

Impact of Namma Metro on Traffic

VISHRUTI BISHWAS¹, YASHI SONEGARA², MANYA SAKLECHA³, TASNIM JAHAN⁴,
PROF. THANGA KUMAR⁵, PROF. SHANKAR PRASAD⁶

^{1, 2, 3, 4, 5, 6} Center for Management Studies - Jain (Deemed-to-be University)

Abstract- For the inhabitants of Bengaluru, traffic has been one of the major issues. Bangalore has grown to be a busier city as a result of people moving there and staying there in quest of better career, lifestyle, and educational prospects. Originally known as the Silicon Valley of India, IT Hub, and steadily transitioning into an Educational City, Bangalore has seen a growth in its population. Namma Metro is steadily working to improve the quality of life for its residents despite the fact that regulating the worst traffic to linking last miles is only a faraway dream. This study was conducted to determine how Metro rail affects traffic. For this analysis, three important criteria are taken into account: The metro trains, Metro station locations and connectivity and lastly, the Metro Rail employees. Keeping these things in mind. We research how much less traffic there is on the highways now that the metro train is running. This study demonstrates how the Metro Rail System has turned out to be the most effective in terms of energy use, space occupancy, and number of passengers transported. There are many trips in the peak hour in the peak direction, as well as high-capacity carriers. It has shown to be environmentally benign because it uses less energy, produces little sound pollution and doesn't pollute the air. To ascertain what the general public believes about the metro's impact on the reduction in traffic. This essay outlines the various aspects of metro utilization, such as cost, utility, time savings, environmental issues, etc. This study also highlights the effects of the metro on traffic. It also demonstrates the additional advantageous effects it has on the community and the environment. Overall, a metro rail system can have a large positive effect on traffic, with advantages for the economy, environment, and public health. However, a number of variables, including the system's accessibility, affordability, and design, as well as the presence of other transportation options, will affect its effectiveness.

Indexed Terms- Movement, Rush hour, Influx, Ends of the cities, Travel, Distance, Time and Value, Economy, Work Zones, Metro system, Speed, Eco-friendly

I. INTRODUCTION

This research paper is done to understand the impact of Metro rail on the traffic. There are three main factors taken into consideration for this study i.e.

1. The metro trains
2. Locations of metro stations and connectivity
3. Metro rail staff

With these factors in mind. We study the reduction of traffic on the roads after the commencement of the metro train.

India's first metro train was introduced in 1984 in Kolkata (the mass rapid system). There were a lot of reasons for the introduction of the metro. Increasing population, increasing pollution, need for better transport facilities, increasing prices of fuel. These were some of the reasons that the government felt the need of the metro train. Work Zone is defined as an area of a highway in which maintenance and construction operations are taking place that impinge on the number of lanes available to traffic or affect the operational characteristics of traffic flowing through the area. Due to the rapid growth of urban population and increasing vehicle count supplemented by increased use of private vehicles, congestion on urban roads has increased tremendously. In a developing country like India augmentation of road infrastructure and development of mass rapid rail systems are projected as the solution to address this problem. Implementation of these projects paves way to the construction activities and in this process long term construction work zones in urban areas are inevitable. Though these projects are aimed to decongest the roads but lack of proper planning and implementation norms for these long

term urban work zones leads to many problems such as reduction in capacity, increase the travel time delays, queue length, fuel consumption, number of forced merges, and roadway accidents which lead to unaccounted economic losses. So as a first step it becomes necessary to study and quantify the impact of a mass rapid transit system construction work zones on traffic environment. Indian Roads Congress has suggested guidelines on safety in road construction work zone [1] and Highway capacity manual (2000) provides capacity of short term and long term construction work zones, but the nature and construction activities related to a construction of a metro rail project differ much from a road project and consequently the effects of work zones due a metro rail construction project is different than highway projects and thus it becomes necessary to study and quantify the impact of mass rapid transit system construction work zones on traffic environment which will further help in estimating the economic loss due to metro rail construction work zone. There are 12 cities currently that have Metro connectivity

1. Delhi – Delhi Metro Rail Corporation (DMRC)
2. Mumbai – Mumbai Metro Rail Corporation Limited (MMRC)
3. Bengaluru – Namma Metro
4. Hyderabad – Hyderabad Metro Rail
5. Chennai – Chennai Metro Rail (CMRL)
6. Kochi – Kochi Metro Rail Limited
7. Jaipur – Jaipur Metro Rail Corporation Ltd (JMRC)
8. Kolkata – Kolkata Metro Rail Corporation Ltd (KMRC)
9. Lucknow – Lucknow Metro Rail Corporation (LMRC)
10. Noida – Noida Metro Rail Corporation Ltd (NMRC)
11. Gurgaon – Rapid Metro Gurgaon
12. Nagpur – Nagpur Metro Rail

Besides this there are 15 cities that have taken up the Metro project and are in construction stages,

1. Ahmedabad – Gujarat Metro Rail Corporation Limited
2. Pune – Pune Metropolitan Region Development Authority
3. Indore – Madhya Pradesh Metro Rail Corporation
4. Bhopal – Madhya Pradesh Metro Rail Corporation

5. Varanasi – Uttar Pradesh Metro Rail Corporation
6. Kozhikode – Kerala Rapid Transit Corporation Ltd
7. Vijayawada – Amaravati Metro Rail Corporation (AMRC)
8. Meerut – Uttar Pradesh Metro Rail Corporation
9. Visakhapatnam – Amaravati Metro Rail Corporation (AMRC)
10. Kanpur – Lucknow Metro Rail Corporation
11. Agra – Uttar Pradesh Metro Rail Corporation
12. Coimbatore – Chennai Metro Rail Limited
13. Patna – Delhi Metro Rail Corporation
14. Navi Mumbai – City and Industrial Development Corporation (CIDCO)
15. Guwahati – Guwahati Metropolitan Development Authority.

- Delhi Metro is the biggest operational metro in India. The metro trains run underground and upper ground. It covers 342.12 kms (about 212.58 mi) at a top speed of 132 km (about 82.02 mi)/h. It is well connected by 255 metro stations. It runs with 8 lines which are red, yellow, blue, green, violet, airport pink line, magenta, grey. The train services start at 5:30am and end at 11:30pm, the airport train services start at 4:45am and end at 11:30pm.
- Hyderabad Metro is the 2nd biggest operator in India. It runs underground and upper ground. It covers 66.5 kms (about 41.32 mi) at a top speed of 80km (about 49.71 mi)/h. It is connected by 57 metro stations. It runs with 3 lanes which are red, green, and blue. The train services start at 6:00am and end at 11:15pm. The daily ridership is 490,000(as per February 2020).
- Namma Metro (Bengaluru Metro) is the 3rd biggest metro operator in India. It runs underground and upper ground. It covers 56.1 kms (about 34.86 mi) at a top speed of 80km (about 49.71 mi)/h

Objectives of the present study

- To study, identify and assess the different characteristics of an elevated metro construction work zone in NAMABENGALURU
- the study area

- To study the traffic flow characteristics at work zone location and compare it with non work conditions
- To study fuel consumption characteristics in a work zone.
- To estimate economic loss due to the increased fuel consumption and loss of travel time in a work zone.
- To simulate various scenario using VisSim software and study the impact of changing work zone
- conditions on traffic flow characteristics.
- Nomenclature
- History and Background

Railway system occupies significant place in the realm of transportation. Comparing with other means of transportation system, this particular mode has grater advantages as it can carry a large number of passenger and large & heavy loads to long distances. Since its launch in the field in transportation, railway underwent tremendous changes in term of shape, speed, mode of running, distance of what ever field human mind can imagine. Among those changes, the most important one is considered to be the emergence and spread of metro rail 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. As of April 2014, 168 metro system in 55 countries are listed. Let us have a peep into 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 termini in its urban centro 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 passenger 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 GalataPera" 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 would'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 station and is one of the busiest metro system 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 Brasil 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 station, 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.

- 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. Rapid Metro Rail Gurgaon, which started operations in November 2013, is India's first privately owned & operated metro.

Metro rail lines in India is composed of both standard gauges and broad gauges. Project likes in Delhi Metro used broad gauge 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 Ahmedabad Metro, which has planned to use broad gauges, as there is more space available inside the coaches.

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 under ground) 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, The journey is not completed. Let's wait for more wonders in metro world.

Purpose of the Metro Rail

- The Metro Rail System has proven to be most efficient in terms of energy consumption, space occupancy and numbers transported.
- High-capacity carriers – very high volumes of peak hour peak direction trips.
- Eco-friendly – causes no air pollution, much less sound pollution.
- Low energy consumption – 20 per passenger km in comparison to road-based systems.

- Greater traffic capacity – carries as much traffic as 7 lanes of bus traffic or 24 lanes of car traffic (either way).
- Very low ground space occupation – 2 meter width only for elevated rail.
- Faster – reduces journey time by 50% to 75%.

- Definition

Mass rapid transit system is considered as an ideal solution to meet the growing transportation needs of the modern world. It can carry a large number of people and reduces traffic congestion and pollution.[7] With the introduction of mass transit, the station surrounding is likely to experience change of land uses, improved accessibility and reduced road traffic congestion. The area that experiences these changes is called impact area or transit influence area. This area is usually within reasonable walking distance from the metro station. An area of this size tends to experience the greatest impact from station area. Traffic environment can be defined as a combination of moving vehicles and road traffic situations that can influence the behaviour characteristics of a road user. The impact of metro rail on traffic environment can be studied by comparing the traffic characteristics like speed of the moving vehicles and delay time before and after the metro is introduced. The level of traffic congestion incoming to the study area before and after the implementation of the metro station can be recorded by conducting a speed and delay survey along the metro stretch. A minimum of 4 samples must be taken to analyse the average speed and delay time.

- Description of the Product/Service/Process/Practice

BBM Railway Equipment has expanded our service capabilities to include field repairs, preventative maintenance, equipment rebuilds and engineering services. Our service abilities include a variety of machines such as; wheel presses, truck test stands, railcar hoists, truck repair hoists, drop tables and turntables from a variety of manufacturers including Whiting, Macton, and more. We can perform basic inspections of your equipment or even provide a multi-year service contract for inspection and preventative maintenance to keep your equipment up

and running at peak performance and extend the life of the machine. As industrial technology continues to develop, we understand that your equipment control system can become obsolete in a very short amount of time. That is why we also offer full control system upgrades for various types of railway maintenance equipment. With almost 100 trains running on the network, the operations control centre or OCC at Shastri Park is the nerve centre of the Delhi Metro. From here, every aspect of the Delhi Metro system is monitored—the time-table, speed, security, traction or electricity, the trains, auxiliary equipment like air-conditioning and ventilation system in underground tunnels, and even the crowds in the station. As you walk into the room barefoot, lights are flashing on a giant screen even as a man talks into the system, keeping a close eye on another screen with multiple CCTV images from different stations flashing. With a fully automated rail system, it's not surprising that Delhi Metro regards the OCC as its nerve centre. Delhi Metro's trio of systems keeps the network running—ATP (automatic train protection), ATO (automatic train operation) and ATS (automatic train supervision).

Each train has a special identity, called the train ID. Of this, the first part is the destination code while the second is the train number. The screen at the OCC tracks the movement of the train through the track circuits—which are like electrical nodes which send the information to the OCC.

These are placed at intervals of 20m along the track. With no lag in the real time location of the train and the OCC circuit, every minute movement of the train is monitored by the system. The ATC (automatic train control) system, which controls the route of the train, works in tandem with the ATS, which interfaces between the train and the line side equipment like the track circuits.

Together, the system moves the train from one station to the next, ensuring that a minimum speed is maintained.

Considering the Rs 80 crore tag, it is not surprising that the Metro coaches are so jealously guarded. The train goes through physical checks every day, along with constant monitoring by a team of professionals,

so that operation schedules can be maintained and the train doesn't stop in the middle of the track. As a maintenance and safety official of Delhi Metro Rail Corporation says, the trains are the much-monitored babies, not left alone for a single minute.

With over 2 lakh litres of water being used every day, the depot at Khyber Pass in north Delhi may well be one of the most watered areas in Delhi. All that water is recycled for irrigation, say Delhi Metro officials. As you walk into the depot late at night, though, it's the meticulous maintenance work going on that first strikes you.

The PPIO is the planning, progress and investigation organisation at the depot, which keeps the schedule of the train maintenance as well as does a physical check every day, based on a pre-determined schedule. The third layer of checking is done by the train operator (TO), who not only gauges the operational running but also keeps an eye out for anything that requires a closer look once in the depot. In fact, the constant exchange of data between the PPIO and the OCC determines the maintenance plan of the train at the depot.

The maintenance is broken up into parts: the under-frame, the interiors and the roof. "It's not just scheduled maintenance. We also do active, preventive maintenance," says an official. The basic check is done every day at the depot.

If a problem is detected, it goes into the IBL or the workshop, depending on the snag. If the train is going into revenue service without any major maintenance being planned, it only goes through a routine cleaning. If a thorough cleaning is scheduled — which is done every three days—then it will go through the automated washing process.

- Latest technology

According to the previous classification, the importance of the metro system appears, as it is the most attractive system for investments of governments and countries, on the one hand, and for individuals and goods on the other hand. Some previous studies of public transport systems in urban areas over the past century stated that it was found, by analysis and comparison, that metro systems were

the best solution and choice to handle public transport issues. There is a clear agreement among planners, policymakers, and transport and traffic experts that the metro system is the most flexible and convenient solution to transport and traffic problems within cities and capitals. The metro system has proven its efficiency and effectiveness in addressing public transport and traffic issues in China, Hong Kong, India, Paris, London...etc. Metro combines the advantages of trains in terms of speed, reliability, distances it travels, and passenger capacity, and the advantages of buses in terms of cost, connectivity, speed of movement, frequency, availability, operating cost ... etc. This is due to the ease of its integration into public transport schemes and its integration with other public transport systems. It is used schematically along the land uses to direct the urban mass and limit its extension, and it can be reliable and predict its trips and ensure the completion of daily trips easily, flexibly, and safely. Moreover, it has timetables and specific ticket prices that can be booked in advance before going to the station, which saves time and effort and reduces waiting time.

- Future growth

India is investing heavily in the country's transport infrastructure, imitating the Western Transportation System. The prospects of the metro rail are pretty bright in India. Cities are witnessing fast growth in the economic domain, and the clear manifestation is the increased number of personal vehicles. The negative side of the coin is that it has resulted in severe congestion and an increase in the pollution level of a country. The remedying efforts are required in the public transportation system, and the most pressing need is the implementation of the MRTS.

Metro rail has seen substantial growth in India in recent years, and the rate of growth is going to become twice or thrice in the coming years. The cities are facing the need for metro rail to meet daily mobility requirements. The metro rail encourages the walkable developmental pattern, which is also beneficial for society. The other merit of Metro rail is that it reduces cost and travelling time, which lowers the cost of production of goods and services, which significantly improves the city's competitiveness. The pollution level has also reduced with the

maximum public transport usage, bringing down chronic diseases and resulting in public health benefits. Innovativeness of the study

The Metro Railway is gaining increasing favor to provide fast, punctual, reliable, comfortable, and convenient transport in all cities of India, especially those with a population greater than 2 million.

As of today, the Metro Railway network is present in the following 12 cities :

Kolkata/ Delhi/ Mumbai/ Bengaluru/ Hyderabad/ Chennai/ Kochi/ Jaipur/ Lucknow/ Noida/ Gurugram/ Nagpur

And Metro Network is being planned and will be operational in the following 15 Cities soon : Ahmedabad/ Pune/ Indore/ Bhopal/ Varanasi/ Kozhikode/ Vijayawada/ Meerut/ Vishakapatnam/ Kanpur/ Agra/ Coimbatore/ Patna/ Navi Mumbai/ Guwahati.

The first metro in India was started in 1984 in Kolkata.

Let us start with the First Metro railway built, in Kolkata.

The first Metro began operational in Kolkata way back in 1984. It was a game-changer. Now, Kolkata is a very densely populated and narrow city, in terms of land area available. The roads available in Kolkata is only 8% for road transport, against 25-30% in other cities

The sales of Personal Vehicles in Kolkata were always very low relative to even much smaller cities in West Bengal and India. This led to Metro Transport being very well received in Kolkata. Many Auto Industry experts in the Two Wheeler and Four Wheeler Industry, especially those based in Delhi, Chennai, Pune used to be bewildered by the low numbers, without pausing to ponder on the power of the Metro.

The Metro Railway was next introduced in Delhi and NCR :

Which sold more four-wheelers than the other 3 metros of Mumbai/Kolkata/Chennai combined.

It was after the Metro was fully operational that the country and the captains of the Auto Industry understood the power of the Metro Railway and how it can affect the personal vehicle industry. How it

could disrupt the Personal Vehicle Industry and its dynamics?

Since then, the Metro has been expanded (and still expanding) very rapidly across Delhi and NCR; and is today the most preferred mode of transport in that region.

The projects in Bengaluru, Hyderabad, Chennai, Nagpur and Jaipur, and other cities too have been well received. Metro Railway has also helped in making it very convenient to visit the very congested spaces in the cities as also making travel between the suburbs and the Central Business Districts in very less time and affordable too. It has helped in appreciating the prices of realty on its stretches. It has expanded the cities and boosted tourism too. On the safety front, the scope and number of accidents have been reduced drastically. The Metro Railway Transit System is the best way to decongest traffic. However, correct defining of present traffic corridors, future expansion plans, and land availability will play an important part in keeping the cost of investment and operation of the Metro Railway profitable and popular.

- Innovativeness of the study

As the topic being quite unique with very less informations available on the websites as well as very less research papers available to its similarness.

The innovativeness of the study was mainly the new experience or digup for the topic on how the metro is affecting the traffic either positively or negatively in the various parts of India.

II. REVIEW OF LITERATURE

Review of literature:

(Eswaran, Bosco, & Rajalakshmi, 2016) Transportation is essential for any country's and economy's long-term development. Cities all around the world are experiencing key issues because of poor design and a failure to use modern transportation systems. Because it is a low-carbon means of transportation, the metro is seen as an environmentally helpful method of reducing pollution in the city. The criteria for developing a metro rail system along a major highway in Chennai examined

in this paper (India). Based on the base year of 2015, the corridor's population and vehicle growth are predicted to increase in the future.

According to the report, 84 percent of commuters are certain to use Metro Rail for commuting once the services are accessible. The major reasons for choosing metro rail over other modes of transportation are travel comfort and reduced trip time. The analysis shows that this corridor requires quick attention for the metro rail system to be implemented before it is too late. This method is a rapid application for determining the feasibility study of any corridor while considering the specifics of the corridor and its surroundings. Only the most critical characteristics that have a significant impact on the outcome are included in this study.

(Bhutani, Ram, & Ravindar, 2016) Construction activities are required for metro rail projects, which will undoubtedly result in long-term construction work zones. Long-term construction zones on city roads result in a variety of concerns, including reduced capacity, increased travel time delays, queue length, fuel consumption, the frequency of forced merges, and traffic accidents, all of which result in unaccounted-for economic losses. As a result, it is critical to investigate and measure the traffic impact of mass rapid transit system construction work zones, which will help determine the economic loss caused by metro rail construction. The purpose of this research was to identify the impact of metro rail construction work zones on traffic and, as a result, quantify these repercussions in the current scenario.

(Advani & Tiwari, 2018) One of the most significant influences on city planning and growth is the transportation sector. It is the sector in charge of inter- and intra-city traffic, as well as transportation via mass transit networks, which represent the culture, urban, economic, and social aspects of a city. The relevance of this study, according to transportation experts and urban planners, is in evaluating the most important mass transit networks, particularly the metro system. It stands out for its speed, safety, and punctuality. It avoids the drawbacks of buses, such as their slowness and mingling with other types of transit. The purpose of

this research was to produce a set of criteria that will aid in improving metro performance and efficiency.

(G.R, Akshay, & Manorianian, 2019) Despite the success of metros in highly populated Indian cities, government officials, designers, and scholars have paid little attention to enhancing pedestrian accessibility to metro stations. The purpose of this study is to investigate the impact of various microscale built environmental elements on pedestrian satisfaction about metro station access, to gain insight into design methods and policy actions that can improve pedestrian access. In Delhi, India, personal interviews were held with metro users who live near metro stations. Individual, household, and trip characteristics, as well as people's attitudes toward numerous environmental elements affecting pedestrian access to the metro, were gathered. The information gathered was evaluated using structural equation models.

(Tiwari, 2013) The study states that the government is more concerned with the cost of constructing a Metro system than with the system's overall benefits. Even though the bus system carries at least 5 times as many passengers as the Metro, the Metro obtains tax benefits that the bus system does not. He concludes by claiming that the metro system derives a large amount of its money from sources other than fares. This has a substantial impact on the self-sufficiency of the metro framework. It leads to metro frameworks' reliance on real estate, at the expense of displacing underprivileged families.

(Bag & Sankar, 2012) This study suggests finding and evaluating the factors that drive customer loyalty and satisfaction to make the appropriate changes based on customer feedback. They discovered that the Kolkata Metro is used by most customers because of its low rates and Extended Multi Ride plan, which decreases consumer spending.

(Neware, Sanghai, & Jajulwar, 2018) includes a study of the impact of the Nagpur metro rail on the use of alternative road-based transportation modes, particularly private modes like bike and four-wheeler, as well as a look at fuel consumption and emission savings after the metro rail was installed in Nagpur. They noticed that those who run a business will not

choose to travel by metro because they must visit several locations in one day. The overall prediction of autos following the installation of a metro along a 4-kilometer test route for which they evaluated fuel consumption and discovered a difference of 1860.68 gallons (about 7043.44 L).

(Lather & Sangeeta, 2007) This study investigates the characteristics of work and individual capabilities among teammates to infer the link between work and individual abilities. The Organizational Commitment Instrument (OCI) and the Personal Efficacy Test (PET) were used. A substantial number of executive partners were extremely dedicated, a decent number of executives were in the moderate duty range, and only a few were low executives, according to the relationship between executive and non-executive partners. The outcomes were the opposite for non-executives.

(S.P, 2012) In his study, he states that surface-based transportation frameworks in metropolitan areas can be monitored until the city reaches a population of one million people. The Planner or Manager must now implement a high-capacity, dependable, and productive rail-based structure. The metro's implementation would also alter the city's organization in several ways, such as empowering downtown districts and replacing private users with commercial and institutional customers.

(et al, 2003) According to the study, as traffic congestion grows in tandem with the number of vehicles on the road, concerns such as traffic congestion, street accidents, and environmental contamination have grown significantly in the last few years in various urban areas throughout the world. The most well-known approach for improving traffic and environmental conditions in these metropolitan communities have been to provide a functional public transportation system, with the goal of encouraging private vehicle owners to switch to public transportation.

III. RESEARCH METHODOLOGY

Introduction

Bangalore, officially known as Bengaluru, has a metro rail system referred to as Namma Metro. The

Namma Metro is operated by the Bangalore Metro Rail Corporation Limited (BMRCL) and serves the city of Bangalore and few of the other parts of the surrounding areas.

The first section of the Namma Metro, which was the 7.5 km stretch between Baiyappanahalli and MG Road, was inaugurated in October 2011. Since then, the system has expanded and now has two operational lines, the Purple Line and the Green Line. The Purple Line runs from Baiyappanahalli to Mysore Road and the Green Line runs from Nagasandra to Yelachenahalli.

The Namma Metro is a fast, efficient, and affordable mode of transportation for commuters in Bangalore. It has helped to ease traffic congestion and improve connectivity in the city. It is the 3rd biggest metro operator in India. It runs underground and upper ground. It covers 56.1 kms (about 34.86 mi) at a top speed of 80km (about 49.71 mi)/h

TYPE OF RESEARCH TOOL (QUESTIONNAIRE):

Occupation

Age Group

Have you ever used Metro?

How often do you use metro?

For research, information was gathered from understudies, instructors and guardians. An aggregate of 100 respondents were chosen by the comfort testing technique. The review has utilized just essential information for accomplishing the targets of the review. A web-based survey was created and sent to every one of the respondents. Reactions were likewise gathered online from respondents. We arranged the forms utilizing Google records and sent to various people utilizing WhatsApp and email. The information was gathered and dissected utilizing google forms and spread sheet. For factual examination factor investigation, bunch insights and autonomous example tests were utilized for this review. Information is gathered from a sum of 83 respondents.

SCOPE OF THE STUDY

This study was done to determine the elements that influence Metro usage.

To find out what the general population thinks about traffic decrease due to the metro.

METHODOLOGY

Study design, location and participants: The study participants were in the age group of 10- 46 and above years. Various questions are prepared and shared to the participants in various locations in Bangalore. A validated questionnaire was prepared, which is approved by our mentors & the google form is circulated among various groups for the purpose of responses for our research study.

Questionnaire administration and data collection: A validated questionnaire was used for data collection and the participants filled in the questionnaire, later the responses were analysed for the purpose of study and evaluation. The questionnaire had several sections focusing on - year of birth, occupation, usage of metro, factors influencing usage of metro, reduced traffic time, satisfaction with metro, metro staff etc.

Data Entry and analyses: Based on the responses to the pre-coded questions, the data were entered in Microsoft Excel. Responses to the open-ended questions were transcribed verbatim from the survey forms into Microsoft Word for quantitative and qualitative data analyses, respectively. Demographic details, metro usage, year of birth, gender, location, ticketing facilities, staff politeness, cleanliness, connection of trains, punctuation, were assessed using descriptive statistics.

There are several factors that can influence metro usage in Bangalore

Convenience: The convenience of using the metro can be a major factor in its usage. If the metro stations are located in areas that are easily accessible and well-connected to other parts of the city, it can encourage more people to use it.

Cost: The cost of using the metro can also influence its usage. If the ticket prices are affordable and

competitive compared to other modes of transportation, it can attract more commuters.

Time savings: If the metro is able to provide faster and more efficient transportation compared to other modes of transportation, it can attract more passengers who value their time.

Availability: The availability of the metro service is also an important factor. If the metro runs frequently and is available during peak commuting hours, it can encourage more people to use it.

Safety and security: The safety and security of the metro system can also play a role in its usage. If the stations and trains are well-maintained, clean, and safe, it can create a more comfortable and trustworthy experience for commuters.

Environmental concerns: With the increasing concern for the environment, the eco-friendliness of the metro system can also be a factor in its usage. If the metro is seen as a greener and more sustainable mode of transportation, it can encourage more people to switch to it.

Last-mile connectivity: The availability of last-mile connectivity, such as buses or cabs, from the metro stations to the final destination can also influence its usage. If the last-mile connectivity is seamless, it can provide a more convenient and attractive option for commuters.

The impact of metro rail on traffic can be significant in several ways:

Reduced congestion: One of the primary benefits of a metro rail system is the reduction of congestion on the roads. With more people choosing to use the metro instead of driving, there are fewer cars on the road, which can help to reduce traffic congestion.

Faster travel time: Metro rail systems can also provide faster travel times than driving, especially during peak hours. This can help to reduce the amount of time people spend stuck in traffic, leading to a more efficient and reliable transportation system.

Improved air quality: By reducing the number of cars on the road, a metro rail system can also help to improve air quality in the city. This can have significant health benefits for residents, as air pollution has been linked to a range of health issues.

Reduced carbon emissions: In addition to improving air quality, a metro rail system can also help to reduce carbon emissions, which can have a positive impact on the environment. By providing an alternative to driving, the metro can help to reduce the amount of greenhouse gases being emitted into the atmosphere.

Economic benefits: A well-designed metro rail system can also have economic benefits, by improving accessibility and connectivity, and attracting new businesses and residents to the area.

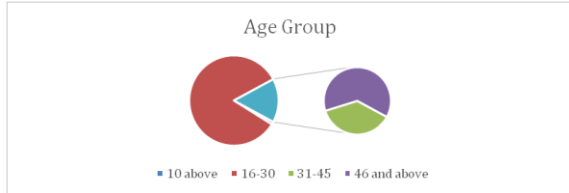
Overall, the impact of a metro rail system on traffic can be significant, with benefits for the environment, public health, and the economy. However, the success of the system will depend on a range of factors, including its design, cost, and accessibility, as well as the availability of alternative transportation options.

In this paper, Part of Purple Line Phase-1, was considered for the evaluation impact of Socioeconomic characteristics of Namma Metro on Bengaluru city. In one of the studies conducted for a Metro station along the purple line showed that, it has helped in decongestion of the traffic and thus aiding in sustainable development of the city (R.Hemasree, n.d.). One more study along the purple line, to understand the relevance of the location also concluded that Metro rail systems helps in promoting the Non -motorized transport and also reduction in traffic congestion, pollution in a positivity note but also suggesting for a better planning of parking and other facilities for better use of Metro rail system.(Hemasree& Subramanian, 2019). The study was conducted along the corridor Byappanahalli to Majestic of purple line i.e., East-West corridor.

IV. DATA INTERPRETATION

1. Age group

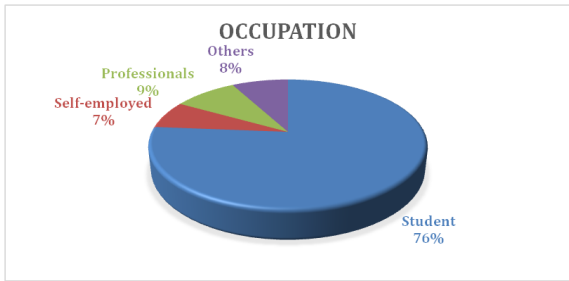
Age group 10-15	(1%)
16-30	(83.2%)
31-45	(5.9%)
46 and above	(9.9%)



The above charts shows that the age group using metro are more between 16-30.

2. Occupation

Occupation Student	(76.2%)
Self-employed	(6.9%)
Professional	(8.9%)
Other	(7.9%)

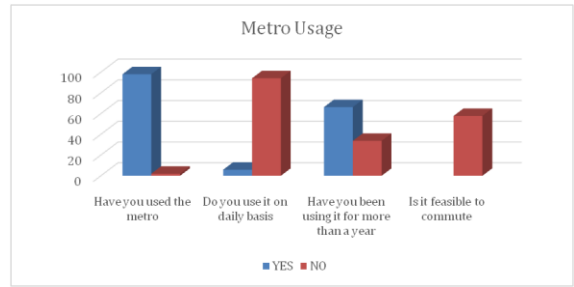


In the above chart students use metro in high percentile compared to others for the purpose of commuting from School/college/universities to way back home and vise versa.

3. How often do you use the Metro

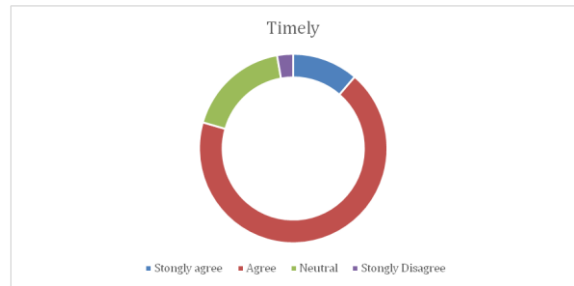
Have you ever used the Metro train	Yes	(99%)
	No	(1%)
How often do you use the Metro Train?	Everyday	(5.9%)
	A few times a week	(6.9%) (38.6%)
	A few times a month	(48.5%)
	A few times a year	

How long have you been using the metro?	0-12 months	(15.8%)
	1-5 years	(66.3%)
	5+ years	(17.8%)



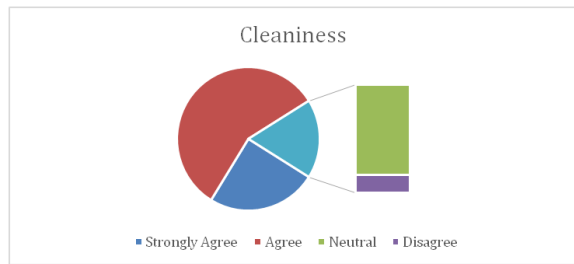
4. Are metro trains always on time

Metro trains are always on time	Strongly agree	35.6%
	Agree	49.5%
	Neutral	12.9%
	Disagree	2%
	Strongly disagree	0



5. Metro stations are clean

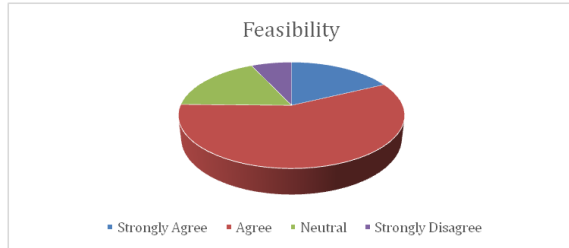
Metro stations are clean	Strongly agree	24.8%
	Agree	57.4%
	Neutral	14.9%
	Disagree	3%
	Strongly disagree	0



In the above chart around 58% of the responders agree to the cleanliness of the metros where as 25%

agree and rest 15% are neutral about it where as 2% disagree.

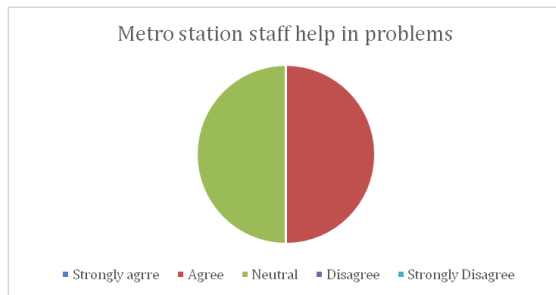
6. Metro stations ticketing facilities are good



Here it shows more than half of the responders agree about the feasibility of metro ticketing as now Namma Metro tickets can be booked are bought through the help of WhatsApp as well which is very feasible.

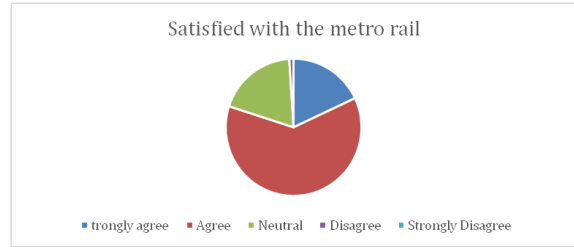
15. Metro station staff help in problems

Strongly agree	0
Agree	50%
Neutral	50%
Disagree	0
Strongly Disagree	0



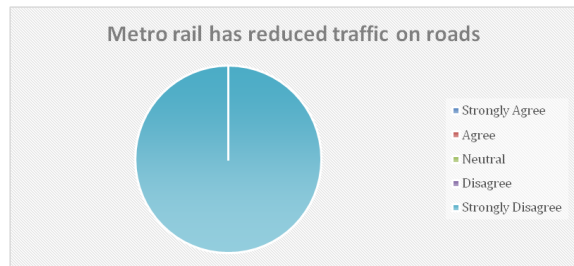
16. Satisfied with the metro rail

Strongly Agree	17.8%
Agree	61.4%
Neutral	18.8%
Disagree	1%
Strongly Disagree	1%



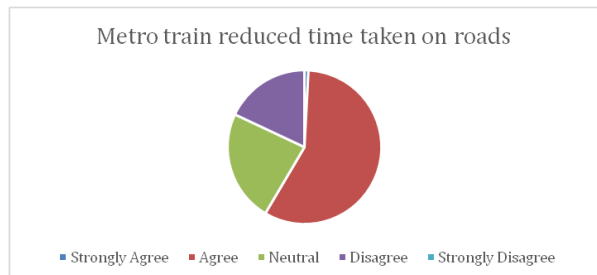
17. Metro rail has reduced traffic on roads

Strongly Agreed	23.8%
Agreed	23.8%
Neutral	28.7%
Disagree	19.8%
Strongly Disagree	4%



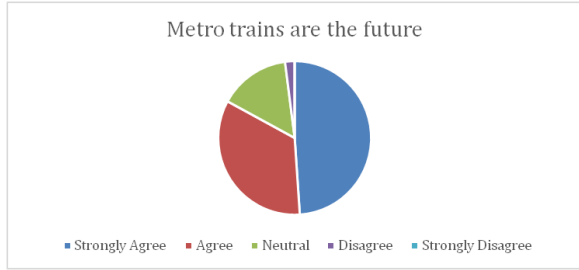
18. Metro train reduced time taken on roads

Strongly agree	45.5%
Agree	31.7%
Neutral	12.9%
Disagree	9.9%
Strongly Disagree	0



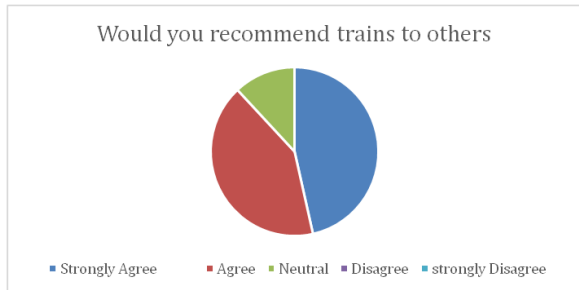
19. Metro trains are the future of communicating

Strongly Agree	48.5%
Agree	33.7%
Neutral	14.9%
Disagree	2%
Strongly Disagree	1%



20. Would you recommend trains to others

Strongly Agree	46.5%
Agree	41.6%
Neutral	11.9%
Disagree	0
Strongly Disagree	0



V. DATA FINDINGS

The researcher found that a maximum of 10 respondents (1%) belonged to the age of 10-15 years followed by 40 respondents 16-30 years (83.2 per cent) and only 50 respondents (15.8%) come under the category of 31 - 45years.

It is understood that one half (57%) of the respondents are female whereas the other (43%) of the respondents are male.

It is found that the maximum of 40 respondents is (76.2%) are student, 23 respondents (6.9%) self employed, 15 respondents under professional (8.9%) and other 22 respondents fall under (7.9%).

It is clear that a majority portion (53.25%) has used metro and (24.85%) haven't use metro yet and only 37 respondents (21.89 respondents) that they are regular passenger

It is implicit that a maximum of 72 respondents (42.60%) who uses metro a few times a week followed by (30.18%) uses few times a month and only 46 respondents (27.22%) uses few times a year

It is clear that a majority of the portion (53.25%) using metro for 0-12 months , (24.85%) uses metro and only 37 respondents of 1-5 years (18.3%) 21 respondents uses metro for more than 5 years.

It is clear that a majority portion (60.5%) agreed with the fact that metro is clean, (30.2%) people strongly agreed, (9.3%) people is natural, and no one disagreed. Age range of participants is (18-50 y/o)

It is cleared that majority portion (60.8%) people agreed with the fact that metro station provide facilities, (39.2%) people was neutral and no one disagreed. Age range of participants is (18-50 y/o)

It is cleared that majority portion (30.3%) people strongly agreed with the fact that metro station stuff is honest, (68.7%) people agreed, (9.0%) people was neutral and no-one disagreed. Age range of participants is (18-50 y/o)

It is cleared that majority portion (50 percent) people agreed with the fact that metro station stuff help in problem situations and (50 percent) people was neutral. Age range of participants is (22-48 y/o)

It is cleared that majority portion (70.3 percent) people strongly agreed with the fact that they are satisfied with the metro rail and facilities provided and (29.7 percent) people strongly disagreed. Age range of participants is (20-45 y/o)

It is cleared that majority portion (80.7 percent) people was neutral with the fact that metro has reduced traffic on roads, (10.1 percent) people was neutral and (9.2 percent) people disagreed. Age range of participants is (18-40 y/o)

It is cleared that majority portion (53.25 percent) people has strongly agreed with the fact that metro trains are the future of commuting, (24.85 percent) people agreed and (21.89) people disagreed. Age range of participants is (22-50 y/o)

It is cleared that majority portion (70.0 percent) people agreed to recommend trains to others and (30 percent) people disagreed. Age range of participants is (18-30 y/o)

It is cleared that majority portion (56.3 percent) people choose electric vehicles and (43.7 percent) people choose metro. Age range of participants is (22-45 y/o)

It is cleared that majority portion (73.1 percent) people has responded by metro has resulted in choosing metro over the other means of public transport and (26.9 percent) people disagreed. Age range of participants is (30-53 y/o)

It is cleared that majority portion (90 percent people) agreed that the cost of ticket price should be reduced and (30 percent) people are okay with the cost. Age range of participants is (22-45 y/o)

It is confirmed that majority portion (45.5 percent) people has strongly agreed that metro should be extended to other regions of Bangalore to reduce conjunction and (54.5 percent) people was neutral. Age range of participants is (20-40 y/o)

CONCLUSION

The above research pointed towards deciding the variables that impacts the rising utilization of Metro and to gather the assessment of the overall population on the decrease of traffic because of Metro with unique reference to Bengaluru, Delhi, and Hyderabad. The major factors that determine that the use of the metro has reduced traffic are the time taken, metro train, station, and the facilities

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Traffic has been one of the main problems for Bengaluru peoples. With the inscrease in it's population from people relocating and resettling to Bangalore in search of better job, lifestyle and education oppurtunities for being known as the SILICON VALLEY OF INDIA, IT HUB to slowly turning into an Educational City Bangalore has come to be a busier city.

However with the hope of controlling the worse traffic to connecting last mile being a distant dream Namma Metro is pacely working to make lives easier for it's general public. From working on building new metro lanes to agonishing responses of public stating " Unfortunately, despite the thousands of crores being sunk in it, Namma Metro is nowhere near achieving either of these objectives."

The Bangalore Metro Rail Corporation Limited (BMRCL) has expanded it's lane from 7.5 km stretch between Baiyappanahalli and MG Road to now having two operational lines, the Purple Line and the Green Line. The Purple Line which runs from Baiyappanahalli to Mysore Road and the Green Line which runs from Nagasandra to Yelachenahalli. Namma metro being the 3rd largest metro operator in India which runs underground and upper ground covering 56.1 kms (about 34.86 mi) at a top speed of 80km (about 49.71 mi)/h. It is safe to say to some extent the Namma Metro is a fast, efficient, and affordable mode of transportation for commuters in Bangalore specially when tring ends of the city meet. It has helped to ease traffic congestion and improve connectivity in the city.

Hence, from the research conducted to find out the data's and details regarding the impact of metro train on traffic in Bengaluru the data's states that the metro train does not has much of a impact as of now because there is only 2 lines that is working currently and the development of metro trains further is working at a very low and slow pace causing the neitizens trouble and inconvenience from all the work in progress which is further leading to more traffic jams .

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