	226	42.907	3.921	39.114	0.000
Employment	94	47.085	5.918		
House Hold	48	44.125	2.915		
Touring	47	39.064	3.886		
Total	415	43.559	4.925		

One Way ANOVA Applied, P<.05 *Significant

The above table shows the comparison of mean scores of perception about services delivered by Metro on the basis of their Purpose of Travel.

The difference among the five groups was found to be statistically significant (P<0.05), showing that mean score of perception about metro services changes with Purpose of Travel. The mean score is higher for those who prefer Metro to reach to their work stations and shows the lowest value for those who use it for touring.

To find out pair wise comparison the Post hoc Tukey was applied.

Post Hoc Tukey Test - Individual Group Comparison

Pair wise Comparison		Mean Difference	Std. Error	Sig.
Study	Employment	-4.178	0.535	0.000*
	House Hold	-1.218	0.693	0.295
	Touring	3.843	0.699	0.000*
Employment	House Hold	2.960	0.773	0.001*
	Touring	8.021	0.779	0.000*
House Hold	Touring	5.061	0.895	0.000*

P Value < 0.05 *Significant

Based on the test, a statistically significant difference was seen between all the groups except between study & household purpose group. (P<0.05), showing that mean scores between the pairs differ with respondents' purpose of visit in Metro.

5.3.4.11 Association of Respondents' perception about Managing Physical Evidences by Metro with Purpose of Travel

Table 5.58

Comparison of Mean Score of Perception about Managing Physical Evidences by Metro on Basis of Purpose of Travel

Purpose of Travel	N	Mean	Std. Deviation	F Value	P Value
Study	226	88.363	7.741	44.455	0.000
Employment	94	97.957	12.304		
House Hold	48	89.813	4.365		
Touring	47	81.106	8.333		
Total	415	89.882	10.063		

One Way ANOVA Applied, P< .05 *Significant

The above table shows the comparison of mean scores of perception about managing physical evidences by Metro on the basis of their Purpose of Travel.

The difference among the five groups was found to be statistically significant (P<0.05), showing that mean score of perception about metro facilities changes with Purpose of Travel. The mean score is higher for those who prefer Metro to reach to their work stations and shows the lowest value for those who use it for touring.

To find out pair wise comparison the Post hoc Tukey was applied.

Post Hoc Tukey Test - Individual Group Comparison

Pair wise Comparison		**Mean Difference**	**Std. Error**	**Sig.**
Study	Employment	-9.595	1.077	0.000*****
	House Hold	-1.450	1.395	0.726
	Touring	7.256	1.407	0.000*****
Employment	House Hold	8.145	1.557	0.000*****
	Touring	16.851	1.568	0.000*****
House Hold	Touring	8.706	1.801	0.000*****

P Value < 0.05 *Significant

Based on the test, a statistically significant difference was seen between all the groups except between study & household purpose group. (P<0.05), showing that mean scores between the pairs differ with respondents' purpose of visit in Metro.

5.3.4.12 Association of Respondents' perception about Metro Staff Behaviour with Purpose of Travel

Table 5.59

Comparison of Mean Score of Perception about Metro Staff Behaviour on Basis of Purpose of Travel

Purpose of Travel	N	Mean	Std. Deviation	F Value	P Value
Study	226	15.867	1.766	10.878	0.000
Employment	94	16.713	1.617		
House Hold	48	17.125	2.209		
Touring	47	15.766	1.322		
Total	415	16.193	1.809		

One Way ANOVA Applied, P<.05 *Significant

The above table shows the comparison of mean scores of perception about Metro staff behaviour on the basis of their Purpose of Travel.

The difference among the five groups was found to be statistically significant (P<0.05), showing that mean score of perception about metro staff behaviour changes with Purpose of Travel. The mean score is higher for those who use it for household works and shows the lowest value for those who use it for touring.

To find out pair wise comparison the Post hoc Tukey was applied.

Post Hoc Tukey Test - Individual Group Comparison

Pair wise Comparison		Mean Difference	Std. Error	Sig.
Study	Employment	-0.846	0.214	0.001*
	House Hold	-1.258	0.278	0.000*
	Touring	0.101	0.280	0.984
Employment	House Hold	-0.412	0.310	0.544
	Touring	0.947	0.312	0.014*
House Hold	Touring	1.359	0.359	0.001*

P Value < 0.05 *Significant

Based on the test, a statistically significant difference was seen between all the groups except between study & touring, and employment & household purpose group. ($P<0.05$), showing that mean scores between the pairs differ with respondents' purpose of visit in Metro.

Hypothesis Conclusion

As per above tables and comparing the opinion of the sample passengers it was found that mean scores of their perceptions about Metro services and its physical evidences change with age, occupation and purpose of travelling. However, their perceptions do not vary with their gender implying a non-significant impact of gender on their perceptions.

Further, mean scores of perceptions about the behaviour of Metro employees change with their age, gender, occupation and purpose of travelling. Hence null hypothesis was rejected and it was accepted a significant association lies between various independent variables (Gender, Age, Occupational and Purpose of travel) of the sample passengers and their perception about Performance of Metro.

5.3.5 HYPOTHESIS- 5

H_{05} (Null Hypothesis): There is no significant impact of Metro on other means of transport

H_{15} (Alternate Hypothesis): There is a significant impact of Metro on other means of transport

For testing this hypothesis, a representative sample of para transport operators including drivers of taxies, autos and buses was chosen to know their perceptions about the impact of Metro on their daily operations. A separate questionnaire was framed to get their responses, a copy of which is enclosed as annexure. A pre – post comparison analysis was done to identify the impact of Metro on their business. For this Z- test for two sample proportion was applied to compare pre and post performance of para transport operators. For the sake of better understanding, the researcher has presented the data in graphical manner too.

5.3.5.1 Para transit operators' perception about Impact of Metro on their daily income

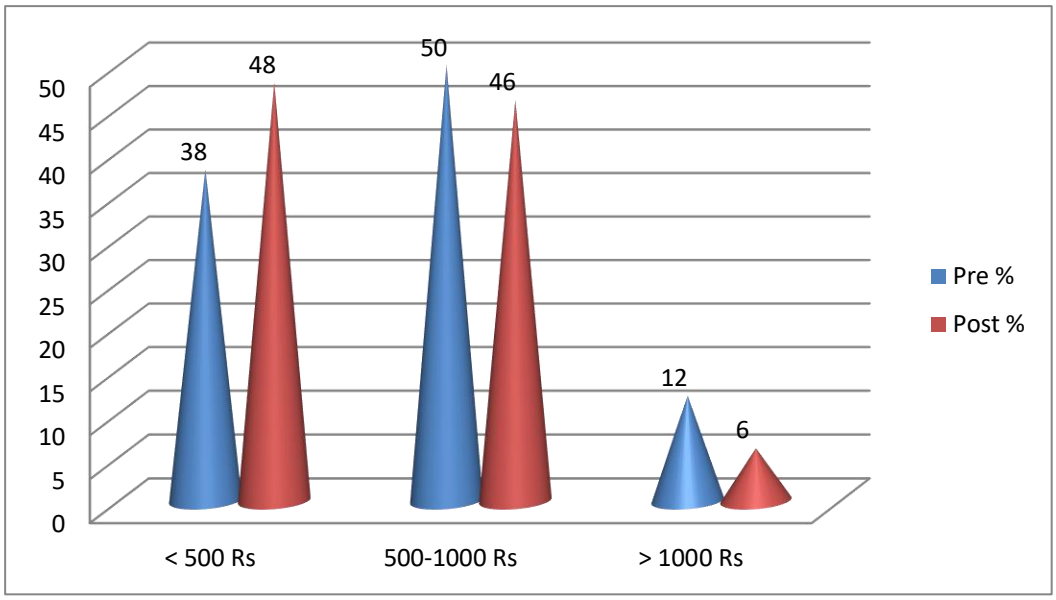
Table 5.60

Impact of Metro on Daily Income of Para- transport Operators

Daily Income	**Before commencement of Metro**		**After Commencement of Metro**		P Value	Result
	Frequency	Percent	Frequency	Percent		
< 500 Rs	19	38.0	24	48.0	0.311	Non Sig
500-1000 Rs	25	50.0	23	46.0	0.689	Non Sig
> 1000 Rs	6	12.0	3	6.0	0.292	Non Sig
Total	50	100.0	50	100.0		

Chart 5.16

Impact of Metro on Daily Income of Para- transport Operators



Z- test for two sample proportion was applied to determine the significant difference if any, between the daily income earned by para transport operators during before and after commencing of Metro.

It is evident from the above table that previously 38 percent of the sample operators were earning less than Rs. 500 daily but after commencing of Metro their percentage has increased to 48. On the other hand, those whose daily income was between Rs. 500-1000 have decreased in percentage from 50 to 46 whilst those earning more than Rs. 1000 have also decreased in percentage from 12 to 6. However, in all the cases, the difference was statistically non- significant ($p > 0.05$).

Hence it can be concluded that there was no significant change in the daily earnings for para transport operators due to commencement of Metro services. Few of them show that their earning reduces to less than Rs 500 and very few shows shifting from more than 1000 to earning between Rs 500-1000, it may be due to decrease in long distance operations but simultaneously there was an increase in number of short distances customers.

5.3.5.2 Para transit operators' perception about Impact of Metro on their Number of Trips per day

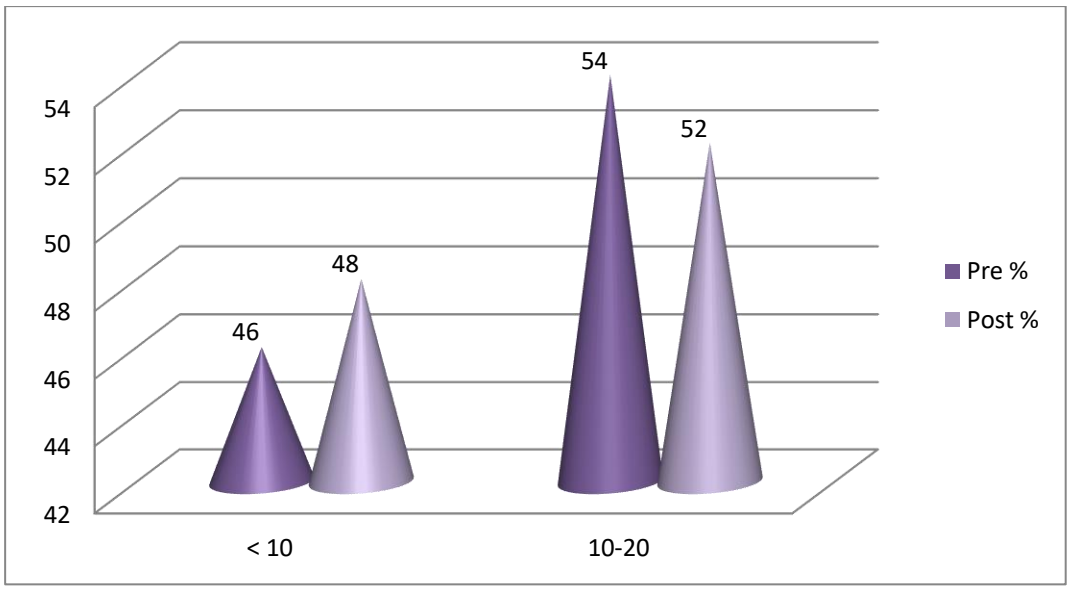
Table 5.61

Impact of Metro on the Number of Trips per day by Para- transport Operators

Trips Per Day	Before commencement of Metro		After Commencement of Metro		P Value	Result
	Frequency	Percent	Frequency	Percent		
< 10	23	46.0	24	48.0	0.841	Non Sig
10-20	27	54.0	26	52.0	0.841	Non Sig
Total	50	100.0	50	100.0		

Chart 5.17

Impact of Metro on the Number of Trips per day by Para- transport Operators



Z- test for two sample proportion was applied to determine the significant difference if any, between the trips per day done by Para-transport operators during before and after the commencement of Metro.

It is evident from above table that the operators having less than 10 trips daily has increased from 46 per cent to 48 per cent after commencing of Metro. On the other hand, those who were doing 10-20 trips daily have decreased in percentage from 54 to 52. However, in both cases, the difference was statistically non- significant ($p > 0.05$).

Hence it can be concluded that there is no decrease in number of trips of para transport operators due to Metro services. Surely their trips for metro stations increase for short distances travelling.

5.3.5.3 Para transit operators' perception about Impact of Metro on their Average Working Hours per day

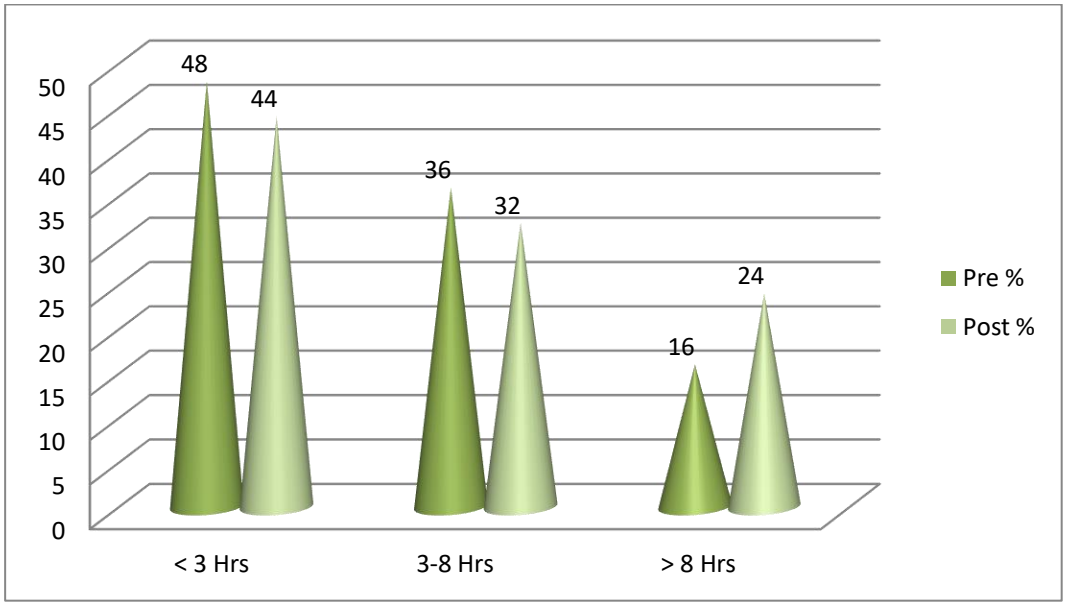
Table 5.62

Impact of Metro on Average Working Hours per day spent by Para- transport Operators

Average Working Hours	**Before commencement of Metro**		**After Commencement of Metro**		P Value	Result
	Frequency	Percent	Frequency	Percent		
< 3 Hrs	24	48.0	22	44.0	0.688	Non Sig
3-8 Hrs	18	36.0	16	32.0	0.673	Non Sig
> 8 Hrs	8	16.0	12	24.0	0.315	Non Sig
Total	50	100.0	50	100.0		

Chart 5.18

Impact of Metro on Average Working Hours per day spent by Para- transport Operators



Z- test for two sample proportion was applied to determine the significant difference if any, between the average working hours spent by Para-transport operators during before and after commencing of Metro operations.

It is evident from the above table that previously 24 percent of the sample operators were working for less than 3 hours but after commencing of Metro their percentage has decreased to 22 and those working for 3-8 hours daily have also decreased from 18 per cent to 16 per cent. On the other hand, those who were spending more than 8 hours daily on their work have increased from 8 to 12 per cent. However, in all the cases, the difference was statistically non- significant ($p > 0.05$).

Hence it can be concluded that their average working hours has slightly increased to more than 8 hours may be due to operating time of metro trains. Now they have to start early in the morning and take trips till late night.

5.3.5.4 Para transit operators' perception about Impact of Metro on Average Delay Time due to Traffic Congestion

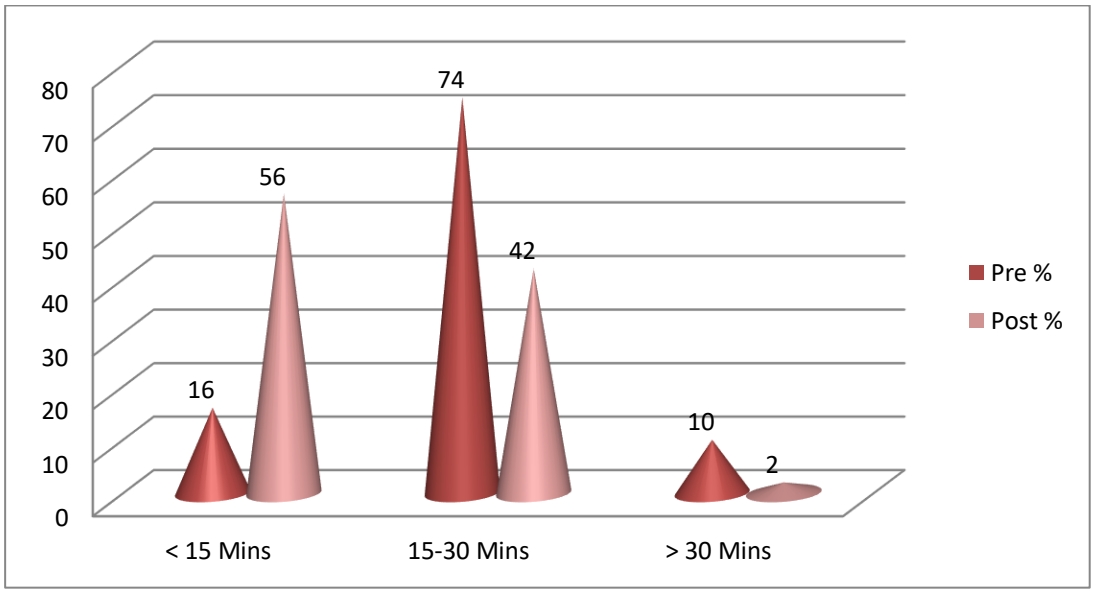
Table 5.63

Impact of Metro on Average Delay Time due to Traffic Congestion faced by Para-transport Operators

Average Delay Time due to traffic congestion	Pre Metro		Post Metro		P Value	Result
	Frequency	Percent	Frequency	Percent		
< 15 Mins	8	16.0	28	56.0	0.000	Significant
15-30 Mins	37	74.0	21	42.0	0.001	Significant
> 30 Mins	5	10.0	1	2.0	0.088	Non Sig
Total	50	100.0	50	100.0		

Chart 5.19

Impact of Metro on Average Delay Time due to Traffic Congestion faced by Para-transport Operators



Z- test for two sample proportion was applied to determine the significant difference if any, between average Delay Time due to Traffic Congestion faced by Para-transport operators during before and after commencing of Metro operations.

It is observed from the above table that previously 74 percent of the sample operators were stuck in traffic and got delayed by 15-30 minutes to reach the destination but after commencing of Metro their percentage has decreased significantly ($p< 0.05$) to only 42 per cent and those who got delayed for less than 15 minutes has increased significantly ($p<0.05$) from 16 per cent to 56 per cent. On the other hand, those who were spending more than 30 minutes in traffic congestion has decreased from 10 per cent to 2 per cent which was statistically non- significant ($p> 0.05$).

Hence it can be concluded that there was a positive impact on traffic congestion faced by para operator transport operators and now they are able to reach their destination either on time or with very little delay of time.

5.3.5.5 Para transit operators' perception about Impact of Metro on Demand for Autos and Buses at Metro Stations

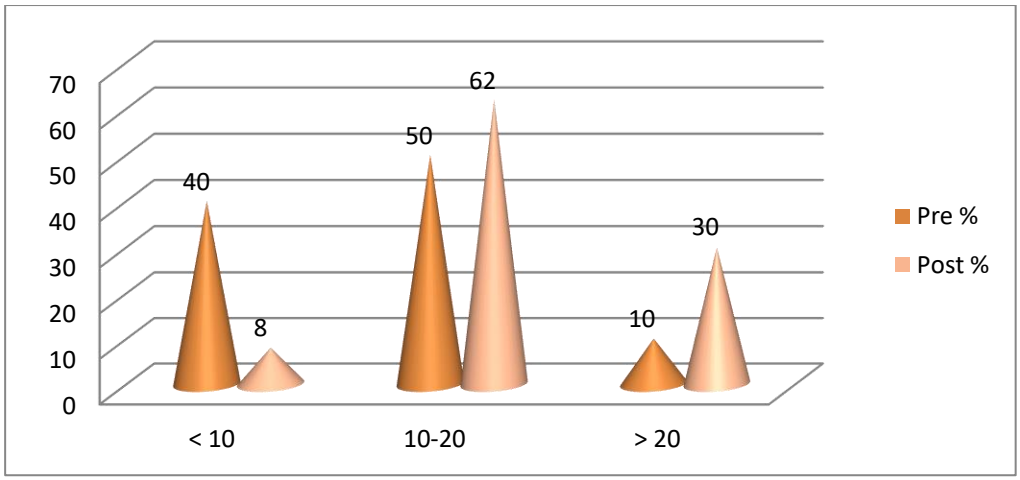
Table 5.64

Impact of Metro on Demand for Autos and Buses at Metro Stations

Demand for Autos/ Buses	Pre Metro		Post Metro		P Value	Result
	Frequency	Percent	Frequency	Percent		
< 10	20	40.0	4	8.0	0.000	Significant
10-20	25	50.0	31	62.0	0.223	Non Sig
> 20	5	10.0	15	30.0	0.010	Significant
Total	50	100.0	50	100.0		

Chart 5.20

Impact of Metro on Demand for Autos and Buses at Metro Stations



Z- test for two sample proportion was applied to determine the significant difference if any, between the demand for Autos and connected local Buses at Metro stations for nearby destinations by the metro users during before and after commencing of Metro operations.

It is observed from the above table that previously demand of more than 20 autos or buses was only 10 per cent which increased significantly to 30 per cent after commencing of Metro. This increase was due to higher demand by metro users to reach nearby destinations.

Initially demand of less than 10 autos or buses was 40 percent which significantly reduced to only 8 percent ($p< 0.05$). On the other hand, demand of 10-20 autos or buses has increased from 50 percent to 62 percent, but it was statistically non- significant ($p> 0.05$).

Hence it can be concluded that there was positive impact on demand of autos and local buses for short distance or to and fro travelling from metro stations. Metro users are now using more autos and connecting buses to reach to metro stations which have positive impact on para- operators' daily earnings.

Hypothesis Conclusion

As per above analyses and comparing the opinion of the sample operators of para – transport modes it was found that there was a non-significant impact of Metro on other modes of transport. However, for long distance travel people started preferring Metro whilst for short distance travel they still use other modes of transport. Hence null hypothesis stood accepted that operators of other modes of transport have not been affected significantly by Metro operations.

5.4 HYPOTHESES VIEWED AS PER THE ANALYSIS

1. As per the analysis null hypothesis was rejected and it was accepted that Metro is delivering services as per the expectations of the passengers. (time, cost, availability, safety).

2. Null hypothesis stood rejected and it was accepted that Metro is managing well its physical evidences.

3. Null hypothesis was rejected and it was accepted that Passengers are satisfied with the behavior of Metro's employees.

4. Null hypothesis got rejected and it was accepted that there is a significant association between various independent variables (Gender, Age, Occupational and Purpose of travel) of the sample passengers and their satisfaction level.

5. Null hypothesis was accepted that there is no significant impact of Metro on other means of transport.

CHAPTER 6

MAJOR FINDINGS AND CONCLUSION

CHAPTER VI

MAJOR FINDINGS AND CONCLUSION

INTRODUCTION

In chapter V, analysis of collected data pertaining to the study was performed using appropriate statistical tools to get the outcome of the present research. With the help of results derived from the previous chapter, major findings of the present study have been discussed here. This chapter highlights perception of sample passengers on performance of Metro and its impact on other means of transport. Moreover, this chapter also presents the conclusion drawn from the study.

6.1 MAJOR FINDINGS OF THE STUDY

Over the years, the demand for transport has increased in big cities which has seriously affected the urban ecosystem. Due to inadequate public transport facilities, number of private vehicles on roads has increased resulting into congestion and air pollution, in turn causing a number of health problems. In order to avoid such problems, an ecologically sustainable urban transport system is required which the metro rail aims to fulfill. Jaipur metro provides a number of incentives to commuters, both tangible and intangible, to make a switch from the previous mode of transport. This section discusses some of those incentives and appeals. This section summarizes the findings of the study on the basis of the data analysis.

6.1.1 PASSENGERS' PROFILE AND GENERAL INFORMATION

- A majority of sample passengers belonged to the age group of 20-29 years followed by 30-39 years. It implies that majority of Metro passengers are youth.

- A majority of the sample passengers i.e. 54 per cent were male while only 46 per cent were female.

- Maximum sample passengers were students followed by service class people, professionals and business owners respectively.

- A majority of the sample passengers did not belong to disabled category while only 4.1 per cent were disabled.

- Most of the sample passengers i.e. 33.7 per cent were using Metro as their preferred mode of transport. About 31.1 per cent usually travel by their own vehicle; nearly 25 per cent were travelling by buses whilst only 9.6 per cent were travelling by other modes including taxies, auto rickshaw, cycle rickshaw etc.

- The maximum number of the sample passengers i.e. 27.5 per cent was travelling by Metro almost daily. About 21.7 per cent had been using Metro occasionally whilst 21.2 per cent were using very rarely, nearly 16 per cent rarely and only 14 per cent were weekly travelling by Metro.

- Most of the sample passengers, i.e., 54.5 per cent were travelling by Metro for their study purpose. About 23 per cent for employment purpose whilst 11.6 per cent for household purpose and only 11.3 per cent was travelling by Metro for touring purpose.

- A majority of the sample passengers i.e. 54.2 per cent stated traffic congestion as the most serious problem which they have to face while moving in the city. About 20 per cent reported that they do not get suitable mode of transport that can fulfill their requirements, nearly 16 per cent were not getting reasonable mode of transport whilst only 9.9 per cent were bothered with security issues prevalent in the present transportation system.

- The maximum number of the sample passengers has agreed that Metro is the best choice to get relieved from traffic congestion.

- The maximum number of the sample passengers has agreed about the necessity of Metro in Jaipur city.

- Most of the sample passengers have agreed that Metro has affected the demand of other means of transport.

- Most of the sample passengers were satisfied with the facility of separate lines for women and disabled.

- The maximum number of sample passengers i.e. 51.1 per cent has stated that they use Metro mobile app sometimes. About 28 per cent have used it daily whilst 20.5 per cent have never used the app.

- A majority of the respondents i.e. 61 per cent have reported that they prefer buying tickets for travelling by Metro. About 22 per cent preferred metro card whilst nearly 17 per cent have no preference of any mode.

- The maximum number of sample passengers i.e. 50.8 per cent has agreed about paying cash for buying tickets, about 33 per cent were using bank card whilst nearly 16 per cent were using both the modes to pay for the ticket.

6.1.2 SERVICES DELIVERED BY METRO

- A Statistical significant difference was found in the opinions of the sample passengers and it was accepted that a majority of respondents have agreed the fact that Metro is charging reasonable fare for its services.

- Most of the respondents have agreed about no requirement of any revision in existing fare of Metro. It implies that a majority of the sample passengers do not want any change in the existing fare.

- Most of the respondents have agreed about the adequate frequency of Metro and the difference in their opinion was found significant.

- A majority of the respondents have agreed that they reach on time to the desired destination by Metro.

- Most of the respondents have agreed about saving in travel time using Metro.

- Most of the sample passengers have agreed about the provision of proper security arrangements inside Metro.

- A majority of the sample passengers have agreed about the adequacy of security provided by Metro authorities at stations and platforms.

Hence it can be concluded that sample passengers are satisfied with the services delivered by Jaipur Metro and it has been successful in meeting their expectations. It is a better choice that helps in saving time and cost, and ensures on time availability, and safety to the users.

6.1.3 FACILITIES PROVIDED BY METRO (INSIDE AND AT STATIONS)

Inside Metro

- Most of the respondents were satisfied with the cleanliness evident inside Metro.

- A majority of the sample passengers were satisfied with the fact that Metro properly maintains its coaches.

- As per majority of the sample passengers Metro has proper watering arrangements inside the train.

- Most of the respondents were satisfied with availability of ladies coaches inside Metro.

- A majority of the sample passengers were satisfied with the fact that Metro provides medical assistance during emergencies.

- A majority of the respondents were satisfied with mobile charging facility provided by Metro.

At stations

- Most of the respondents were satisfied with the fact that Metro provides facilities for physically challenged people.

- A majority of the respondents were satisfied with the cleanliness exercised by Metro at stations and platforms.

- Most of the sample passengers were satisfied with drinking water arrangements done at platforms and stations.

- Most of the sample passengers were satisfied with the fact that Metro properly maintains waiting areas at various stations.

- A majority of the respondents were satisfied with the seating, fans and lighting facilities provided by Metro at stations and platforms.

- Most of the respondents were satisfied with pay and use toilets facility at Metro stations.

- Most of the respondents were satisfied with the fact that Metro provides ATM facility at stations.

- A majority of the respondents were satisfied with the refreshment/food plazas facility provided by Metro authorities at stations and platforms.

- Most of the respondents were satisfied with touch screen system facility at Metro stations.

- As per majority of the respondents Metro properly maintains signage and coach indication boards at its stations.

- A majority of the respondents were satisfied with Television and Audio systems facility at Metro stations.
- Most of the respondents were satisfied with the fact that Metro provides proper parking facility at its stations.

- A majority of respondents were satisfied with the feeder vehicles provided by Metro outside stations.

Therefore, it can be concluded that Jaipur Metro has been capable in properly managing its physical evidences thus extending passenger satisfaction.

6.1.4 BEHAVIOUR OF METRO EMPLOYEES

- Most of the sample passengers were satisfied with the behaviour of Metro employees placed on the counter.

- A majority of the respondents were satisfied with the behaviour of Metro employees placed at the station.

- Maximum respondents were satisfied with the behaviour of Metro employees in the train

- Most of the respondents were satisfied with sincerity of Metro employees in discharging their duties.

Hence it can be concluded that most of the sample passengers are satisfied with the behaviour of employees placed at counters, stations and inside Metro.

6.1.5 ASSOCIATION OF RESPONDENTS' PERCEPTION ABOUT THE PERFORMANCE OF METRO WITH INDEPENDENT VARIABLES (AGE, GENDER, OCCUPATION AND PURPOSE OF TRAVELLING)

- As the mean score of perception about Metro services and physical evidences managed by Metro change with age, occupation and purpose of travelling, it can be concluded that these variables have a significant influence upon their perceptions regarding services delivered by Metro and its physical evidences. However, their perceptions do not vary with their gender implying a non-significant impact of gender on their perceptions.

- The mean score of perception about the behaviour of Metro employees changes with their age, gender, occupation and purpose of travelling, it can be concluded that these variables have a significant influence upon their perceptions regarding behavior of Metro employees.

6.1.6 IMPACT OF METRO ON OTHER MEANS OF TRANSPORT

- No significant difference was found in the daily earnings for para transport operators due to commencement of Metro services. Few of them reported that their earnings reduced after commencing Metro, that may be due to decrease in long distance operations but simultaneously there was an increase in number of short distances customers.

- A non-significant difference was found between the average working hours spent by Para-transport operators during before and after commencing of Metro operations. It was observed that their average working hours has slightly increased to more than 8 hours may be due to operating time of metro trains. Now they have to start early in the morning and take trips till late night.

- It has been observed that previously 74 percent of the sample operators were stuck in traffic and got delayed by 15-30 minutes to reach the destination but after commencing of Metro their percentage has decreased significantly to only 42 per cent and those who got delayed for less than 15 minutes has increased significantly from 16 per cent to 56 per cent. On the other hand, those who were spending more than 30 minutes in traffic congestion have decreased from 10 per cent to 2 per cent which was statistically non- significant. Hence, it can be said that there was a positive impact on traffic congestion faced by para operator transport operators and now they are able to reach their destination either on time or with a very little delay time.

Therefore, it can be concluded that there was a non-significant impact of Metro on other modes of transport. However, for long distance travel people started preferring Metro whilst for short distance travel they still use other modes of transport.

6.2 CONCLUSION

The results of stated hypotheses conclude the findings of the study as,

Table 6.1

Hypothesis Testing Results

Hypothesis			Result
H1	Null	Metro is not delivering services as per the expectations of the passengers. (time, cost, availability, safety)	Reject
	Alternate	Metro is delivering services as per the expectations of the passengers. (time, cost, availability, safety)	Accept
H2	Null	Metro is not managing well its physical evidences.	Reject
	Alternate	Metro is managing well its physical evidences.	Accept
H3	Null	Passengers are not satisfied with the behavior of Metro's employees.	Reject
	Alternate	Passengers are satisfied with the behavior of Metro's employees.	Accept
H4	Null	There is no significant association between various independent variables (Gender, Age, Occupational and Purpose of travel) of the sample passengers and their satisfaction level.	Reject
	Alternate	There is a significant association between various independent variables (Gender, Age, Occupational and Purpose of travel) of the sample passengers and their satisfaction level.	Accept
H5	Null	There is no significant impact of Metro on other means of transport.	Accept
	Alternate	There is a significant impact of Metro on other means of transport.	Reject

As observed in the Detailed Project Report (DPR) of Jaipur Metro, it is a step towards urban transformation. Created mainly for improving the transportation system, the metro project is envisaged to provide a safe and reliable rapid transport system in Jaipur, improving general mobility, enhancing the quality of life and making city more pleasant to live and work.

Phase IA of Jaipur Metro named as 'Pink line' is one of the fastest project implementation in Metro sector. As it is doing well in terms of average daily ridership, prospects are bright that it would be able to achieve its goals in near future and establish itself as the preferred mode of travel and would contribute in meeting social obligations of the welfare state

As can be extracted from the study, the metro has been successful in reducing traffic congestion, providing services to passengers as desired, thus making it the suitable alternative for them. However, it is important to note whether the establishment of the metro has been affecting the operations of other means of transport.

Still, Jaipur Metro is in its nascent stage, it is all set to be expanded in near future. With on-going construction work, the metro would add new trains in the existing lines and the completion of the remaining phases thus improving the frequency and reach. As work progresses, there is a high possibility for existing issues to be resolved and commuters in Jaipur being provided with good quality services.

As lot of people are willing to choose Jaipur Metro as their preferred mode over other modes of transportation, still it is unclear whether the metro service will have any adverse impact on other modes of public transportation such as buses, rickshaws, autos, taxis, etc. As per the present analysis it can be predicted that for long distance travel Metro can be the best solution and thus would affect the operations of other modes of transport.

CHAPTER 7

RECOMMENDATIONS

CHAPTER VII

RECOMMENDATIONS

7.1 INTRODUCTION

In the last chapter, the researcher has discussed major findings of the study and the conclusion derived from the study. Listing the main findings of the research and relating these to the objectives mentioned in Chapter 4, it was then possible to make relevant recommendations based on the findings. This chapter is an attempt to extend recommendations based on findings of the study to improve the present system for better customer experience and support people whose earnings are getting affected by Metro operations. Furthermore, since the present study does not cover all the aspects pertaining to the assessment of Jaipur Metro, further studies can be done to examine uncovered areas that have been suggested by the researcher in this chapter.

The present study provides a good explanation of variation in sample passengers' perceptions about various aspects of Jaipur Metro based on age, gender, occupation, and purpose of visit. The findings and suggestions have significant bearing for both passengers and for planners also. On one hand planners would be able to resolve existing issues pertaining to transportation system in Jaipur and to provide passengers complete satisfaction and on the other hand passengers' needs and aspirations could be catered in a better way. Depending upon present study future researcher could devote their time and energy on elaborating differences based on individual constructs.

7.2 RECOMMENDATIONS

- In order to ensure security to passengers in all manners, separate coaches for women only should be added. In future, as the number of passengers has been increasing day by day, number of security guards can be increased to avoid threats from pick-pocketers and mischievous people.

- A travelling experience is always good and memorable when it is comfortable and hassle free. Jaipur Metro should make its customer interface more

simplified. Customers expect consistency in service across all channels of communication therefore better customer support should be ensured.

- Although wheel chairs for passengers with disabilities are available at Metro stations, other infrastructure facilities such as footpaths, feeder services etc. should be developed around Metro to provide them desired comfort and ease.

- Problems pertaining to the frequency of the metro, the time taken by its feeder services, parking issues etc. should be resolved. Parking facility should be offered at minimum rent for regular passengers. For them, parking card may be issued.

- Lift & escalator facility should be provided at stations wherever needed.

- Jaipur Metro may be promoted as a point of tourist attraction by adding some coaches especially for them that may have features like palace on wheels.

- In future, the coaches should have reserving seats for women, disabled and elderly people.

- An effective Grievance Redressal Cell should be placed at every station to ensure timely resolution of passengers' complaints.

- In order to protect the interest of para-transit operators, they can be employed by Metro authorities to drive feeder vehicles arranged by Metro or for performing other duties that match with their skills.

- For encouraging people to travel by Metro, Government as well as private employers may issue metro cards to their employees at subsidized rates to use it to travel to and from their office. This would help in reducing congestion on roads, thus save travellers' time and decrease pollution in the city.

- There is a need to revisit the metro rail project and critically review it. An independent expert group should conduct the review based on clear, objective criteria and examine all aspects such as their justification, governance, accountability, viability and integration with other modes, and the review findings should be publicly debated.

7.3 FUTURE SCOPE OF THE STUDY

1. A comparative study between the performances of different Metros could be done with reference to impact on other modes of travelling.

2. To examine the impact of Jaipur Metro in true manner, the study with similar objectives could be done after completing all the phases.

3. The identification of the reaction of general public influenced by this project would be of much use to planners.

4. The study can be extended to assessing employee satisfaction at Jaipur Metro.

5. Further studies may cover social cost benefit analysis and financial appraisal of this project to evaluate its actual performance.

SUMMARY

SUMMARY

In this study, an attempt has been made to judge the overall satisfaction that customers are deriving from using Metro by considering all the components of its Marketing Mix. Since service marketing mix consists of 7Ps, including, product, price, place, promotion, people, physical evidences and process, a user survey based on these attributes of Metro may help to explore the satisfaction level of its users. Further, in order to assess the impact of Metro on other means of transport, an assessment of their present status by contacting them directly can strengthen the outcome of the study. It includes a pre-post analysis of factors that have affected their livelihood, including, trips taken by them, time taken to run a trip, their daily earnings, and demand for para-transport in Metro Corridor etc.

To determine the level of satisfaction consumers are deriving using Metro in Jaipur and its impact on other means of transport, the topic of the study was identified and titled as,

"A Critical Evaluation of Impact of Jaipur Metro on Means of Transport"

The main objectives of the present research work are as follows:

1. To find out the importance attached to the various aspects of Jaipur Metro by passengers.
2. To know about services delivered by Jaipur Metro and their capability to meet passengers' expectations.
3. To examine how Metro manages its physical evidences including facilities inside Metro and at stations.
4. To identify the level of passenger satisfaction towards the behaviour of employees of Jaipur Metro.
5. To identify the impact of various demographic variables on passengers' perceptions about performance of Metro.
6. To study the impact of Jaipur Metro on the performance, productivity and status of other means of transport.

7. To find out the problem pertaining to the Jaipur Metro and other means of transport and thereafter suggest the remedial measures.

The researcher has adopted descriptive research design for the present study. The study is largely empirical in approach. Purposive Random Sampling has been used to collect data relevant to solve the problem under study. Sampling units i.e. respondents have been selected from various metro stations located in Jaipur. The sample size of the present research work comprises of 415 passengers and 50 para transport operators.

The researcher has used a variety of statistical techniques to the data to test stated hypotheses, including Percentage analysis, Chi- square test (goodness of fit), One Way ANOVA and Z- test for two sample proportion.

Hypotheses viewed as per the analysis:

1. As per the analysis null hypothesis was rejected and it was accepted that Metro is delivering services as per the expectations of the passengers. (time, cost, availability, safety).

2. Null hypothesis stood rejected and it was accepted that Metro is managing well its physical evidences.

3. Null hypothesis was rejected and it was accepted that Passengers are satisfied with the behavior of Metro's employees.

4. Null hypothesis got rejected and it was accepted that there is a significant association between various independent variables (Gender, Age, Occupational and Purpose of travel) of the sample passengers and their satisfaction level.

5. Null hypothesis was accepted that there is no significant impact of Metro on other means of transport.

As observed in the Detailed Project Report (DPR) of Jaipur Metro, it is a step towards urban transformation. Created mainly for improving the transportation system, the metro project is envisaged to provide a safe and reliable rapid transport system in Jaipur, improving general mobility, enhancing the quality of life and making city more pleasant to live and work.

Phase IA of Jaipur Metro named as 'Pink line' is one of the fastest project implementation in Metro sector. As it is doing well in terms of average daily ridership,

prospects are bright that it would be able to achieve its goals in near future and establish itself as the preferred mode of travel and would contribute in meeting social obligations of the welfare state

As can be extracted from the study, the metro has been successful in reducing traffic congestion, providing services to passengers as desired, thus making it the suitable alternative for them. However, it is important to note whether the establishment of the metro has been affecting the operations of other means of transport.

Still, Jaipur Metro is in its nascent stage, it is all set to be expanded in near future. With on-going construction work, the metro would add new trains in the existing lines and the completion of the remaining phases thus improving the frequency and reach. As work progresses, there is a high possibility for existing issues to be resolved and commuters in Jaipur being provided with good quality services.

As lot of people are willing to choose Jaipur Metro as their preferred mode over other modes of transportation, still it is unclear whether the metro service will have any adverse impact on other modes of public transportation such as buses, rickshaws, autos, taxis, etc. As per the present analysis it can be predicted that for long distance travel Metro can be the best solution and thus would affect the operations of other modes of transport.

There is a need to revisit the metro rail project and critically review it. An independent expert group should conduct the review based on clear, objective criteria and examine all aspects such as their justification, governance, accountability, viability and integration with other modes, and the review findings should be publicly debated.

The researcher has extended suggestions on the basis of the study undertaken-

- In order to ensure security to passengers in all manners, separate coaches for women only should be added. In future, as the number of passengers has been increasing day by day, number of security guards can be increased to avoid threats from pick-pocketers and mischievous people.
- A travelling experience is always good and memorable when it is comfortable and hassle free. Jaipur Metro should make its customer interface more simplified. Customers expect consistency in service across all channels of communication therefore better customer support should be ensured.

- Although wheel chairs for passengers with disabilities are available at Metro stations, other infrastructure facilities such as footpaths, feeder services etc. should be developed around Metro to provide them desired comfort and ease.
- Problems pertaining to the frequency of the metro, the time taken by its feeder services, parking issues etc. should be resolved. Parking facility should be offered at minimum rent for regular passengers. For them, parking card may be issued.
- Lift & escalator facility should be provided at stations wherever needed.
- Jaipur Metro may be promoted as a point of tourist attraction by adding some coaches, especially for them that may have features like palace on wheels.
- In future, the coaches should have reserving seats for women, disabled and elderly people.
- An effective Grievance Redressal Cell should be placed at every station to ensure timely resolution of passengers' complaints.
- In order to protect the interest of para-transit operators, they can be employed by Metro authorities to drive feeder vehicles arranged by Metro or for performing other duties that match with their skills.
- For encouraging people to travel by Metro, Government as well as private employers may issue metro cards to their employees at subsidized rates to use it to travel to and from their office. This would help in reducing congestion on roads, thus save travellers' time and decrease pollution in the city.
- There is a need to revisit the metro rail project and critically review it. An independent expert group should conduct the review based on clear, objective criteria and examine all aspects such as their justification, governance, accountability, viability and integration with other modes, and the review findings should be publicly debated.

BIBLIOGRAPHY

BIBLIOGRAPHY

Books

- C. R. Kothari (2004). Research Methodology: Methods & Techniques. New Age International (P) Ltd.

- Crimp M. and Wright L. T. (1995). The Marketing Research Process, (4th ed.). Prentice Hall, London.

- Donald R. Cooper and Pamela S. Schindler. (2006). Business Research Methods, (9th ed.). Tata McGraw-Hill, New Delhi.

- Gill, J. and Johnson, P. (2002). Research methods for managers. London: Sage Publications.

- Kerlinger Fred N. (1986). Foundations of Behavioural Research, (3rd ed.). Holt, Rinehart and Winston, New York.

- Lovelock,C. , Wirtz,J. and Chatterjee, J. (2010). Service Marketing, Sixth Edition

- Ranjit Kumar. (2009). Research Methodology – A step by step guide for beg inners, (2nded.). Dorling Kindersley India Pvt. Ltd., New Delhi

- Schiffman, G.L. , Kanuk, L.L. and Kumer, S.R. (2010). Consumer Behavoiur, Tenth Edition; pg 12-14, 42-46.

- Srivastava, K.K & Khandai S. Consumer Behaviour (In Indian context), 1st Edition.

- Yin K. R, (2002). Case Study Research: Design and Method. New Delhi: Sage Publications

Research papers/ Thesis

- Acharya, R., 2000. Indian Railways: where the commuter is king. Japan Railways and Transport Review 25, 34–45.

- Anand Nitesh & Qack Sans (2013). Urban Logistics & Future Development. Procedia Journal of Social Sciences, 12(36).

- Andreassen, Tor Wallin (1995). Dissatisfaction with public services: the case of public transportation. Journal of Services Marketing, Vol. 9 Iss: 5, pp.30 – 41

- Badami, M., Tiwari, G., Mohan, D., 2004. Access and mobility for the urban poor in India: bridging the gap between policy and needs. Paper presented at the Forum on Urban Infrastructure and Public Service Delivery for the Urban Poor, July 24–25, 2004. National Institute of Urban Affairs, Delhi, India.

- Borck & Wrede (2007). Commuting Subsidies with Two Transport Modes. Transport Reviews, pp 1-13.

- Brown A & Dayal A (2012). Future of Urban Transportation in India. Saga Journal of Sustainable Development 4(6).

- Chinmoy Kumar (2006). Indian Railway; IT Innovations in Passenger Services. The ICFAI Journal of Service Marketing , Vol.4, No.1., pp 64-71.

- D.V. Nalini Devi (1996). A Study of Personal Management Practices in South Central Railway and the Perceived Effectiveness of Its Operations by the Passengers. Dissertation submitted to Osmania University

- Debabrata Das, Subhash Datta & A.Sharfuddin (2007). Importance of Metro Rail in Public Transport Network: A case study of Delhi. Indian Journal of Transport Management, p.no. 223.

- Gakenheimer, R., 1999. Urban mobility in the developing world. Transportation Research 33A, 671–690.

- Gakenheimer, R., 2002. Planning Transportation and Land Use for Cities in India. Massachusetts Institute of Technology, Cambridge, MA.

- Hounsell, Shreshta et. Al. (2016). Open Data and the Needs of Older People for Public Transport Information. University of South Hampton.

- Kuah, G.K. & Perl, J. (1989, August). The Feeder-Bus Network-Design Problem. The Journal of Operational Research Society.

- Low Nikolas & Gleeson. S. (2015). Alternative Transport Models for Rapid Development, International Journal of Economic Development, 9(18).
- Madhavaiah. C. & Durga Rao .S. (2007). Public Sector Road Transport Corporations: A Comparative Study of Service Quality Perceptions. The ICFAI Journal of Service Marketing, Vol.5, No.1, pp31-41.

- Marc Ivaldi & Catherine Vibes (2005). Intermodal and Intramodel Competition in Passenger Rail Transport. Transportation Science, pp 1-15.

- Naidu.B.V & Kutty Thomas (2016). Prospects of Competitiveness in Urban Transportation, Palgrave Journal of Urban Studies, 12(3).

- Raja.S. (2007). Consumer Image of Indian railways – An Empirical Analysis. SMART Journal of Business Management, Vol.3, No2, pp 59-63.

- Roy & Datta (2005). Ranking of public transport Modes According to the characteristics of abstract nature in Kolkata. Indian journal of Transport Management, Vol.29, No2, pp 136-143.

- Samrat .J (2014). Sustainability of Project Appraisal Techniques in Urban Transport Projects, Landscape Journal of Development 16(32).

- Singh Bhagwan and Kumar Devender (2014). Customer Satisfaction Analysis of Services: The impact of corporate image on quality, customer satisfaction and loyalty for customers with varying degrees of service expertise. International Journal of Service Industry Management, Vol. 9 Iss: 1, pp.7 – 23

- Subash, Chandrabose, Umamaheshwari & Maharajan (2013). Feasibility Study of Metro Transport: Case Study Madurai. International Journal of Civil Engineering and Technology (IJCIET), Volume 4, Issue 4

- Tiwari, G., Mohan, D., 1999. Sustainable transport systems: linkages between environmental issues, public transport, non-motorized transport, and safety. Economic and Political Weekly 34 (25), 1589–1596.

Websites

- Accessible and Inclusive Urban Development (2015). United Nations, Retrieved from http://www.un.org/disabilities/documents/COP/cosp8_desa_forum_on_urban_development_cn.pdf

- Annual Report. (2018), Kolkata Metro Rail Corporation Ltd, Retrieved from http://www.kmrc.in/annual_report.php

- Arakkal, I. (2018, January 15). Telangana: RTC Tweaks Bus Fares for Change. Deccan Chronicle. Retrieved from https://www.deccanchronicle.com/nation/current-affairs/150118/telangana-rtc-tweaks-bus-fares-for-change.html

- Bhatnagar, V. (2002) Metro shows the way — all the way. The Hindu. Retrieved from http://www.thehindu.com/2002/10/12/stories/ 2002101205800400.htm

- Cilarapu, C. S & Narayanan P. Expansion of Metro Rail System in India for

- Cities in a jam: reducing urban traffic congestion (2017), Smart Cities World e-paper. Retrieved from https://smartcitiesworld.net/special-reports/special-reports/cities-in-a-jam-reducing-urban-traffic-congestion

- Cohen, D. & Crabtree, B. (2006). Qualitative Research Guidelines Project. Retrieved from www.qualres.org

- Detailed Project Report (2010). Jaipur Metro (Phase II) Sitapura to Ambabari. Delhi Metro Rail Corporation Ltd, Delhi, 1-2.

- Detailed Project Report (2012). Jaipur Metro Phase I- Mansarovar to Badi Chaupar. Delhi Metro rail Corporation, Delhi, 1.

- Dominic, B. (2017, July 6). Why no 'paan' stains in our Metro stations? Livemint e-paper. Retrieved from https://www.livemint.com/Opinion/H0txA6aMRKB0cOqbpj5IjN/Why-no-paan-stains-in-our-Metro-stations.html

- Energy Efficient, Environment Friendly and Economically Feasible Transportation, retrieved from https://s3.amazonaws.com/.../e3_term_paper_by_palaniappan_narayan,E-3 Term Paper, 1-22.

- Ensuring Equity (2006), Economic and Political Weekly, 41(16), 1492-1492. Retrieved from http://www.jstor.org/stable/4418097

- Environmental Assessment Report (2013). India: Jaipur Metro Rail Project,

- Environmental Assessment Report (2013). India: Jaipur Metro Rail Project,

- Fieldler. (2017). Older People and Public Transport: Challenges and Chances of an Ageing Society. Retrieved from: https://www.emta.com/IMG/pdf/Final_Report_Older_People_protec.pdf

- Frye, A. (2013). Disabled and Older Persons and Sustainable Urban Mobility. Global Report on Human Settlements. Retrieved from https://unhabitat.org/wp-content/uploads/2013/06/GRHS.2013.Thematic.Disabled.and_.Older_.Persons.pdf

- Garari, K., Arakkal I. (2017, November 30). Hyderabad Metro Rail: Rush leaves officials clueless. Retrieved from https://www.deccanchronicle.com/nation/current-affairs/301117/hyderabad-metro-rail-rush-leaves-officials-clueless.html

- Ghanate, N. (2017, December 30). Hyderabad: Metro ridership stabilising. Deccan Chronicle. Retrieved from https://www.deccanchronicle.com/nation/current-affairs/301217/hyderabad-metro-ridership-stabilising.html

- Gulati, M. (2012). Case for Delhi Metro Rail. Economic and Political Weekly, 47(35), 76-77. Retrieved from http://www.jstor.org/stable/41720091

- Halsall, D. (2001). Transport and Travel: Better for Women? Geography, 86(1), 79-81. Retrieved from http://www.jstor.org/stable/405735

- Hyderabad Metro Fares Announced, Minimum is Rs.10 (2017), Telangana Today, Retrieved from https://telanganatoday.com/hyderabad-metro-fares-announced-minimum-is-rs-10

- Hyderabad Metro Rail Limited. Know More About Project. Retrieved from http://hmrl.telangana.gov.in/know-more-about-project.html

- Hyderabad Metro Rail Project – An Overview. (2017). Rail Analysis India. Retrieved from http://railanalysis.in/articles/hyderabad-metro-rail-project-overview/

- Iyer, S. (2018, April 7). Soon, more Metro trains from Nagole to Ameerpet. Times of India. Retrieved from: https://timesofindia.indiatimes.com/city/hyderabad/soon-more-metro-trains-from-nagole-to-ameerpet/articleshow/63655039.cms

- Jaipur Metro Rail Project (2013). Safeguard Due Diligence Report. Asian Development bank

- Kuma, A. (2013). Project Report on Jaipur Metro. Indian Railway Institute of Transportation Management. Lucknow, U.P, 5-8

- Kumar, S. (2017, November 10). Pedal Back Home from Hyderabad Metro Stations. Telangana Today. Retrieved from https://telanganatoday.com/pedal-back-home-from-hyderabad-metro-stations

- Mehta, M. K. (2015, January 9). Commuters eyeing time-saving & comfort may disregard Mumbai Metro fare hike. The Times of India. Retrieved from https://timesofindia.indiatimes.com/city/mumbai/Commuters-eyeing-time-saving-comfort-may-disregard-Mumbai-Metro-fare-hike/articleshow/45814435.cms

- Moosa, MK. (2017, November 15). Metro Will Give 10,000 Cycles, But Where Do We Ride? The New Indian Express. Retrieved from http://www.newindianexpress.com/cities/hyderabad/2017/nov/15/metro-will-give-10000-cycles-but-where-do-we-ride-1701404.html

- Murty, M. N., Dhavala, K. K., Ghosh, M., & R. S. (2006). Social Cost-Benefit Analysis of Delhi Metro. Institute of Economic Growth, Delhi. Retrieved from http://mpra.ub.uni-muenchen.de/1658/

- Onishi, Y. (2016). Breaking Ground A Narrative on the Making of Delhi Metro. Japan International Cooperation Agency. Retrieved from https://www.jica.go.jp/activities/evaluation/ku57pq00001zf034-tt/analysis_en_01.pdf.

- Randhawa, P. (2012). Delhi Metro Rail: Beyond Mass Transit. Economic and Political Weekly, 47(16), 25-29. Retrieved from http://www.jstor.org/stable/23214589

- Murty, M. N., Dhavala, K. K., Ghosh, M., & R. S. (2006). Social Cost-Benefit Analysis of Delhi Metro. Institute of Economic Growth, Delhi. Retrieved from http://mpra.ub.uni-muenchen.de/1658/

- Reddy, S. (2017, November 11). 24 Metro Stations Lack Access to Bus Bays, Feeder Service: Study. Times of India. Retrieved from https://timesofindia.indiatimes.com/city/hyderabad/24-metro-stations-lack-access-to-bus-bays-feeder-service-study/articleshow/61604151.cms

- Tara, S. (2011). Private Space in Public Transport: Locating Gender in the Delhi Metro. Economic and Political Weekly, 46(51), 71-74. Retrieved from http://www.jstor.org/stable/23065551

- The Delhi Metro has become a lifeline of the city in 15 years (2017, December 27). Hindustan Times. Retrieved from https://www.hindustantimes.com/editorials/the-delhi-metro-has-become-a-lifeline-of-the-city-in-15-years/story-9yLztehVF3AJjm7l6dv3HM.html

- The World Bank. Retrieved from http://www.worldbank.org/en/news/feature/2015/12/03/for-persons-with-disabilities-accessible-transport-provides-pathways-to-opportunity

- Tiwari, G. (2013, November 30). Metro Rail and the City: Derailing Public Transport. Economic & Political Weekly. Retrieved from http://ezproxy.tiss.edu:2066/system/files/pdf/2013_48/48/Metro_Rail_and_the_City.pdf

- Urban Transport and Public Health (2009). Economic and Political Weekly, 44(51), 7-7. Retrieved from http://www.jstor.org/stable/25663904

- V, G. (2018, March 6). Metro rail far from fast track. Retrieved from http://www.thehindu.com/news/national/telangana/metro-rail-far-from-fast-track/article22937406.ece

- Vislavath (2018). Impact of Metro Rail on Para Transport System of Urban Commutation-A Study on Hyderabad. International Journal of Management Studies. http://www.researchersworld.com/ijms

- Why Metro. (n.d.). Telangana Today. Retrieved from: http://hmrl.telangana.gov.in/why-metro.html

- www. historyhome.com

- www.britannica.com

- www.ibef.org

- Randhawa, P. (2012). Delhi Metro Rail: Beyond Mass Transit. Economic and Political Weekly, 47(16), 25-29. Retrieved from http://www.jstor.org/stable/23214589

- Onishi, Y. (2016). Breaking Ground A Narrative on the Making of Delhi Metro. Japan International Cooperation Agency. Retrieved from https://www.jica.go.jp/activities/evaluation/ku57pq00001zf034-tt/analysis_en_01.pdf.

- Schrag, Z.M. (2002) The Washington Metro as vision and vehicle (PhD dissertation). Columbia University, New York.

- Siemiatycki, M. (2006). Message in a Metro: Building Urban Rail Infrastructure and Image in Delhi, India. International Journal of Urban and Regional Research, 30(2), 277–92. doi: https://doi.org/10.1111/j.1468-2427.2006.00664.x

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METRO RAIL PROJECT IN JAIPUR: AN INITIAL REVIEW

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ABSTRACT

A rapid decline in transport situation has been observed in Indian metropolitan cities due to increasing travel demand and inadequate transportation system. Indian cities of all sizes are facing the crisis of effective means of public transport. Despite investments in road infrastructure and transport development, the problem of congestion in traffic, road accidents and air pollution continue to grow. Metro Rail has been considered as a rapid transit solution to ensure reduction in travel time, improved connectivity, and better travel experience. It is eco-friendly, comfortable and cheaper mode of urban transportation whose key objective is to reduce traffic congestion by encouraging people to travel in public transportation systems. The present study is an attempt to visualize the opening and operation of Jaipur Metro and its impact on the other means of present transport within the city. Further, the study observes the transit situation of Jaipur city and examines the significance of Metro in the city.

Key Words: metro, rapid transportation, means of transport in Jaipur.

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1. INTRODUCTION

Pink City, Jaipur is a most visited tourist attraction of Rajasthan. The land is famous for its bravery, grandeur, artifacts, cuisine, geographical feature and people. The city was ruled by many rulers whose graciousness, prosperity and influence can be easily depicted from the countless memories of history in the

form of notable monuments, edifices, parks and other magnificent memorabilia The city has world renowned tourist attraction like, Hawa Mahal, Ambar Palace, City Palace, Jantar Mantar Observatory, ancient temples and forts. Jaipur city is linked to all major cities of the state and as well as the nation through a well connectivity of roadways, railways and off course the airways.

The city is all time flocked by thousands of commuters either local or visitors for some purpose or another. Though Jaipur was build in such a manner that transportation mechanism, safety and security of the passenger and numerous picks and dropouts is carefully handled but within the city wall premises. Nevertheless the expansion of city, growing population and augmented expectation demanded more enhanced, robust and specific other means of transportation. At present for travelling within the city and close proximity of Jaipur city there are a number of available option likewise, private vehicles (either 2 wheelers or 4 wheelers), taxis, all public means of transportation and now the most thrilling, experiencing and anew attraction, the JAIPUR METRO.

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2. THE NEED FOR METRO SERVICE IN JAIPUR

A Metro Transport System is the most expansive means of transportation with a minimum cost of Rupees 200 crores per KM or more depending upon the Metro type, site location, operative measures, maintenance, security feature, etc. for a city to have Metro there must be about 1000-1500 passengers at a time or per hour.

The city of Jaipur is very vast, as at present it has 34 lakhs of population and it has been growing rapidly. Simultaneously, it has to cater the needs of commuters both inside the city and outside. For this, transport is to be made friendlier, safe and up to the expectation of the passengers. Further the problem of traffic need to be minimized, the traffic management should also be effectively managed, it should be made less chaotic and more promisingly accident free. Public transportation like city buses, auto rickshaws, cycle rickshaws and other municipal means are the cheapest, easily available and have increased frequency for all sectors of the society and from all the corners of the city. Other than this a high increase of two and four wheelers, parking menace, congested roads, long traffic wait and environment predicaments have more added nuisance to the existing transportation. But this is not the final solution for the future forthcoming threats and opportunities, there has to be more development in space of the expansive nature of the city. So like other metropolitan cities of the nation, it was felt that now Jaipur too need a Metro Train service at the earliest for a safer side of transportation. Jaipur Metro is a point cooperation of the Central Government from New Delhi and the State Government of Rajasthan.

Jaipur Metro was not a day dream. For years of continuous homework, feedback obtained from the common citizen and as per the close context with the metropolitan nature of the city; Jaipur Metro Rail Corporation Limited (JMRC) was established on January 1, 2010. Jaipur Metro has at present two phases. The first phase cost about rupees 3200 crores and will be completed around 2018. On June 3, 2015 existing Chief Minister of Rajasthan Smt. Vasundhara Raje Scindia inaugurated the first metro line. At current

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Jaipur Metro run between Chandpole and Mansarovar metro stations covering about 9.2 kms with 8 elevated and 1 underground station. The second phase will be totally underground from Chandpole to Sitapura connecting Ambabari with a stretch of 24 Kms.

3. PROBABLE IMPACTS ON OTHER MEANS OF TRANSPORT

The current study tries to apprehend and make a close comparative study on the impact of Jaipur Metro on the other means of transport and vice versa. It will have both positive and negative impacts on each other. Definitely on one side Jaipur Metro has the advantages like it will reduce congestion on the roads, it will save time for millions of commuters, rapid means of travelling, environmentally friendly, a place of social integrity of the city, reduced accidental rates in the city and a good means for the Government for the collection of revenues. But on the other side of the coin the Jaipur Metro will run on the fixed line and with fixed schedule, so passenger need to be peculiar to catch Metro, heavy cost of infrastructural investment, unnecessary tax burden on citizen, persons with disabilities, small children, elderly persons require patience and safety measures while using this service benefits, threats to other means of transport, socially and economically affects on the people who have their and their family livelihood dependence on cheap means of transport.

- **SHIFTING TO METRO**

  In the following section trip profile of bus and two wheeler users to understand the possibility of these users to shift to metro has been analyzed.

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- **BUS USERS**

In case of availability of direct bus from home to destination, one

has to walk up to bus stop, which generally lies at less than 500 m and takes bus to reach the bus stop near the destination and again walks for less than 500 m and reaches the destination. In case of metro, person living within the 500 m distance from metro walks up to metro station and board in metro and again walks little to reach destination. However, for person who lives away from the metro station trip by cycle rickshaw or auto-rickshaw or by a feeder bus is required to reach the metro station.Each type of transfer has its own characteristics and impact on the person.

Possibility of person to shift the mode includes all these transfer impacts. A person has to change a bus to reach his destination area if it is not covered by any direct route. In that case the waiting time at transfer bus stop and the distance and convenience from bus stop where one has alighted to the bus stop from which one can get the next connecting bus is important. In the case of metro, time at transfer points and convenience of changing trains is an important factor which can influence modal shift. Thus, instead of just comparing available travel options by total time, fare, distance, etc. one should consider this influence of transfer activity (waiting time at transfer point, convinces at of changing trains) for the total trip comparison.

- **TWO- WHEELER USERS**

If two-wheeler users want to use the public transport the following table shows the possibilities that may attract them to shift to the metro.

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TABLE1

Issue	Bus	Metro	Remarks
Door to door service	One has to walk up to bus stop (maximum 500 m)	One can reach to the metro station by walk or by cycle rickshaw, auto rickshaw or by feeder bus.	Probability of shifting the mode is very low.
Transfer inconvenience	If destination does not lie in any bus route one has to shift in-between	If direct route is not available one has to get transferred in-between	Transfer type can be different for metro and bus.
No need to follow timings	One has to follow the schedule of buses	One has to follow the metro schedules	If more frequencies are provided then it can help to shift the two wheeler users to bus or metro
Work/shopping place is very near	In any case one will use two wheeler only	In any case one will use two wheeler only	As distance is short probability of shifting from two wheeler to bus or metro is negligible.
Travel timings	If only in-vehicle time is considered it takes more time than metro	If only in-vehicle time is compared, Metro takes less time.	User will compare a total profile, i.e. total access time of trip it includes transfer-waiting time, availability of connecting bus/rail, convenience to reach at stop/station. As metro has less stoppage in comparison to bus and it has separate track and doesn't mix with other traffic, its speed is more than bus system.

Issues affecting two wheeler users to Shift to Other Mode

Source: https://www.researchgate.net/publication/237562363

4. CONCLUSION

Jaipur metro is the latest means of attraction for the traverse and now it is fast becoming one of the major sources of transport system in the city. The benefits of any service are calculated by it usage and current Jaipur metro is slowly gaining its pace, popularity and parking problems, encroachment of roads, fast and safe means of transport and subsidized train tickets. Jaipur metro will try making the city clear, and clean environment, protect the ancient monuments, habitat and citizens from the disastrous emission of harmful gases from vehicles and reducing the dependence of common citizens on the high priced public transport service utility. At the same time Jaipur metro will try to eliminate traffic congestion, condense self deriving stress, helpful for those who are afraid of congested traffic or phobia of travelling in public utilities, safe and time saving mode as people travel a far distance within a shorter period of time. On the other hand the introduction of Metro in Jaipur may have adverse impacts on other means of transport, like, auto rickshaws, cycle rickshaws, and city buses etc.

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REFERENCES

1. Agarwal V.K. Managing the Indian Railways: The Future Ahead . New Delhi: Jain Book Depot, 2004.

2. Dayal Anuj. Management Strategies for Delhi Metro Success. New Delhi: Delhi Metro Rail Coporation, 2014.

3. Kulshreshta, D.K. Management of State Road Transport in India. New Delhi: Mittal Publications, Delhi, 1996.

4. Kulshreshta,D.K. Transport Management in India. New Delhi: Mittal Publications,1999.

5. Lal Dr. and Jain. Delhi Metro Rail Corporation. Agra: Upkar Prakashan,2012.

6. Saklani Juhi. Delhi by Metro. New Delhi: Times Group, 2014.

7. Singh, Y. P. (2002). "Performance of the Kolkata Metro Railway: A case study". CODATU X Pa., 337-342.

8. https://www.researchgate.net/publication/237562363_EVALUATION_OF_PUBLIC_TRANSPORT_SYSTEMS_CASE_STUDY_OF_DELHI_METRO

9. http://www.delhimetrorail.com

10. http://www.dda.com

11. http://www.planningcommission.com

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RECENT DEVELOPMENTS IN PUBLIC TRANSPORT SECTOR IN INDIA

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ABSTRACT

India is one of the fastest growing economies in the world and at present its growth is accelerating at the rate of 7.5% per annum. With a growing population too, the country is working hard to transform itself over the next few decades. Improving public transportation is on priority although private-vehicle ownership in India is growing and therefore causing major congestion problems in cities, there are however many plans to revamp bus systems and invest in metro networks. For improving Road Transport, government's policy to increase private sector participation has proved to be a boon for the infrastructure industry with a large number of private players entering the business through the public-private partnership (PPP) model. Similarly, for the betterment of Railway Transport the Government of India has focused on investing on railway infrastructure by making investor-friendly policies. The present chapter describes the present status of public transport service in India and highlights the recent developments in the sector. It also focuses on future prospects of this sector.

1. INTRODUCTION

Economic and social development of a country depends largely upon its well built transport infrastructure. It provides opportunities to the unprivileged and enabling economies to face the challenges effectively. A strong Transport infrastructure connects remote places, thus makes it easy for the people to work, get education, health and other services; it enables the availability of goods and services at every place all over the world. Availability of transportation services in rural areas is also helpful in increasing farmers'

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income because of finding markets, preventing maternal deaths, promoting girl education etc. Hence, this industry is playing an essential role in boosting business, reducing poverty, enhancing prosperity, and achieving the Sustainable Development Goals.

2. PUBLIC TRANSPORTS IN INDIA

An important social role played by public transport is to ensure that all members of society are able to travel which include groups such as young, the old, the poor and rich, and other strata of the society. Public transport consists of light rail, commuter train, buses, Metro, Mono rail etc. It is provided by a company or authority. In a country which has not been adequately served by advanced modes of transport, such as railways, airways and road transport, the road transport become most significant mode of transport.

The Emergence of Metro System

1. After the success of the Delhi Metro, lots of Indian cities are exploring the option of implementing metro rail networks. The Ministry of Urban Development (MoUD) estimates that there is approximately 316km of metro lines currently in operation and more than 500km of metro lines under construction across the country. This includes metro/mono rail systems promoted by state governments and private bodies.

2. Delhi Metro is the largest metro system with a total length of 213 km, carrying 2.8 million passengers a day. Some of the new metro systems are still facing issues with building ridership; for example, Jaipur Metro carries only 20,000 passengers per day, incurring a loss of INR 30 million (US$ 500,000) every month.

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3. Most of the systems are developed by public authorities with external funding and support from federal government. However, some of the cities have developed the system in partnership with private players e.g. Gurgaon (operated by IL&FS), Mumbai (operated by RATP) and Hyderabad (operated by Keolis – under development). In the Union Budget 2014-2015, the government emphasised that the planning of metro projects must begin now. The federal government has earmarked INR 100 billion (US$ 1.5 billion) for under Prime Minister's Gram Sadak Yojana (PMGSY) was 47,447 km in 2017-18.

3. PRESENT SCENARION OF PUBLIC TRANSPORT SECTOR AND FUTURE PROSPECTS

As per the data collected from different Media Reports, Press Releases, Ministry of Road Transport and Highways, NHAI website, Press Information Bureau (PIB), Department of Industrial Policy and Promotion, Railways Budget 2016-17, Indian Railways, internet sources; following section describes the present status of public transport sector in India.

- ### ROAD TRANSPORT PRESENT STATUS

  According to Ministry of Road Transport and Highways, India has one of the largest road networks across the world which spreads over a total of 5.5 million km. About 64.5 per cent of all goods are transported through this network in the country and among total passengers 90 per cent traffic uses road network to commute. The use of road transportation has increased progressively over the years because of improved connectivity between different parts of the country. Now transportation of heavy vehicles and other freight is also done rapidly through roads.

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i. The private sector has emerged as a key player in the development of road infrastructure in India. Increased industrial activities, along with increasing number of two and four wheelers have supported the growth in the road transport infrastructure projects. The government's policy to increase private sector participation has proved to be a boon for the infrastructure industry with a large number of private players entering the business through the public-private partnership (PPP) model.

ii. As per the report published by the concerned ministry, during FY18 the construction of highways reached to 9,829 km thus, total national highways touched length of 122,434 kms till FY18. The Government of India has set a target for construction of 10,000 km national highway in FY19. Total length of roads constructed under Prime Minister's Gram Sadak Yojana (PMGSY) was 47,447 km in 2017-18.

- **RECENT DEVELOPMENTS**

In order to boost corporate investment in roads sector, business-friendly strategies are being introduced by the government that will balance profitability with effective project execution. According to data released by the Department of Industrial Policy and Promotion (DIPP), construction development including Townships, housing, built-up infrastructure and construction-development projects attracted Foreign Direct Investment (FDI) worth US$ 24.87 billion between April 2000 and June 2018.

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With the Government permitting

100 per cent foreign direct investment (FDI) in the road sector, several foreign companies have formed partnerships with Indian players to capitalise on the sector's growth. MAIF 2 became the first largest foreign investment in Indian roads sector under TOT mode worth Rs 9,681.5 crore (US$ 1.50 billion). In May 2018, the Government of India signed US$ 500 million loan agreement with World Bank to provide additional funding for construction of 7,000 km climate resilient roads out of which 3,500 km will be built using green technologies under Pradhan Mantri Gram Sadak Yojna (PMGDY).

- **FUTURE PROSPECTS**

The government, through a series of initiatives, is working on policies to attract significant investor interest. A total of 200,000 km national highways are expected to be completed by 2022. The Ministry of Road Transport and Highways has fixed an overall target to award 15,000 km projects and construction of 10,000 km national highways in FY19. A total of about 295 major projects including bridges and roads are expected to be completed during the same period.

- **RAIL TRANSPORT PRESENT STATUS**

The Indian Railways is among the world's largest rail networks. The Indian Railways network is spread over 115,000 km, with 12,617 passenger trains and 7,421 freight trains. It carries load of nearly 23 million travellers and 3 million tonnes (MT) of freight daily. India's railway network is recognised as one of the largest railway systems in the world under single management.

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The railway network is the most suitable mode used for long distance travel and transportation of bulk commodities, apart from being energy efficient and cost-effective mode of transportation. The Government of India has focused on investing on railway infrastructure by making investor-friendly policies. It has moved quickly to enable Foreign Direct Investment (FDI) in railways to improve infrastructure for freight and high-speed trains. At present, several domestic and foreign companies are also looking to invest in Indian rail projects.

- **RECENT DEVELOPMENTS**

  - Foreign Direct Investment (FDI) inflows into Railways Related Components from April 2000 to June 2018 stood at US$ 920.21 million.

  - In December 2018, France-based Alstom announced plans to augment its coach production capacity at its facility in Sri City from 20 cars per month to 24 cars per month. Also, it will set up a new production line to increase capacity to 44 cars per month by the end of 2019.

  - In December 2018, the Prime Minister of India laid the foundation stone for the third phase of the Pune metro.

- **FUTURE PROSPECTS**

  In the next five years, the Indian railway market will be the third largest, accounting for 10 per cent of the global market. Indian Railways is targeting to increase its freight traffic to 3.3 billion tonnes by 2030 from 1.1 billion tonnes in 2017. It is projected that freight traffic via the Dedicated Freight Corridors will increase at a CAGR of 5.4 per cent to 182 MT in 2021–22 from 140 MT in 2016–17.

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4. CONCLUSION

The Indian public transport sector plays a significant role in providing quality and affordable services to the public. Currently, in addition to the public and organised segment, unorganised segment is also growing to cater to the demand in the form of personal modes such as cars and taxi aggregators. By providing a deep and sharp shift in policies and adopting new ideas can be considered to take a generational leap and transform the public transport services and improve user experience completely. With the right enabling environment and proper structuring, private sector investment, innovation and efficiency can be brought onto a common platform to fill gaps in service delivery. The opportunity is now to strengthen the infrastructure of our public transport and advance its customer experience.

5. REFERENCES

- www.ibef.com
- www.nhai.org
- www.mospi.gov.in
- https://en.wikipedia.org/wiki/Transport_i n_India
- http://www.yourarticlelibrary.com
- https://www.transport.govt.nz

YOGITA SACHDEVA

Research Scholar, University of Kota

Metro Rail Project in Jaipur: An Initial Review

QUESTIONNAIRE FOR CUSTOMERS

I PERSONAL INFORMATION:

1. Age :
   a. Below 20 b. 20-29 c. 30-29
   d. 50-59 e. 60 & Above

2. Sex :
   a. male b. female c. other

3. occupation
   a. student b. business c. salaried
   d. professional e. other
   yes-1,no-0

4. Person with Disability
   a. Yes b. No

5. Type of mode of transport you frequently use
   a. Own b. Bus Metro c. Other

6. How frequently do you avail the service of Metro?
   a. Daily b. Weekly c. Occasionally
   d. Rarely e. Very Rarely

7. Purpose of journey
   a. Study b. Employment c. House hold matters
   d. Touring

8. Are you able to reach your destination in time using the present mode?

   a. Yes b. No

9. What are the problems that you face while in movement inside jaipue?

   a. Non availability of suitable mode of transport
   b. Trafic Congestion
   c. Security issues
   d. Cost
   e. Other

10. What is your choice to relief from the traffic congestion?

   a. Metro
   b. increase of public buses
   c. own use of vehicles
   d. contract conveyance

II INFORMATION REGARDING METRO SERVICES

11. Is metro transport necessary in jaipur
    a. Essential
    b. Not necessary
    c. Undecided

12. Rank your opinion as 1,2,3,4,5,& 6 about preference of metro service to other mode of transport.
    a. low fare b. comforts c. speed
    d. security e. reliability
    f. proper information about next station

13. Do you think the metro service will adversely impact other modes of public transportation?
    a. yes b. no c. May be

14 In terms of cost, how does metro fare in comparison to other modes of transport?
    a. Cheaper than other modes of transport
    b. Same as other modes of transport
    c. Expensive than other modes of transport
    d. If expensive, why do you continue to use it?

15. Do you want the existing fares to be revised?
    a. Yes b. No c. No Idea

16. What is your opinion on the frequency of metros?
    a. Satisfactory b. No Idea c. Inadequate

17. What is your opinion on the total time spent on travel if taken metro service (based on your travel routes)?

a. Very less b. less c. no difference

d. more e. much more

18. If you use metro mobile app, how has your experience been with the app?

a. Highly satisfied b. Satisfied c. Uncertain

d. Dissatisfied e. Highly Dissatisfied

19. Do you buy tickets or have a metro-card?

a. Ticket b. Metro-card

20. If metro card, do you receive any discounts/ benefits through the card?

a. Yes b. No

21. Mode of payment to buy tickets/metro card?

a. cash b. card c. e-wallet

22. If buy ticket, are there separate lines for women, elderly, differently abled?

a. Yes b. No

III FACILITIES INSIDE METRO

23. Please mark your opinion by putting a tick mark	Highly dissatisfied	Dissatisfied	Mode rate	Satisfied	Highly satisfied
Cleanliness in train					
Proper maintenance of coaches					
Security in train					
Watering arrangements					
Availability of ladies coaches					
Medical assistance during emergencies					
Modern amenities					
Mobile charging facilities					
Planned Recreation facilities					
Facilities for physically challenged persons					

IV FACILITIES AT PLATFORMS AND STATIONS

24. Please mark your opinion by putting a tick mark	Highly dissatisfied	Dissatisfied	Mode rate	Satisfied	Highly satisfied
Basic amenities					
Cleanliness on platforms					
Security at stations and platforms					
Drinking water arrangements					
Waiting area					
Seating, fans and lighting facilities					
Pay and use toilets					
Modern amenities					
ATM facilities					
Planned provisions for Refreshment/food plazas					
Touch screen system					
Signage and coach indication bpards					
Planned provision for Television and Audio system					
Out-station or transportation facilities					
Availabilities of porters and trolleys					
Parking facility					
Availability of Auto/ Taxi/Buses					

V BEHAVIOUR OF RAILWAY EMPLOYEES

25. Please mark your opinion by putting a tick mark	Highly dissatisfied	Dissatisfied	Mode rate	Satisfied	Highly satisfied
At the counter					
At the station					
In the train					
Sincerity in discharging their duties					

INTERVIEW QUESTIONS FOR AUTO AND BUS OWNERS

	BEFORE METRO	AFTER METRO
1. Your daily income through running An auto	A<500/- B 500/-to 1000 C > 1000/-	A<500/- B 500/-to 1000 C > 1000/-
2. Average number of trips per day	A < 10 B 10 to 20 C > 20	A < 10 B 10 to 20 C > 20
3. Average hours of running	A < 3hrs B 3 to 8hrs C > 8hrs	A< 3hrs B 3 to 8hrs C > 8hrs
4. Average traffic conjunction in the Running time per trip	A < 15min. B 15 to 30min. C > 30mins.	A < 15min. B 15 to 30min. C > 30mins
5 Demand for autos/feeder buses in the Metro corridor	A < 10 B 10 to 20 C > 20	A < 10 B 10 to 20 C > 20

CERTIFICATE

2nd INTERNATIONAL CONFERENCE

On

"Innovative Research In Science, Technology and Management" (IC-IRSTM-2019)

Venue: Modi Institute of Management & Technology, Kota, Rajasthan, India

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shared in technical session I

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20-21 April 2019

Two Days National Workshop & Seminar On "Latest Trends In Physical Education & Sports"

6th - 7th Feb., 2019

Organized by:

Department of Physical Education & Sports

University of Kota, Kota (Rajasthan)

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Designation Research Scholar Institution J.D.B. Girls Govt. College, Kota (Raj.) participated as a Resource Person/Registered Delegate/Student in the Two days National Workshop & Seminar on "Latest Trends in Physical Education & Sports" held at University of Kota, Kota (Rajasthan) on 6th - 7th Feb., 2019. He /She attended/presented a paper/delivered extension lecture on "The Role of YOGA in Stress - Management"

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Project at a Glance
JAIPUR METRO
A Way Forward
North
CBD
Phase-I
(E-W Corridor)
PHPDT 11264
Phase-II
(N-S Corridor)
PHPDT 12901