

TRAFFIC CONGESTION: CAUSES AND SOLUTIONS

CASE STUDY: HINJEWADI, PUNE

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Abstract – Congestion impacts the movement of people. Traffic congestion not only causes pollution, but also wastes time and energy. The major factor for traffic congestion in Hinjewadi today is the imbalance seen in its Modal Split Ratio - a very low ridership in public transport due to poor service quality and less frequency - which leads to an increase in the number of private vehicles causing congestion which further leads to an increase in travel time and emission of exhaust gases causing air pollution. Change in commuters' thinking and their behavioral pattern is studied by extensive surveying. Vehicle Composition and Occupancy Factor of commuters is also analyzed to understand the traffic flow in the area. The Origin-Destination matrix was drawn and the visuals were created using VISSIM Software. Solutions for increasing congestion in the area are given by suggesting optimal infrastructural changes, enhancing the use of public/semi-public transportation, and increasing the Occupancy Factor of vehicles. The future development of the IT-sector and the impact of Pune Metro Rail are also taken into account.

Key Words: Modal Split, Origin-Destination Matrix, Occupancy Factor, Vehicle Composition, Travel Time, Congestion

1. INTRODUCTION

Traffic Congestion is one of the major issues experienced in most metropolitan cities in the developing nations. Traffic Congestion involves queuing, slower speeds and increased travel time which wastes energy of the commuters and causes stress, thus reducing the overall productivity and imposing an intangible cost on the society. It also affects various other factors like environment, usage of natural resources, quality of life and safety of commuters as well as pedestrians, directly and/or indirectly. Hence, Urban Traffic Congestion possesses a challenge for all large and growing urban areas and thus many measures have been taken over years to attenuate the same. As congestion continues to increase, the conventional approach of 'building more roads' does not always work due to varying circumstances. In fact, building new roads can actually compound congestion in some cases by inducing greater demands for vehicle travel that quickly eat away the additional capacity. This is becoming more and more apparent in the form of greater congestion and delays observed in major cities. Besides this, suitable corridors in such cities for major roadwork are becoming increasingly difficult to be obtained, thus increasing the cost of construction.

The major factors contributing to Urban Traffic Congestion can be categorized as follows:

- Prevailing imbalance in Modal Split
- Inadequate Transport Infrastructure
- Sub-optimal use of existing Infrastructure

Studying different major cities around the world shows us how Public Transportation can reduce the transport problems faced by Indian cities. These cities cannot afford to cater only to private cars and two-wheelers. There must be a general understanding amongst the locals that without public transport, cities would be even less viable. To encourage Public Transportation, one must increase the quality and quantity of Public Transportation, while simultaneously creating a balance on the Demand-and-Supply scale.

The existing transport system in Indian cities has not been able to keep up with the rapidly increasing demand over the past few decades, particularly the 'Bus Transit System'. The last two decades have seen a gradual decline in the level of Bus services in the country. Their relative output is further diminished as commuters opt to travel with private and semi-private vehicles as we can see in Fig. 1. Against this backdrop of serious problem, traffic control techniques and information systems are needed that can significantly improve the traffic flow efficiency and its carrying capacity. Application of Intelligent Transport System (ITS) technologies in such areas has significant potential for relieving congestion. In the past decade, ITS has surged around the world providing us with additional tools to help solve our transport problems. ITS can produce major benefits in reducing congestion and its environmental impacts. ITS not only has the ability to reduce the number of accidents and thus boost public safety, but it can also make remarkable improvements to the efficiency of Public Transport fleets and Inter-Modal integration.

2. METHODOLOGY

Taking into account the various parameters and the extent of the project, a list of research papers is studied. Literature survey is the most important part of the project as it shows a direction to proceed and set achievable objectives. Various papers related to traffic congestion measurements and solutions were considered to get a broader outlook towards the problem. This was followed by Reconnaissance Survey which included study of the area, interaction with locals,

officials and experts, study of previous investigations, etc. The Preliminary Survey included collecting data by conducting various surveys like Volumetric Study, Road-Side Interview Surveys, Occupancy Factor Survey, Origin-Destination Survey, Speed and Delay Survey, Accident Survey, etc. Based on the observations made during the field reconnaissance and analysis of data, the most obvious problems have been identified and optimum solutions were then formulated. The costs of these alternatives, their impact on the traffic flow and congestion, etc. were calculated using various software. The impact of Pune Metro Rail was also taken into consideration.

3. CASE STUDY

Hinjewadi is a suburb located in Pune (India), mainly known for its IT-Park (Rajeev Gandhi Infotech Park). The 2800 acre IT-Park in Hinjewadi houses more than 120 companies of different sizes. The Infotech Park is subdivided in three phases, with four further phases planned. According to a survey conducted by OLA Cabs in the year 2017- Shivaji Chowk, located in the IT-Park is considered amongst the seven biggest bottlenecks in India. The average speed of vehicles in Pune during peak hours is 22 kilometres per hour (kmph) while that in Hinjewadi is just 16 kmph. In some areas, the average speed drops as low as 6 kmph. On an average, the commuters spend more than an hour to travel a distance of 2 km between Wakad Taking into account the various parameters and the extent of the project, a list of research papers is studied. Literature survey is the most important part of the project as it shows a direction to proceed and set achievable objectives. Various papers related to traffic congestion measurements and solutions were considered to get a broader outlook towards the problem. This was followed by Reconnaissance Survey which included study of the area, interaction with locals, officials and experts, study of previous investigations, etc. The Preliminary Survey included collecting data by conducting various surveys like Volumetric Study, Road-Side Interview Surveys, Occupancy Factor Survey, Origin-Destination Survey, Speed and Delay Survey, Accident Survey, etc. Based on the observations made during the field reconnaissance and analysis of data, the most obvious problems have been identified and optimum solutions were then formulated. The costs of these alternatives, their impact on the traffic flow and congestion, etc. were calculated using various software. The impact of Pune Metro Rail was also taken into consideration.

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areas, the average speed drops as low as 6 kmph. On an average, the commuters spend more

Bridge and Wipro Circle. The companies in this area were constructed before building a basic infrastructure. This has led to the infrastructural development leap-frogging behind the overall development of Hinjewadi.

Chart -1: Modal Split (Hinjewadi IT Park)

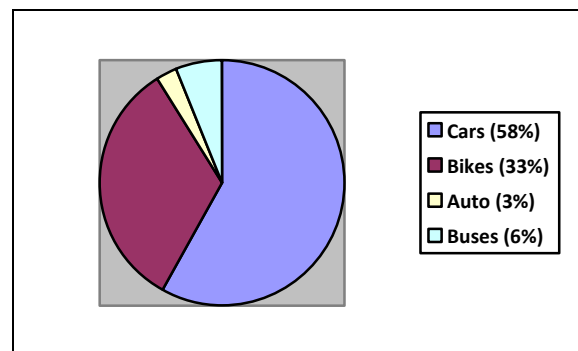
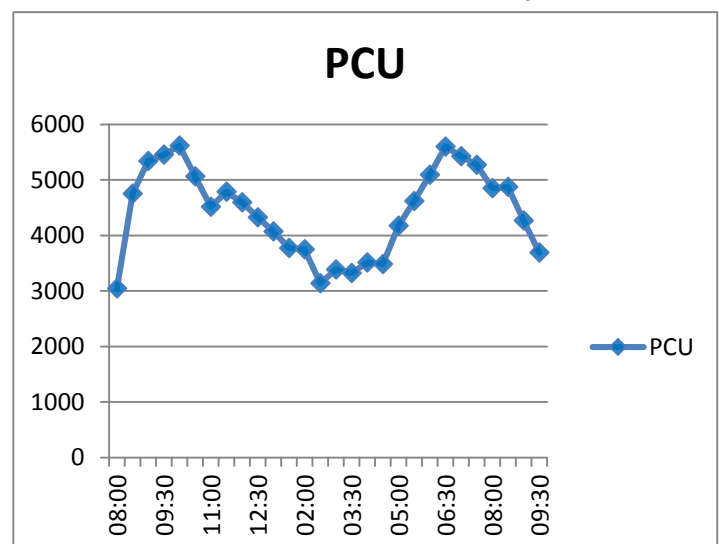


Chart -2: Volumetric Study



3.1 Pre-feasibility study of Pune Metro Rail

Pune Metro is a rail based Rapid Transit System under construction to serve the city of Pune and its industrial twin Pimpri Chinchwad in Indian state, Maharashtra. The third line (Phase – II) of the project – 23.33 km elevated route will connect the Rajeev Gandhi IT-Park in Hinjewadi to Shivaji Nagar, Pune. A survey to study the impact of this project on the commuters of Hinjewadi was conducted. The study included an online survey which focused on the possible shortcomings Pune Metro could face in the near future and provide suggestions to the afore-mentioned problems. The survey included various questions for the commuters like: travel distance, current mode of transport, average travel time, preferred waiting time at the stations, etc. The result of this survey was presented in the form of graphs and pie-charts showing the adaptability and preference of the metro rail, if constructed, by the household who generally

preferred bus as their primary source of commute. It helped us understand the balance between the adequacy of Metro Rail and demand side of dwellers. Some of the results from the survey are exemplified below

Chart -3: Current Mode of Transportation

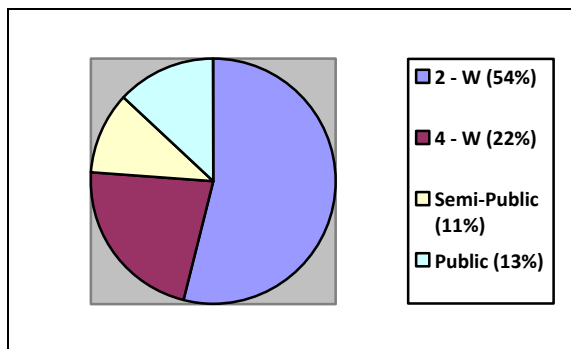
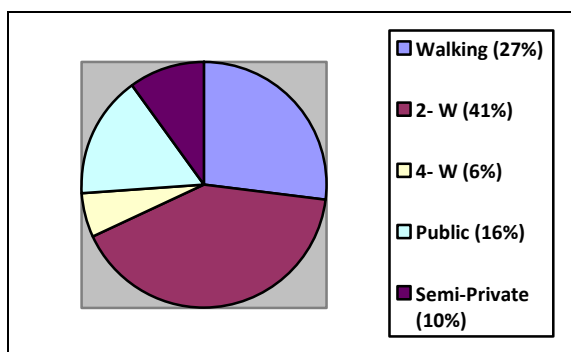


Chart - 4: Preferred mode of transportation to reach metro Station



3.2 Causes of Traffic Congestion

Inadequacy of Traffic System

The traffic system fails to clear the queue during peak hours. All cross-roads need at least 4-8 traffic policemen simultaneously. A heavy patrol of 86 traffic controllers including 4 officers, 31 warden, and 51 traffic police, work from 8 a.m. to 10 p.m. in this area consisting of just 3 major intersections.

Narrow Roads

The major routes connecting the IT park and Hinjewadi are not wide enough for a free flow of traffic. Though most of these roads have undergone road-widening recently, the illegal encroachment of hawkers still creates bottlenecks at various intersections.

Illegal Parking

Illegal road-side parking between the Indian Oil Petrol pump and Shivaji chowk hampers the flow of traffic leaving Hinjewadi during the evening hours.

Increasing number of Commuters

With an ever-so-growing IT Sector at its core, there is a continuous increase in the number of employees. This directly puts a load on the Transport System as the number of Commuters steeply increases along with it.

High purchasing power of Public

The standard of living of regular commuters increases along with the growth of IT sector. This brings in the psychology of travelling alone, preferably so in a car, with maximum comfort, thus, gradually increasing the modal share of Private vehicles.

Redundant Public Transport Facilities

It has been observed that the frequency of public vehicles is very low in the IT Park as on an average one government transport bus (PMPML) is available every half hour. Buses have then been issued by a local authority and some major IT companies themselves. Still the employees prefer private or semi-private transportation as it gives them more freedom of movement. This, thereby, reduces the Modal share of Public Transportation.

Improper Planning

The companies in this area were constructed before building a basic infrastructure. This has led to the infrastructural development leap-frogging behind the overall development of Hinjewadi.

Improper Lane Management

One of the most common causes of traffic congestion in every developing country is improper lane management. Commuters in a hurry to reach their destination disregard the traffic laws and indirectly end up slowing themselves.

Low Occupancy Factor

The occupancy factor in Hinjewadi is 1.25 for 'Two wheelers' and 1.87 for 'Cars'. This is very low when compared to the average occupancy factor for Pune city as specified in the 'Comprehensive Mobility Plan for Pune' is 1.6 for 'Two wheelers' and 2.9 for 'Cars' respectively.

3.3 Solutions for Congestion

Various government as well as non-government organizations have been working on the issue of traffic congestion in Hinjewadi since last few years. The different solutions implemented over this period include:

- Modification of roads – A 1.75 km road from Vinode Vasti to Tata Junction through Laxmi Chowk and one from Shivaji Chowk to Bhumkar Chowk (on Dehu Rd.-Katraj Bypass) were recently widened by the State Government and PCMC respectively. Along with this, two more routes are proposed for widening, which include the road connecting Wakad Flyover to the tail of Phase-I, and Balewadi

Stadium to Phase-II of IT Park. Apart from this, a median is being constructed from Shivaji Chowk to Jambhulkar Gym Junction while the road connecting Mezza 9 and Bhumkar Chowk is being asphalted and widened simultaneously.

- Proposed Alternate Routes-
 - Lavasa City to Shivaji Chowk via Mann Village
 - Mhalunge to Infosys (Phase - I)
 - Pirangut to Infosys (Phase - I)
- Contraflow Lanes
- Staggering of Office Timings
- Dedicated Bus Lane
- Infrastructural Changes like reduction in the diameter of Wipro Circle from 40m to 20m.
- Removal of encroachments from Shivaji Chowk to Bhumkar Chowk

Considering the various surveys and analysis of the traffic flow along with this study, several short-term and long-term improvement plans were suggested. Creating awareness related to traffic and its harm; removing encroachment of hawkers between Shivaji Chowk and Wakad Flyover; proper lane management; and keeping a check on illegal parking include the basic solutions which should be implemented on high priority.

Other long term measures suggested include:

Grade Separation Interchange at Shivaji Chowk [Underpass]:

The average queue length at Shivaji Chowk [Phase I – Dange Chowk] is 318 m. during the peak hours. Moreover, a vehicle has to wait for an average of 5 minutes at this signal during this period. Similarly, the 'Queue Length' and 'Stoppage Time' at various junctions were studied. Integrating these values and the volumetric count observed at these junctions, various simulations were run with the help of VISSIM software. Comparing all the simulations, current scenario and future development of Pune Metro, an underpass at Shivaji Chowk connecting Phase-I and Dange Chowk was suggested.

Vehicle Pooling Applications

Considering the Low Occupancy Factor, reasons behind the same were studied through Road Side Interview Surveys. The survey suggested that more than seventy percent of car travellers, travel solo, thus, formulating new Vehicle Pooling Applications for the usage of IT employees in Hinjewadi is an immediate need. Companies can support this project by encouraging the employees to use this app by providing suitable incentives if needed.

Optimization of Metro-Zip Services

With minimal PMPML buses traversing in and out of the IT Park, Metro-Zip [an initiative of Hinjewadi Industries Association (HIA)] is the primary source of public transportation in Hinjewadi. At present more than 120

Metro-Zip buses are in use. To improve the demand for the same, various parameters were studied in a survey done of around 280 people using this service. The study suggests that the major scope for improvement lies in increasing the transit service coverage and frequency. Various other solutions like providing express commuter service and transit priority measures, developing more accessible land use patterns, providing services for inter-zonal movement, etc. were also suggested.

Congestion Charges

The IT Park is experiencing adverse problems due to Traffic Congestion with just three phases in function. Optimum Congestion charges should be applied on the proposed phases to preclude congestion.

4. RESULTS AND CONCLUSIONS

Traffic Congestion is an everyday problem faced by the population of any developing country and the various factors introducing traffic congestion are narrow roads, illegal

parking, improper lane management, low occupancy factor, etc. The most common measures implemented throughout these cities are to construct alternative routes or road widening. While the construction of alternative routes is affected by various socio-economic and political factors, it has been understood that widening of roads does not always help in reducing the congestion. Greater the width of road, greater is the number of vehicles. But private vehicles give the utmost comfort to a commuter and thus, travelers tend to use their own vehicles. This leads to increase in Modal Share of private vehicles, and thereby a substantial decrease in the share of public vehicles.

In Hinjewadi, according to various surveys conducted, the private vehicle ridership is more than eighty percent while the public vehicle ridership is as low as nine percent. The occupancy factor obtained for bikes and cars is also as low as 1.25 and 1.87 respectively. The immediate need to curb the congestion is blatant as the vicinity experiences around 4-5 fatal accidents and around 20 minor or major accidents per month. The average queue length and stoppage time at major intersections, travel time during the peak hours, average trip length, etc were also studied and tabulated. Along with this, the pre-feasibility study encompasses the view of the locals as well as the daily commuters, regarding the 'Pune metro rail project'. An extensive survey which could collect more responses should be conducted to understand the nuances of the public regarding the project.

The results obtained from these surveys and observations led to the investigation of the causes and solutions to the congestion in this area. Traffic congestion curbs can be refurbished by undertaking several strategies like road widening, providing contra-flow lanes, infrastructural changes, increasing the occupancy factor of vehicles and creating awareness among travelers. Most importantly, Improvement in the Metro-zip services along with public

awareness of the adverse effects of low occupancy rate is necessary to mitigate the problem of congestion in Hinjewadi.

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