INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X
Impact Factor: 6.078
(Volume 7, Issue 3 - V7I3-1917)
Available online at: https://www.ijariit.com

Solution on traffic congestion for Pune

Shriyash Bhondve
shriyashbhondve3377@gmail.com
Symbiosis Skills and Professional University, Pune, Maharashtra

Shreyas Galagali
shreyasg27@gmail.com
Symbiosis Skills and Professional University, Pune, Maharashtra

Chanakya Sahasrabuddhe
csahasrabuddhe@gmail.com
Symbiosis Skills and Professional University, Pune, Maharashtra

Akshay Gada
akshaygada.2000@gmail.com
Symbiosis Skills and Professional University, Pune, Maharashtra

Tejas Aher
tejasaher190@gmail.com
Symbiosis Skills and Professional University, Pune, Maharashtra

Khalid Shaifullah
shaifullahkhalid@gmail.com
Symbiosis Skills and Professional University, Pune, Maharashtra

A CAPSTONE PROJECT REPORT

ON

"INNOVATIVE SOLUTION :- SOLUTION ON TRAFFIC CONGESTION FOR PUNE."

SUBMITTED

BY

Mr. SHREYAS SHRIDHAR GALAGALI

Mr. SHRIYASH RAM BHONDVE

Mr. CHANAKYA HEMANT SAHASRABUDDHE

Mr. AKSHAY ALPESH GADA

Mr. TEJAS VIJAY AHER

Mr. KHALID SHAIFULLAH

Under the Guidance of

Prof. ANIRUDDH DUBAL

In fulfillment of

B.Tech in Construction Engineering & Infrastructure Management

Symbiosis Skills & Professional University, Kiwale, Pune

2020-21

Department of Construction Engineering

SSPU - Kiwale, Adjoining Mumbai – Pune Expressway, Pune- 412101,

Academic Year 2020-2021

DEPARTMENT OF CONSTRUCTION ENGINEERING

CERTIFICATE

This is to certify that

Mr. SHREYAS SHRIDHAR GALAGALI

Mr. SHRIYASH RAM BHONDVE

Mr. CHANAKYA HEMANT SAHASRABUDDHE

Mr. AKSHAY ALPESH GADA

Mr. TEJAS VIJAY AHER

Mr. KHALID SHAIFULLAH

has satisfactorily and successfully completed

A Dissertation work on

"INNOVATIVE SOLUTION :- SOLUTION ON TRAFFIC CONGESTION FOR PUNE."

In partial fulfillment of Bachelor's degree in

B.Tech in Construction Engineering and Infrastructure Management

From the Symbiosis Skills and Professional University, Pune during the academic year 2020-21

Prof. Aniruddh Dubal
(Head of Dept.)

Examination Approval Sheet

The Dissertation report entitled

"INNOVATIVE SOLUTION :-
SOLUTION ON TRAFFIC CONGESTION FOR PUNE."

By

Mr. SHREYAS SHRIDHAR GALAGALI

Mr. SHRIYASH RAM BHONDVE

Mr. CHANAKYA HEMANT SAHASRABUDDHE

Mr. AKSHAY ALPESH GADA

Mr. TEJAS VIJAY AHER

Mr. KHALID SHAIFULLAH

Is approved for Graduation

B.Tech in Construction Engineering

From

Department of Construction Engineering

SSPU - Kiwale, Adjoining Mumbai – Pune Expressway, Pune- 412101,

Academic Year 2020-2021

Examiners:

External Examiner:-……

Internal Examiner:-…….

Date:……..

Place:……

ACKNOWLEDGEMENT

I have a great pleasure to express my deep sense of gratitude and sincere regards to my guide and our head of Construction Engineering Department Mr. Aniruddh Dubal, for his guidance and friendly discussion which helped me immensely in selecting this topic. His generous encouragement throughout this course has helped me in completingthis.

I would also like to thank university’s Vice – Chancellor, Registrar and Campus Admin for providing all facilities and data at the right period of time. I am thankful to all the faculty members of Construction Engineering and other staff for helping me in this work.

Finally, I would like to thank all those who directly or indirectly helped me in dissertation work.

Mr. SHREYAS SHRIDHAR GALAGALI

Mr. SHRIYASH RAM BHONDVE

Mr. CHANAKYA HEMANT SAHASRABUDDHE

Mr. AKSHAY ALPESH GADA

Mr. TEJAS VIJAY AHER

Mr. KHALID SHAIFULLAH

ABSTRACT

Traffic condition in most of the cities are very complex. The high increase in number of vehicles on road and increasing urbanization leads to the problem of traffic congestion, which further leads to complications and hazards on the city roads. Many arterial roads in Pune city are suffering from this problem, especially during peak traffic hours. In this work, we witnessed actual traffic congestion problems. For further analysis, we conducted traffic volume survey through manual counting of vehicles and converted this data in to the PCU coefficients. After analyzing all thework, we pinned the root problem of road and proposed a solution to avoidtraffic congestions.

Keywords: traffic congestion, peak hour traffic, Traffic volume study, traffic solution, Passenger Car Unit

INDEX

Chapter 1 – Introduction

According to the Oxford Dictionary, A traffic jam is defined as “a long line of vehicles that cannot move forward because there is too much traffic, or because the road is blocked by something.”

Nowadays, transportation leads to a number of problems with traffic congestion being one of the most burning issues in every territory of the world. Traffic congestion is a normal phenomenon associated with transportation, especially in urban areas where the population density is high. To tackle this problem, every country is approaching differently according to their country’s situation regarding population and needs, and solving their transportation problems within their capabilities.

According to the World Bank, United States Census Bureau the population of India recorded in 2017 was found to be 1.34 Billion, the second largest populated country in the world. And Indians everyday face the problem of traffic congestion, wasting hours of their lives. To be precise, On average travellers in India spend 1.5 hours more on their daily commutes than their counterparts in other Asian cities during peak traffic times according to report released by The Boston Consulting Group (BCG) and commissioned by Uber. In fact, Transport demand in India has increased by almost eight times since the 1980s as rapid economic development and increasing wealth among households has led to higher vehicle ownership. This is higher than anywhere else in the Asia-Pacific region, according to BCG.

Pune, the second largest city in Maharashtra and the ninth most populous city in the country is one of India’s most famed metropolitan hubs, also being known as the "Oxford of the East" due to the presence of several well-known educational institutions. In one of its document on Smart City project, the Pune Municipal Corporation (PMC) states that the city ‘aspires to become global urban centre”.

Due to such rapid urbanization, Pune is also facing the problem of traffic congestion especially the arterial roads. In fact, As per the results of the TomTom Traffic Index conducted in 2019 (dec), a report detailing the traffic situation in 416 cities in 57 countries, Pune was the fifth most traffic congested city in the world, with traffic users spending an average of 59per cent extra travel time stuck in traffic.

Figure No. 1 Showing heavy traffic congestion

There are some traffic problems of Pune City which needs to be attended to as soon as possible so as to maintain the actual growth in terms of basic development. Most arterial roads in the city are facing the problem of traffic congestion especially during peak hours. This as a result causes delay to the road users as well as an increase in the accidents on road.

Chapter 2 – Literature Survey

2.1 Review Of Research Papers

2.1.1.) H. M. Zhang* “A Theory Of Nonequilibrium Traffic Flow”The University of Iowa, Iowa City, IA 52242, U.S.A.

This paper presents a mathematical theory for modeling the hysteresis phenomenon observed in traffic flow. It proposes that acceleration, deceleration and equilibrium flow should be distinguished in obtaining speed – concentration and/or occupancy relationships, such that the phase transitions from one phase to another can be correctly identified. The analysis shows that the speed ± concentration curves obtained following this approach are hysteresis loops,as predicted by the theory. The paper also gives a discussion ofthe general properties of the proposed modeling equations and examines the relationship between traffic hysterisis and stop-start waves observed in traffic flow.

The hysteresis phenomenon in traffic flow have been known to transportation researchers fordecades, yet no theory to-date has been able to model such a phenomenon. The researchers have in this paper made an attempt to model traffic hysteresis using a traffic theory. We have shown that the predictions of the theory have accorded well with certain empirical observations, and provided anexplanation for those for which theoretical predictions do not affect empirical results. In the process, the researchers provided guidelines for proper data treatment in traffic flow analysis and clarified certain misconceptions in the study of traffic flow relationships.

2.1.2.) SougataMaji, “Traffic Congestion And Possible Solutions A CASE STUDY OF ASANSOL” Journal of Research in Humanities and Social Science Volume 5 ~ Issue 9 (2017) pp.: 42 -46 ISSN(Online) : 2321-9467

The traffic condition in third world countries like India on urban road pose serious problem. The high increase in number of vehicles on road and increasing urbanization leads to problem of congestion, which further leads to complication and hazard on the cities road. Asansol city already suffering in terms of infrastructure as well as operational efficiencies. Considering the regulation and infrastructure gap on city road this paper first describe the factor causing the congestion on the city road and after that present some recommended measure like rationalize the design of road, implementation the regulation for road users.

The main objective of the study is to identification the actual causebehind the congestion and provided the practical solutionsfor Asansol city to reduced congestion.

Now traffic congestionbecame common problemfor all urban cities also for Asansol city. The prime reason of traffic congestion in Asansol city is occupancy by various menace. In this paper I study the actual cause behind the congestion through primary survey and observed the situation of the road atpeak hour (9.30am-10.30am). Basedon the analysis of current situation, the paper present some logical solutions which are available within Asansol transport systemonly needproper executionin a right way. The advantage of the paper is the recommended solutions is supportable by financial condition, less harassment to common people, safetyfrom accident, reducing trip delay,and welfare for city environment.But in case of implementation there may come constraints like-lake of regular monitoring system,lake of operational efficiency, delay in implementation etc.By considering the policy gap the above maintainsolutionscan mitigatethe congestion in Asansol cityat greater extent. Keepingin view the essentiality of time and population growth The Asansol Municipal Corporation needsto implement such kindofsolutions to maintain proper traffic flow.

2.1.3.) A. de la Escalera*, J.MaArmingol, M. Mata,“Traffic sign recognition and analysis for intelligent vehicles”. Division of Systems Engineering and Automation,Universidad Carlos III de Madrid, C/Butarque 15, 28911 Legane ´s, Madrid, Spain ,Received 22 October 2000; accepted 24 October 2002.

This paper deals with object recognition in outdoor environments. In this type of environments, lighting conditions cannot be controlledand predicted, objects can be partially occluded, and their position and orientation is not known a priori. The chosen type of objects is trafficor road signs, due to their usefulness for sign maintenance, inventory in highwaysand cities, Driver Support Systems and IntelligentAutonomous Vehicles. A genetic algorithm is used for the detection step, allowing an invariance localization to changes in position, scale,rotation, weather conditions, partial occlusion, and the presence of other objects of the same colour. A neural network achieves theclassification. The global system not only recognizes the traffic sign but also provides information about its condition or state.

The objectives of the present paper are:

1. The system has to be able to detect traffic signsindependently of their appearance in the image. Becauseof that, it has to be invariant to:

- Perspective distortion.
- Lighting changes.
- Partial occlusions.
- Shadows.

2. In addition, it has to provide information about thepresence of possible problems:

- Lack of visibility.
- Bad condition.
- Bad placement.

2.2 Problem Statement:- Causes Of Traffic Congestion In Pune City

One of the most common and frustrating problems that one faces in Pune City is getting caught in traffic jams. The daily commuting on the roads of Pune is becoming longer and more relentless day by day, depicting the failure of public transportation infrastructure to keep pace with the growing developing activities in the “Oxford Of The West”.

The causes of traffic congestion in Pune City have been classified by us into –

2.2.1 Long Term Problems

- BRT project failure.
- Cycle Track Failure.

2.2.2 Short Term Problems

- Pune Metro Construction

2.2.1 Long Term Problems

These are the problems faced by the citizens which has been leading to traffic congestion on the roads for a long period and will continue to be problematic in the future if no proper suggestion or change is made. These are –

2.2.1.1 BRT (Bus Rapid Transit System) Project Failure

In 2006, Pune became the second city after Ahmedabad to introduce the BRTS (Bus Rapid Transit System) project, an ambitious scheme that envisaged the implementation of a high-quality public transport system to offset the rising vehicular traffic and the subsequent congestion within city limits.To provide its citizens with a reliable medium of public transport, the scheme promised the construction and layout of dedicated bus corridors along with new air-conditioned buses and high-end terminals and stations.

While the BRTS is designed to provide an integrated network of safer, faster, affordable and more efficient public transportation, the project is plagued by major execution and operational challenges. Project milestones have not been met or are poorly implemented. Some of the causes which resulted in the failure of the BRT Project are given below –

1. Improper maintenance of busses

The buses are not properly maintained which leads to frequent breakdowns of the buses and ultimately ends up blocking the lane.

Figure No. 2: Shows breakdown of the one PMPML bus the lane got blocked

2. Empty BRT Tracks

As the frequency of the busses is less and not on time, the tracks/lanes are remaining empty which causes loss of carriage way area.

Figure No. 3: Shows BRT system chokes road at Swargate

3. BRT lanes used as Parking spaces

After the failure of BRT the lanes are used as parking for vehicles which is improper use of costly carriage way area.

Figure No. 4: Shows unused pmpml which is being used as parking in kalewadi area

2.2.1.2 Failure Of Provision Of Cycle Track

Under the Smart City Project, that Pune is undergoing, the provision of a cycle track was made in the arterial roads of the City. But this provision failed to be implemented practically. The construction of these cycle tracks resulted in the reduction of area of the carriageway. The cycle track was also found to be misused and empty often. some of the causes or reasons by which the cycle track provision is a failure has been given below –

1. Empty Cycle track

The cycle track was found to be empty with very less cycles on this track.

Figure No. 5: Shows unused and empty cycle tracknot being used by cyclists.

2. Cycle track being used by Pedestrians

After construction of cycle track, as the cycle counts are less, the often empty track is being used by the pedestrians and they taking up space. This is prompting the cyclists to take the main carriage way for travel.

Figure No. 6: Shows Cycle track being occupied by Pedestrians.

2.2.2 Short Term Problems

These are the problems that the citizens and road users are facing presently, and after a certain period these problems may seize to exist. These problems include –

2.2.2.1 Pimpri Chinchwad Metro Construction

Pune Metro is an urban Mass Rapid Transit System (MRTS) with 3 lines under construction in the city of Pune, Maharashtra by Maharashtra Metro Rail Corporation Limited (Maha- Metro) and Pune Metropolitan Region Development Authority (PMRDA).Although the State Government approved the project in 2012, it had run into red tape, politics and opposition from local NGOs & activists over its mostly elevated nature. The project received a final approval from the Union Government’s Cabinet on December 7, 2016.

Due to the ongoing construction work of this metro line, the road has to shrunken down to facilitate enough construction area and new routes have to established which are insufficient for the traffic. The inconvenience caused to the road user is although temporary, it is also an important factor affecting traffic congestion.

Figure No. 7: Shows manapa bus stop which is affected by pune metro work.

Chapter 3 – Scope Of The Project

The main objective of this work is to identify the actual cause behind the traffic congestion and provide practical solutions for reducing traffic congestion in Pune.

Traffic congestion is a situation on road networks that arises as use increases and is defined by slower speeds, longer journey times and increased vehicular queuing. Extreme traffic congestion happens as demand exceeds the capacity of a road or when the road is improperly used. Our objective here is to find out the actual reasons why such type of traffic congestion takes place and try to add our contributions to reduce traffic congestion, and ensure smooth flow of traffic.

There are number of situations which cause or magnify congestion; most of them reduce the capacity of a road at a given point or over a certain length or increase the number of vehicles required for a given volume of people or goods, and our aim here is to identify such situations.

Chapter 4 – Methodology

Sample Examination

After sample examination on a selected road, helped us to innovate the best practical solution for traffic congestion in Pune.For the examination we selected the most important, arterial road of Pune city which is Hinjewadi IT Park.

Figure No. 8 :- Red line marks the Hinjewadi IT Park in map

This Project's Sample Examination was done in four parts -

4.1 Conducting Visual Analysis

4.2 Conducting "Traffic Volume Survey".

4.3 Conducting "Traffic Congestion Survey" with the help pedestrian and road user

4.4 General interview with the road users and pedestrians

4.1 Conducting Visual Analysis

Before the start of any project, the visual analysis is an important and the first inspection. In this analysis, we actually went on site which is Hinjewadi IT Road, and observed the actual field conditions. In this we observed the distribution of road and causes of traffic on Hinjewadi IT Road.

The causes of congestion on Hinjewadi IT Road was also identified. These include –

I. Illegal parking

Illegal parking on the road has been creating congestion every day. Despite erecting mandatory “No Parking” signs, road users chose to park their vehicles according to their convenience. Figure no. 4 shows a parked car in front of a “No Parking” sign.

Fig 9:- showing parked vehicle in front of “No Parking” sign

II. Improper lane management

Lane management is an important factor in managing the traffic at Hinjewadi IT Road. Many vehicles are trying to change from one lane to another lane in the middle of the roadway. This leads to vehicles coming from behind to stop which reduces the vehicle’s speed and increases the time for travel. Sometimes, this also leads to fatal accidents. Fig no. 5 shows a two wheeler changing the lane in the middle of the road.

Fig 10:- Showing improper change of lane

III. Higher Purchasing power of the public

Due to the higher purchasing power of the citizens of Pune city the popularity of private transportation is increasing, but the existing roads are not able to support such a high increase in vehicles. As a result vehicle congestion is increasing at an alarming rate. On top of that, only one or two person are travelling in each car.

IV. Improper crossing of road

Due to small lanes being merged to the road the, users are crossing the road in an improper and indiscipline manner, which is blocking the flow of the other vehicles, wanting to go straight. As shown in the figure no. 7 below, a vehicle is crossing the road perpendicular tothe flow of traffic.

Fig 11:- Showing 2 wheeler crossing the road perpendicular to the flow of traffic

VI. Travelling opposite on one-way

Some road users choose to travel in direction opposite to the direction of flow, to reach their destination in a short distance and time. This creates less space for the road users going in the right way and in peak hours it creates congestion and puts the safety of the road users on the line. The figure no. 12 shows vehicle going in the wrong direction.

Fig 12:- Showing two wheeler going in wrong direction

By conducting this analysis, we visually observed and concluded that the carriageway is insufficient for the traffic.

4.2 Conducting Traffic Volume Survey

Traffic volume study can be defined as the quantity of vehicles crossing a particular cross section of road per unit time at any selected period or location.

Traffic Data Collection is basic requirements for transport planning. Traffic Data forms an integral part of national economics and such knowledge is essential in drawing up a rational transport policy for movement of passengers and goods by both government and the private sectors. Traffic Volume Count is counting of number of vehicles passing through a road over a period of time. It is usually expressed in terms of Passenger Car Unit (PCU) and measured to calculate Level of Service of the road and related attributes like congestion, carrying capacity, V/C Ratio, identification of peak hour or extended peak hour etc. Traffic volume count is usually done as a part of transportation surveys, Traffic Volume Count can be classified or unclassified.

Traffic Volume Survey is an essential part of Town Planning, especially for a town planner. It includes counting the number of vehicles passing through a survey station. The study of Classified Traffic Volume Count is to understand factors that form the basis of:

- Checking the efficiency/saturation of the road network by comparing current traffic volume with the calculated capacity or by identifying level of service
- Establishing the use of the road network by vehicles of different categories, traffic distribution, PCU/vehicle value.
- Need of median shifting or road widening

For this survey, we adopted the manual counting method. The traffic volume study was conducted in two phases: primary and secondary phase.

In primary phase we first selected the locations where this survey will be conducted. These locations included –

- Location which was near the Infosys.
- Location which is exactly opposite to the McDonald’s.

In the secondary phase, we conducted the traffic volume count by manual method for 12 hours, on both these locations and the data collected was combined. The average data was then considered and finalized.

4.2.1 Passenger Car Unit (PCU)

Passenger Car Unit is also an important factor to be considered, especially in developing countries like India as there is a mixed flow of traffic. It can be defined as “the standard vehicular unit which is considered to convert in to passenger car unit”. In case of heterogeneous or mixed traffic flow, the vehicular characteristics such as static and dynamic characteristics comprise of width, speed, length, acceleration. Such characteristics are complex to analyze, hence PCU is considered.

PCU values as per IRC are given below –

Type of wheelers	IRC values
Bicycle	0.4
Motorcycle	0.5
Car	1.0
LCV	1.4
Bus/truck	2.2

Table no. 1 Source for Highway Engineering (S.Chand.)

4.3 Conducting “Traffic Congestion Survey” with the help pedestrian and road users

A questionnaire was formed by us related to traffic congestion problems caused by various vehicle classes.

This questionnaire was distributed and filled by the pedestrians and road users. Near about 1000 such questionnaires were filled in by users

The questionnaires filled by the pedestrians were then analysed and plotted on graph. This indicated the vehicle class that causes most disturbance on the carriage-way, and ultimately helped us to pin-pointing the main problem.

4.4 General Interview With Road Users And Pedestrians

A general interview was also conducted by us with the pedestrians and road users on Hinjewadi IT Road.

In this interview, the pedestrians were free to express their thoughts and views on the traffic problems.

This interview coincided with the traffic congestion survey through questionnaire prepared by us.

The response from this interview was helpful for analysis of various problems which lead to traffic congestion, as well as for pin-pointing the main problem. Most complaints were made to, how various vehicle classes disturb the other classes, especially in case of two wheelers causing disturbance to four wheelers and heavy vehicles as well. By communicating with the pedestrians, most felt that the provision of the cycle track was unnecessary.

Chapter 5 – Details Of Designs, Working And Processes

5.1 Road Width Calculation

Road width calculation, out of the 30m road the percentage of –

- Carriage-way – 55%
- Footpath/Boulevard – 25%
- Cycle Track – 20%

5.2 Traffic Volume Survey

5.2.1 Traffic Volume Survey Observation

The Observations of the traffic volume survey conducted by us by manual counting of vehicles is given below –

Class Of Vehicle	Morning	Evening	Total
Pedestrian	702	2975	3677
Bicycle	107	95	202
2 wheeler	3406	20036	23442
4 wheeler	2052	6957	9009
Bus/truck/auto	953	4105	5058
Total	7220	34168	41388

5.2.2 Calculation and Interpretation of Traffic Volume Count

From the traffic volume count above, the percentage of each vehicle class contributing to the traffic is given below

- Pedestrian = 8.88%
- Bicycle = 0.49%
- wheeler = 56.64%
- wheeler = 21.77%
- Bus/truck/auto = 12.22%

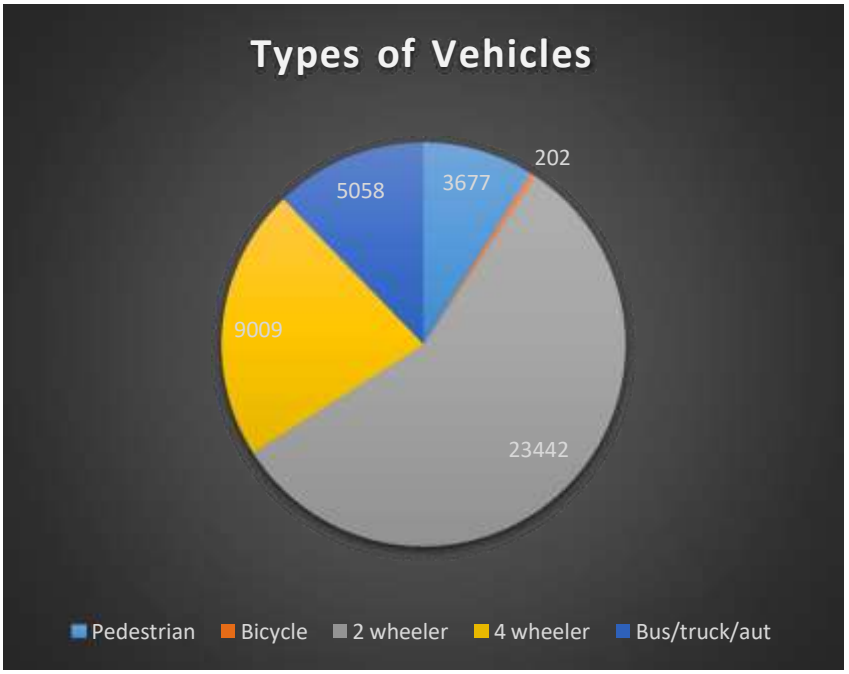


Fig 15:- Showing pie chart of distribution of vehicle classes

5.3 "Traffic Congestion Survey" with the help pedestrian and road users

5.3.1 Sample Survey – Filled

Department of Construction Engineering

SSPU - Kiwale, Adjoining Mumbai – Pune Expressway, Pune- 412101,

Academic Year 2020-2021

Traffic Congestion survey on Hinjewadi IT Road

Q1. Which type of vehicle do you think does not follow traffic signals rules?

- **Two wheeler**
- **Three wheeler**
- **Four wheeler**
- **Other**

Q2. Which type of vehicle do you think does not follow lane management?

- **Two wheeler**
- **Three wheeler**
- **Four wheeler**
- **Other**

Q3. Which type of vehicle do you think improperly parks on streets?

- **Two wheeler**
- **Three wheeler**
- **Four wheeler**
- **Other**

Q4. Which type of vehicle do you think often drives in the wrong way?

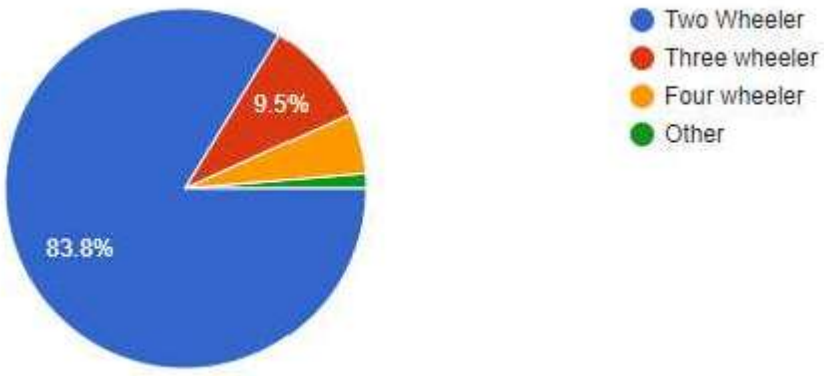
- **Two wheeler**
- **Three wheeler**
- **Four wheeler**
- **Other**

Q5. Which type of vehicle do you think causes most disturbances to the traffic?

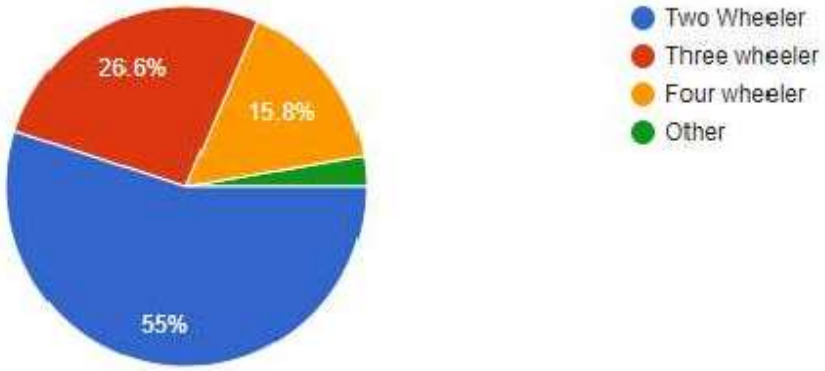
- **Two wheeler**
- **Three wheeler**
- **Four wheeler**
- **Other**

5.3.2 Graph Depicted Results Obtained From Traffic Congestion Survey

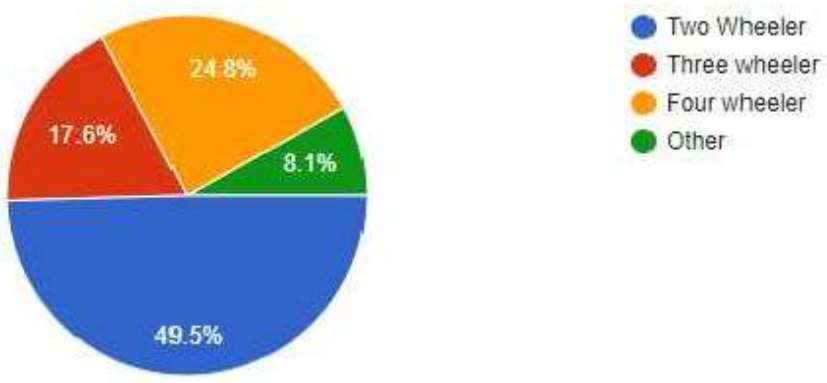
1. Which Type Of Vehicle Do You Think Does Not Follow Traffic Signal Rules?



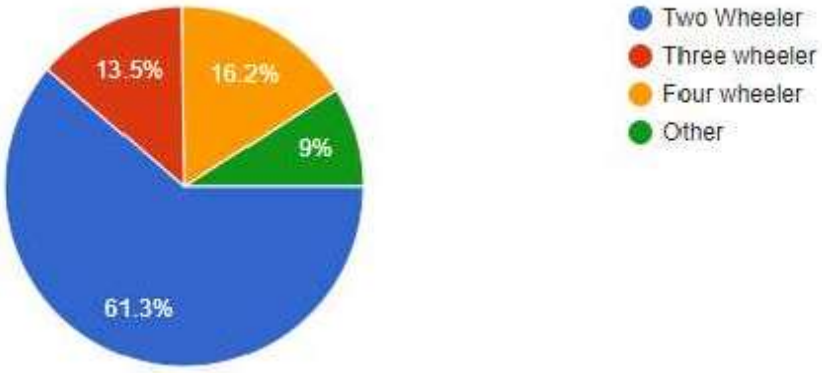
2. Which Type Of Vehicle Do You Think Does Not Follow Lane Management?



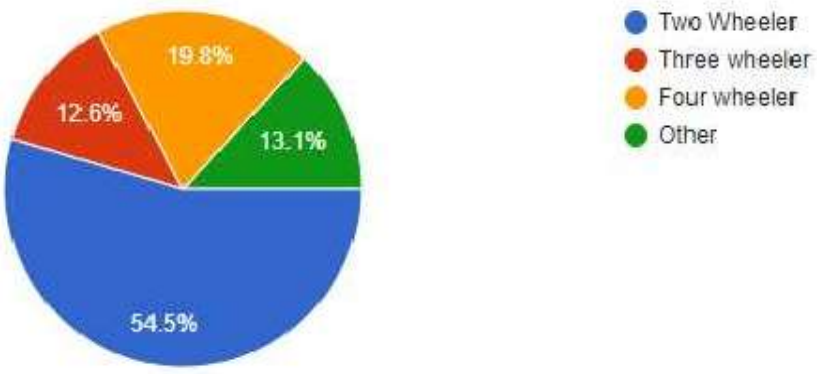
3. Which Type Of Vehicle Do You Think Improperly Parks On The Street?



4. Which Type Of Vehicle Do You Think Often Drives In The Wrong Way?



5.Overall, Which Type Of Vehicle Do You Think Causes Most Disturbances To The Traffic?



Chapter 6 – Results And Applications

6.1 General Solutions

I. Strict lane management

Different lanes for different types of vehicles should be marked on the roads and law i.e. financial penalty should be imposed to make the drivers maintain the lane discipline.

The solution for this problem can be providing suitable markings on the pavement, but this solution would not be very effective as the mentality of the road users will not change.

II. Promotions of traffic rules

Promotion and spreading awareness about traffic rules is necessary in many aspects. By promoting traffic rules, road users can be made to realize the fatal consequences of breaking traffic rules. By spreading such awareness about the importance of traffic rules and regulations, the number of accidents on the road may decrease drastically. This can be done by carrying out awareness campaigns, by hanging or displaying attractive posters clear to the road users.

III. Area licensing system

Fine should be applied if number of passengers in car are less than three (for more than four seated car) on peak hours. By applying fine on the single car user he/she will try to pool the car or use the public transport which will help to reduce no. of vehicle on road. This will in turn reduce traffic congestion. By doing so, full utilization of vehicles can be made and also itwill help in saving money. Hence this will help in the economic growth of the country.

This method is being effectively carried out in other parts of the world such as Singapore, but in India due to high population it wouldn't be much successful.

6.2 Pin Pointing The Main Problem

As seen and observed in traffic volume count the number of two wheeler are almost 60% of the total vehicles on the roadway. The traffic congestion survey as well as the general interview with pedestrians also indicated that two wheelers cause the most disturbance.

6.3 Final / Main Solution

Separate two wheeler lane

As seen and observed in traffic volume count the number of two wheeler are more than 56% of the total vehicles on the roadway.

In Pune, the increase in the number of two wheeler vehicles and improper management of vehicular traffic are the prime causes of traffic congestion. Despite implementing harsher, more strict rules, the results are not desirable. The major problem in this case are two wheelers. Bicycles account for 0.5 PCU valueaccording to the Indian Road Congress they contribute to almost 0.5% of the traffic volume. On the other hand, two wheelers also accountfor just 0.5 PCU value according to the Indian Road Congress, they are responsible foralmost 60% of the traffic volume. But a separate lane is provided for bicycles which contribute to only 0.5% of the traffic volume.

This area can be fully utilized by the two wheelers. Separate lanes can be established to reduce the traffic congestion caused by the two wheelers. As the two wheelers are either spread out on the road or mixed in traffic, and are creating voids on the road. Resulting in disturbance caused to the other PCU values for different vehicular classes. So, a separate laneshould be provided for the two wheelers of appropriate width so that the other vehicular classes are not disturbed which will ultimately ensure continuous flow of traffic.

Chapter 7 – Conclusion

Traffic congestion is a problem not only faced by our country but all around the world. Congestion often reduces regional economic health; it causes delays, which may result in late arrival for education, meetings and employment, ultimately resulting in lost business, disciplinary action or other personal losses. Road congestion has a great impact on wasting fuel which increases air pollution and carbon dioxide emissions.

This work aims to develop a solution for traffic congestion taking place in Hinjewadi IT Road an arterial road of Pune City.

The main cause of traffic is the management of two wheelers, which account for 60% of the total PCU.Hence, by providing a separate lane for two wheelers, 60 % traffic will be diverted on Hinjewadi IT Road. Also by diverting the main cause of traffic, the sub-causes will also not be a problem and ultimately increase the spot speed of that particular area.

By adopting this method on Hinjewadi IT Road, we can assure that at least 50 % of the traffic can be reduced, and ultimately can be converted into 2- way road.Similarly, this idea can be used on other roads of the city, in place of the BRT Lane.

So we can conclude by saying that considering all factors, this solution is the best solution and it can be used in other arterial roads of Pune city.

Chapter9- References

1. Dr. S.K. Sharma Published by S. Chand, (revised edition) “Principles, practice and design of Highway Engineering including airport pavements ”. Chapter 4 – Traffic engineering.
2. Survey: Traffic Volume Count 2017. The Survey for Traffic Volume Count was conducted by - iTrans, PDA & CEE in Consortium, For P.M.C. (Pune Municipal Cooperation)
3. H. M. Zhang* “A Theory Of Nonequilibrium Traffic Flow” The University of Iowa, Iowa City, IA 52242, U.S.A.