JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Impact Assignment Of Level Of Service On Urban Arterial Road: A Case Study In Muzaffarpur, Bihar

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Abstract— *Rapid growth in the urban population causes a huge demand for transportation in daily life. Tier 2 and tier 3 cities across India face the congestion problem due to a lack of transport infrastructure, and these cities are not ready to handle the huge population and traffic. Because of rapid changes in lifestyle in urban areas, a similar percentage of vehicular ownership growth is also increasing, and the increase in the load of city traffic exceeds the carrying capacity of the road at peak hours. The road network is the lifeline of any site. The congested and jam traffic increase fuel consumption causes noise and air pollution and also causes delay and accidents. Due to lacking infrastructure, cities are facing congestion daily and at peak times converted into traffic jams.* [1]

This paper presents the study of the existing traffic situation for the selected 3.1 km stretch located in the city of Muzaffarpur (Bihar), computation of the level of service for the entire roadway and suggests ways to improve the Level of Service of the selected project stretch. This research aims to improve the L.O.S. (Level of Service) of the congested road in urban areas by giving various solutions to current problems.

Keywords— Traffic congestion, Level of Service, Traffic volume studies, Passenger car units (PCU), Bottlenecks, Traffic jams, Artificial Neural Network.

1. INTRODUCTION

The primary contributors to the growing traffic are individual mobility and poor public transportation, especially in tier 2 and tier 3 cities, which leads to an increase in vehicle ownership. Rapid urbanisation is causing a variety of problems in tier 2 and tier 3 cities when people move for a better lifestyle in cities rather than rural. Because of the growth in different forms of transportation, it led to a jam-up in traffic conditions. The quality measurement of traffic facilities is provided by the level of service. [2]

Total study stress of 3.1 km of arterial road connecting two main bus stops (important transportation centre of the city) (Bairiya Bus Stand- Private Bus Stand to Imlichatti Bus Stand- Government Bus Stand).

A significant portion of the city is served by this arterial route, which has developed into a major thoroughfare that travels through a sizable portion of the city (e.g., Institute area, hospital area, commercial area, etc.)., A medical institute area is located along a major length of an arterial route, which serves as a lifeline for the local towns and cities. The patient won't receive treatment at the appropriate time due to traffic jams and congestion. Additionally, there are fatalities from traffic congestion.

1.1 Need of Study

- Like every coin has two sides urbanization also shows the consequences by taking a toll on the urban infrastructure. Urban streets are not spared from the ill effect of urbanization.
- The urban road networks in recent times are badly suffering from the problems like decreasing speeds, increasing congestion, increased travel time, decreased level of service and increase in accident rates.

1.2 Objectives

- To understand the "Level of Service (LOS)" and existing guidelines and parameters.
- To study the existing traffic and level of service (LOS) of the study area.

- To recommend the proposal and intervention to improve the existing LOS of the study area.
- To study and analysis the post-intervention scenario.

2. Literature Review

2.1 Traffic Volume Studies

Traffic volume studies are conducted to determine the volume of the moving traffic and the classification of roads at a particular section and time. It involves the decision for improvement and up-gradation of roads, geometric and pavement design, computation of roadway capacity, analysis and planning of traffic patterns, operations and other regulatory measures.[3]

2.2 Traffic Capacity

Traffic Capacity is expressed as the maximum number of vehicles in a lane or a road that can pass a given point in unit time, usually an hour, i.e., vehicles per hour per lane or roadway. [1]

2.3 Passenger Car Units (PCU)

Passenger Car Unit (PCU) or Passenger Car Equivalent (PCE) is a metric used in Transportation Engineering, to assess the traffic-flow rate on a highway.
Highway capacity is measured in PCU/hour daily.
As per HM (Highway Capacity Manual PCUs are calculated using the STREAMLINE EQUIVALENT equation which has the basis of the GREEN SHIELD MODEL for Traffic flow. [1]

2.4 Greenshields model

Greenshields was able to develop a model of uninterrupted traffic flow that predicts and explains the trends that are observed in real traffic flows. & assumed a linear speed-density relationship and also a relationship between speed-flow and flow-density.

2.5 Level of Service (L.O.S.)

The level of service is a qualitative measure to relate the quality of the traffic services. LOS is used to analyse highways by categorizing traffic flow and assigning quality levels of traffic based on performance measures.
There are 6 L.O.S. grading: which are Free flow (A), Reasonably free flow (B), Stable flow at or near free flow (C), Approaching unstable flow (D), unstable flow (E)and Forced or breakdown flow (F). [3]

2.6 TVC ANALYSIS

After the collection of data calculates the streamlined equivalent for each lane at that particular cordon. Streamline equivalent

$$(Se) = \frac{\text{Flow in PCU/hr}}{\text{Flow in veh/hr}}$$

2.7 Theoretical Maximum Capacity

C = 1000*V/S, one can easily determine the Theoretical Maximum Capacity.
Here, C = Capacity of a single lane, vehicle per hour.
V = Speed, kmph; S = Average centre-to-centre spacing of vehicles, when they follow one behind the other as a queue or space headway.

2.8 Practical Capacity

The capacity depends upon Speed and Spacing. Spacing is governed by the safe stopping distance required by the rear vehicle in case the vehicle ahead stops suddenly.

Numerically spacing is given by, S = Sg + L Where Sg is the space gap (Head to rear) between the vehicles and L is the average length of the vehicle, both combined make the centre-to-centre spacing of the vehicles. [1]

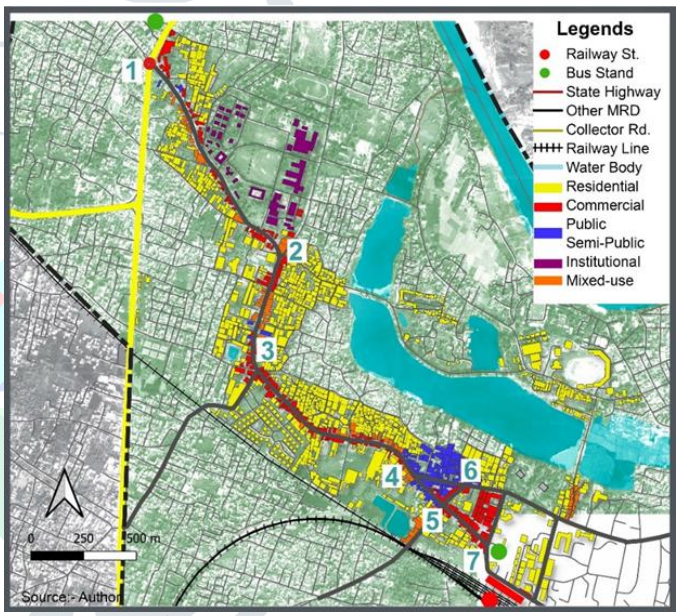
3. *METHOD*

The Methodology Adopted for the study will be as follows:

Fig 1. Methodology

3.1 Finalization of Study Stretch

A Recce survey was used to conduct in-depth site inspections and investigations, and the most problematic and significant road segment for the community was chosen. It was decided to focus on the section of west Muzaffarpur that ran from Bariya chowk to Imillichati chowk. The selected section of the road has unevenly spaced carriageways and is primarily a two-lane road with an undivided carriage. There are a total of 7 intersections over the 3.1-kilometre study area.



Map 1. Location of junctions (marked with number and name written down) along the study stretch of the city.

1. Bairiya Chowk
2. Laxmi Chowk
3. Barhmpura Chowk
4. Juran chhapar
5. Mahesh Babu Chowk
6. Medical chowk
7. Imlichatti chowk

3.2 Finalization of the Survey Nodes/ Spots

The selected stretch had a span of 3.1 km which was inspected for a medical institute located along a major length of an arterial route, which serves as a lifeline for the local towns and cities. And two major transport hub is connected via the road stretch. An ethical survey was able to provide prior information about the extent of the work that had to be carried out. The location that was accessible for the installation of cameras to gather data was chosen which would provide unrestricted visibility of the junctions.

3.3 Traffic Survey (TVC/OD survey)

3.3.1 Road inventory survey

The current condition of the stretch was observed and noted which included measuring the width of shoulders, carriageways, crossroads, etc. For reference, IRC: SP 19: 2001 "Manual for survey, investigation, and preparation of road projects" was referred to.

3.3.2 Traffic Analysis

From the videos taken, the number of vehicles was counted manually and grouped in a systematic format which was later used to analyse and determine the L.O.S.

3.3.3 Measuring current Level of Service and measures to improve it.

By data analysis, the current L.O.S. of the road was determined. This helped to then find out the reasons for the delay of traffic and to determine the solutions to the same.

3.3.4 Origin-destination (O-D)

Through this survey a detailed picture of the trip patterns and travel choices of a city or Study stretch.

- This survey collects valuable data related to:
- Travel patterns and characteristics
- Measure trends
- Provide input to travel demand model development
- Forecasting and planning for area-wise transportation need services

4. *RESULTS AND DISCUSSION*

The NH-28, NH-57, NH-77, and NH-102 all link to Muzaffarpur City. The Muzaffarpur Municipal Corporation (38 km), Public Works Department (17.12 km), and the District Council (16.69 km) are all responsible for managing the city's approximately 72.17 km of roadways.

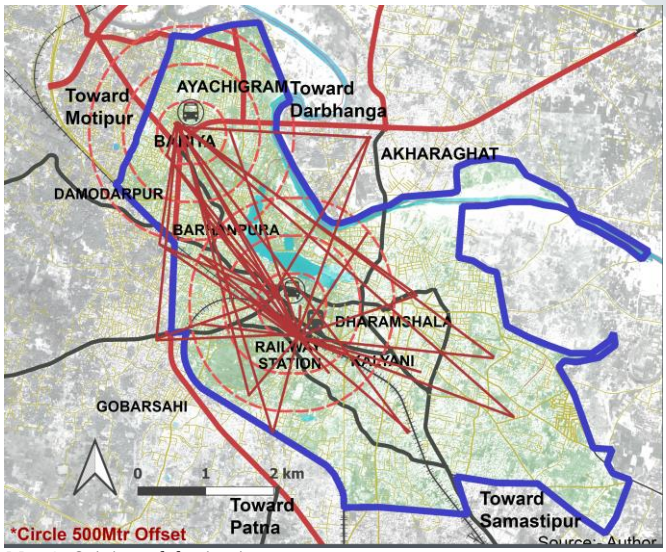
Table 1. Roads under Various Authorities in Muzaffarpur Source: Municipal Corporation, Muzaffarpur and CDP 2031.

S.No	Roads	Length Km	Remarks
1	MMC	38.09	ROW varies between 4 and 25 m
2	PWD	17.12	ROW varies between 8 and 30 m
3	District Council	16.96	ROW varies between 5 and 24 m
4	**Total**	**72.17**	

4.1 Origin and destination survey

Origin-destination describes both 'ends' of a single trip. This term is commonly abbreviated to 'O-D'.

The OD studies provide the basic data for determining the desired directions of vehicular flow of passenger trips in terms of 'Desire Lines.



Map 2. Origin and destination survey map.

INFERENCES

The majority of people travel to the city Centre daily basics for work, business, and full fill their daily utility. Which is crossing via the city transport hub (Government bus stand or Railway station).

4.2 Trip Length Frequency Distribution (Mode Wise).

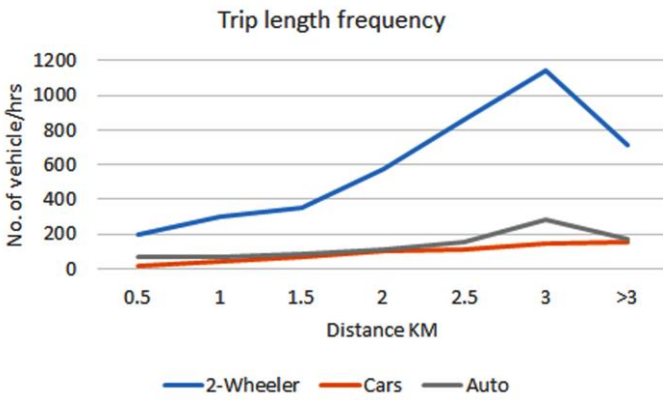


Fig 2. Trip Length Frequency Distribution (Mode Wise).

Table 2. Average Trip Length Frequency Distribution (Mode Wise).

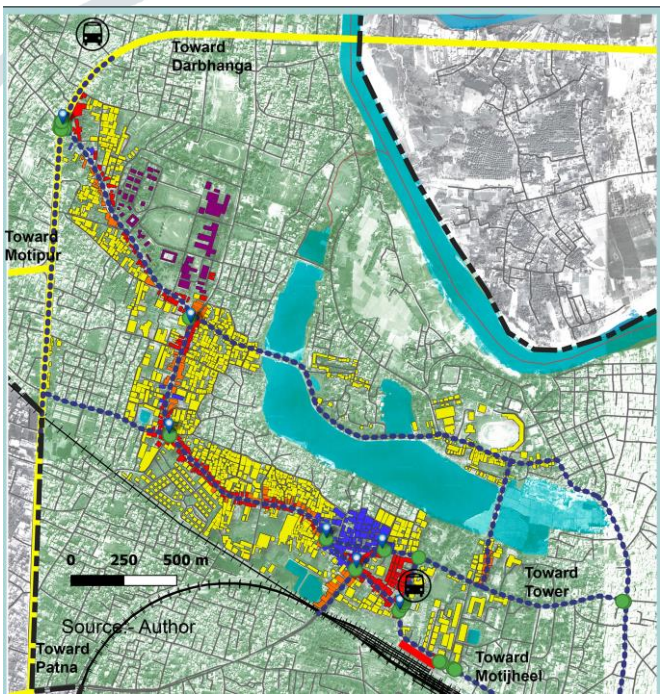
Average Trip Length			
Mode	**2-Wheeler**	**Car**	**Auto**
Avg Distance	**6**	**8**	**7**

4.3 Public Transport Routes

The majority of the low and middle-class inhabitants either depend on the city's public transit system or reside close to their places of employment. In the city of Muzaffarpur, there are a variety of privately run buses, minibuses, auto rickshaws, Vikram, and cycle rickshaws available for usage. The primary form of public transportation in the city is the auto rickshaw or Vikram.

Particular to the Site: Urban poor residents of Muzaffarpur are situated close to their places of employment.

The majority of these residents work as labourers, street sellers, or domestic servants.



Map 3. *Public Transport Routes map.*

INFERENCES

Major arterial roads of the study area direct served the 58k population of 8 wards at the local level.

And other 12k people who used this arterial road for interchange the transport medium. On daily basics.

4.4 Public Transport (PT) onboard User Survey

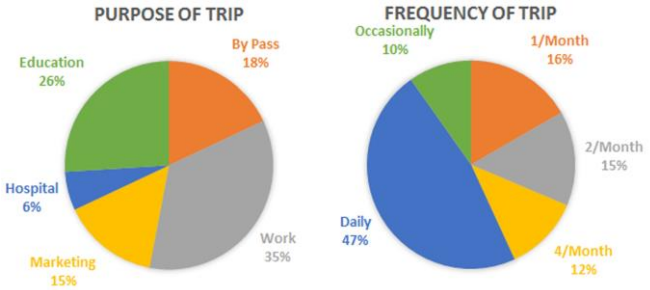


Fig 3. Public Transport onboard User Survey

Most of the trips are for work purposes with a percentage of 35 followed by education purposes.

Daily commuters are having a higher percentage followed once monthly and occasionally.

Table 3. Public Transport Trip and Fair

Average Trip Length	3.5 Km
Average Travel Time	20-25 mins
Minimum Cost per stop	Rs. 5
Maximum Cost per Ride	RS. 30

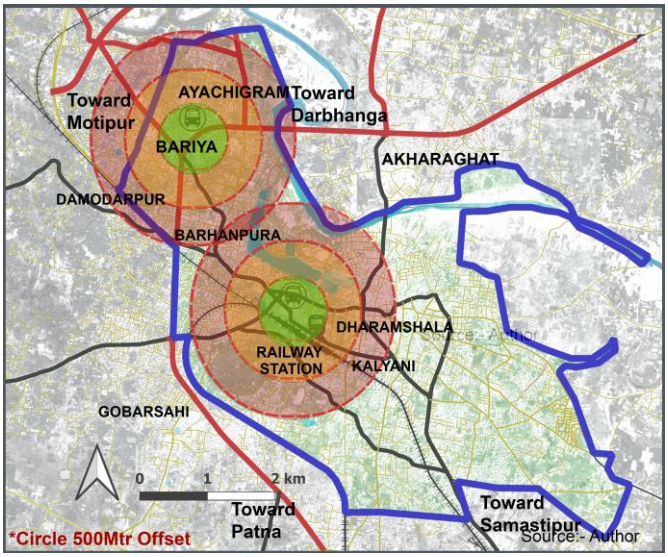
- When considering the auto trips from Bariya to Imillichati Bus Stand and via Barhmpura, the area of the access trips internally is a maximum of 3.1 km.
- The length of average auto trip length is 3.1 Km. But If the Stoppage time is increased, the timing of the trip will increase.
- There are no local bus services available in the city.
- The inter-city and intra-state buses arrived at the bus stand via the same route that uses for daily transportation.

INFERENCES

The auto services were started on 12 different routes of Muzaffarpur in 2021.

All routes are operational as of now and cover all the major areas of the city.

4.5 Proximity Diagram for Local people- WRT Transport Hub

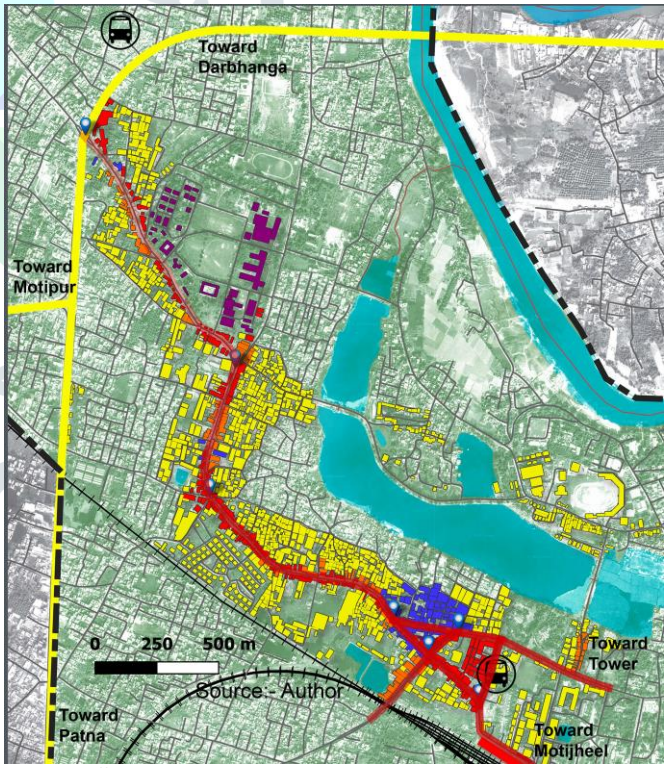


Map 4. Proximity Diagram for Local people- WRT Transport Hub map.

INFERENCES

- The above map of proximity diagram for local people concerning transport hub has shown the range of walkability for pedestrians.
- Each circle are offset by 500 meters.
- To enter change between these two transport hubs public transport is highly required.

4.6 Traffic Density



Map 5. Traffic Density map.

Between Bariya Chowk and Laxmi Chowk, traffic moves at a rate of around 400 PCU per hour, and between Laxmi Chowk and Barhmpura Chowk, it grows gradually as we approach the city centre. PCU rates per hour at Medical Chowk and Imillichati Chowk would rise to 2600.

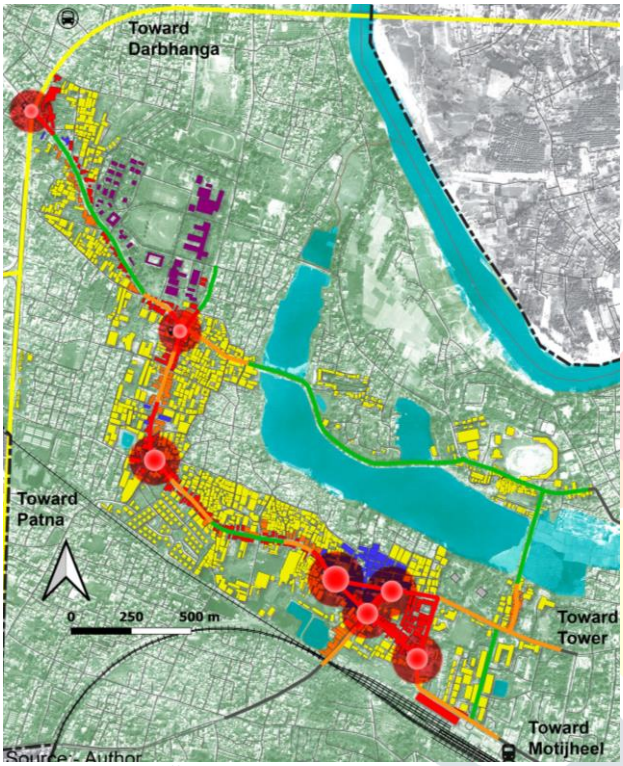
The most crowded and heavily travelled areas are Juran Chhapar, Mahesh Babu, and Imillichati. The medical institute is one of the primary elements of traffic density. Another significant cause of congestion is a lack of parking space. Due

to a lack of public parking, there are automobiles in the middle of the road, reducing the number of lanes and their capacity. Because of the traffic, ambulances, police cars, and fire trucks are also suffering.

INFERENCES

Most of the middle class and poor population are either dependent on public transportation in the city or live within walking distance of their workplaces. Public transport available within Muzaffarpur city includes privately operated buses, minibuses, auto-rickshaws, and Vikram and cycle rickshaws. The auto-rickshaw/Vikram are the predominant mode of mass transportation in the city.

4.7 Real-Time Traffic



Map 6. Real-Time Traffic map.

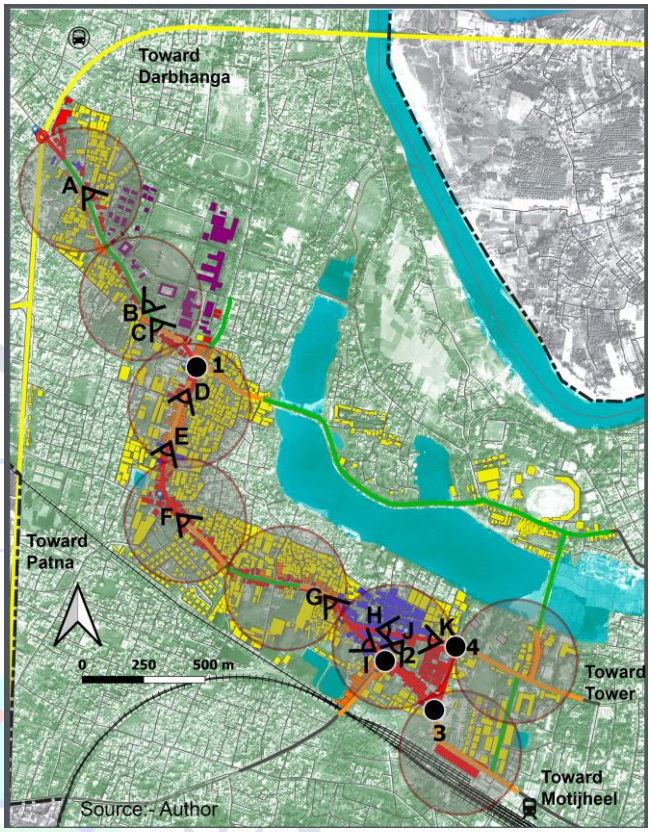
On the map above, you can see the study stretch's traffic in real-time. Green lines indicate areas with free-flowing traffic; these areas mostly contain mixed-use developments with little commercial activity. In contrast to the green line region, where businesses are operating and local vendors are encroaching on the road, the orange line depicts open flow with a little huddle and takes somewhat longer. This causes a delay in traffic flow. The most crowded area is shown by a red line. Due to a significant business district, a hospital, a bank, and other places of importance.

Real-time data is used to monitor and enhance traffic patterns, including cycle flows. Cycle data's Deodaat Boer illustrates how riding data may be identified without any mobile devices. Road sensors might improve safety and help the environment. Additionally, provide us access to real-time traffic information and propose a different route that will save us time, energy, and money.

INFERENCES

- Real-time traffic and congestion maps show details on traffic congestion along the study route. (Average daily congestion).
- The map also reflects the congestion node on the study route by itself.
- The entire study stretch is divided into small areas of 500 Mtr dia circle. To find out the major congestion problem at ground level and also to discover the black spot along the study route according to the guideline.

4.8 Black Spot



Map 7. *Black spot map.*

Fig 4. Local congestion problem and issue

INFERENCES

All the above live pictures show the current status of the infrastructure, the building uses locality and the lifestyle of the study area.

Each picture is taken from a different zone (500 Mtr zone) to understand the current status at different parameters.

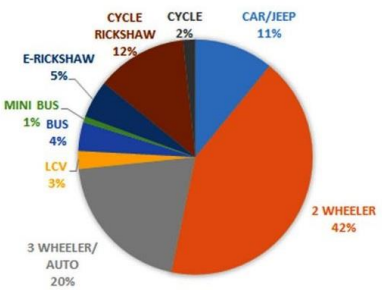
4.9 SURVEY LOCATION AND TIMING

Table 4. Survey location and Timing

S.No.	LOCATION	TYPE OF CARRIAGEWAY	DURATION
Node 1	Bairiya Gambar	2 Lane Undivided	7:00 a.m. - 8:00 p.m.
Node 2	Laxmi Chowk	2 Lane Undivided	7:00 a.m. - 8:00 p.m.
Node 3	Barhmpura Chowk	2 Lane Undivided	7:00 a.m. - 8:00 p.m.
Node 4	Juran chhapar	2 Lane Undivided	7:00 a.m. - 8:00 p.m.
Node 5	Mahesh babu chowk	2 Lane Undivided	7:00 a.m.- 8:00 p.m.
Node 6	Medical chowk	2 Lane Undivided	7:00 a.m. - 8:00 p.m.
Node 7	Imlichatti	2 Lane Undivided	7:00 a.m. - 8:00 p.m.

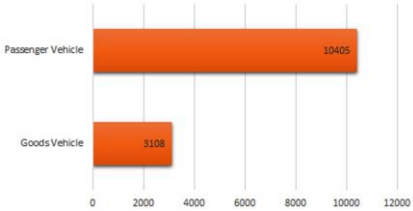
4.10 Distribution of trips by modes

Two-wheelers have major shares of 42%, 3-wheeler and auto have 20% share, and personal 4-wheelers have 11%.



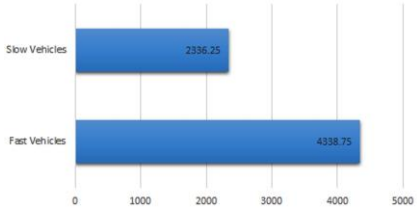
4.10.1 Passenger Goods Vehicles

A large percentage of vehicles use for passengers approx. 85% and 15% for goods.



4.10.2 Slow and Fast Vehicles

The city still uses the slow vehicle for transport at a huge number approx. 41% and 59% fast.



4.11 TVC (Total Vehicle count)

Table 5. Average PCU count per hour

	Volume of the Road			
Sno.	**Location**	**Way**	**Avg. PCU Cross per hrs**	**Time (Hrs)**
1	**Bariya**	Barhampura chwok to Bus	**501**	**1**
	Bariya	Bus stand to Barhampura	**555**	**1**
2	**Laxmi chowk**	Barhampura chwok to Bus	**716**	**1**
	Laxmi chowk	Bus stand to Barhampura	**799**	**1**
3	**Barhampura Chowk**	Laxmi chwok to Juran chapara	**674**	**1**
	Barhampura Chowk	Juran chapara to Laxmi chwok	**1065**	**1**
4	**Juranchapara Chowk**	Barhampura chwok to Bus	**1178**	**1**
	Juranchapara Chowk	Bus stand to Barhampura	**1308**	**1**
5	**Fly over**	Bhagwanpur to Juranchapara	**1598**	**1**
	Fly over	Bus stand to Barhampura	**2365**	**1**
6	**Medical chowk**	Medical chwok to Bus stand	**2685**	**1**
7	**Imillichatti**	Bus stand to Barhampura	**2634**	**1**

INFERENCES

The level of services varies from B to F when we travel outer of the city toward the city Centre.

A major contribution to traffic congestion is population density and commercial activity along the road.

And public and semi-public activity in the city Centre.

4.12 Theoretical Maximum Capacity

Table 6. Level of Service (LOS) calculation

Theoretical Maximum Capacity										
Sno.	Location	Way	Velocity 'V'	C/C Spacir	constant 'k'	V/CC	Capacity 'C'	K/C	GRADE	
1	Bariya	Bus stand to Laxmi chowk	45	30	1000	1.5	1500	0.666667	B	Stable flow with unaffected speed
	Bariya	Laxmi chowk to	45	30	1000	1.5	1500	0.666667	B	Stable flow with unaffected speed
2	Laxmi chowk	Bus stand to Barhampura	30	23	1000	1.304348	1304.3478	0.766667	C	Stable flow but speed is affected
	Laxmi chowk	Barhampura chwok to Bus	30	23	1000	1.304348	1304.3478	0.766667	C	Stable flow but speed is affected
3	Barhampura Chowk	Laxmi chwok to Juran chapara	25	20	1000	1.25	1250	0.8	D	High-density but the stable flow
	Barhampura Chowk	Juran chapara to Laxmi chwok	25	20	1000	1.25	1250	0.8	D	High-density but the stable flow
4	Juranchapara Chowk	Barhampura chwok to Bus	15	13	1000	1.153846	1153.8462	0.866667	E	Traffic volume near or at capacity level with low speed
	Juranchapara Chowk	Bus stand to Barhampura	15	13	1000	1.153846	1153.8462	0.866667	E	Traffic volume near or at capacity level with low speed
5	Fly over	Bhagwanpur to Juranchapara	10	10	1000	1	1000	1	F	Breakdown flow
	Fly over	Bus stand to Barhampura	10	10	1000	1	1000	1	F	Breakdown flow
6	Medical chowk	Medical chwok to Bus stand	10	10	1000	1	1000	1	F	Breakdown flow
7	Imillichatti	Bus stand to Barhampura	10	10	1000	1	1000	1	F	Breakdown flow

4.13 Traffic Demand Forecast

The economic growth that is projected as well as changes in the elasticity of the demand for transportation are taken into account in the methods used for traffic forecasting. To anticipate traffic demand, historical trends in traffic growth, the economy's viewpoint, and transport demand elasticity have all been carefully examined. It is expected that the predicted period would last 20 years. The methods listed below are used to calculate traffic growth rates.

Based on Vehicle Registration Data

The future traffic demand may be predicted using several critical parameters, including the growth rate of traffic. The number of registered motor vehicles in Muzaffarpur is obtained from the Muzaffarpur Road Transport Office, and in this regard, vehicle registration data is an important indicator of traffic increase (MRTO).

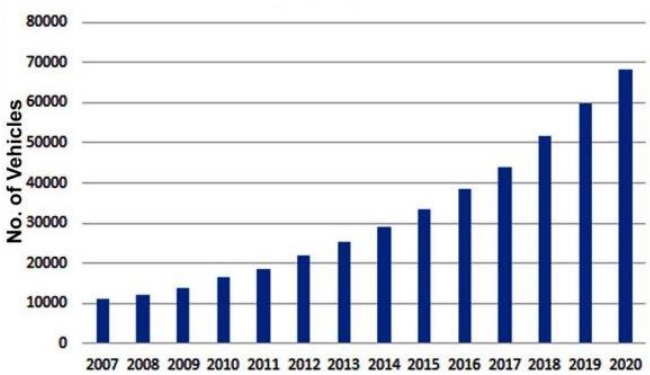


Fig 5. The 2007-2021 year-wise vehicle registration

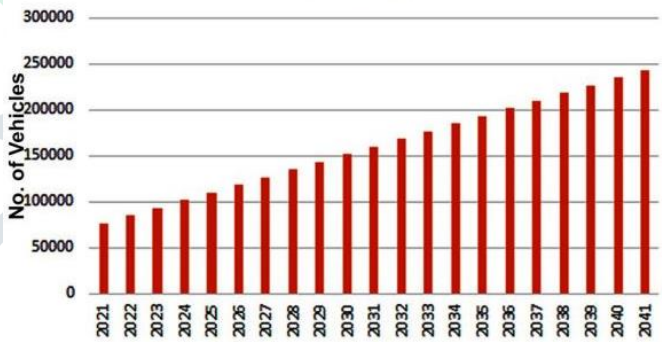


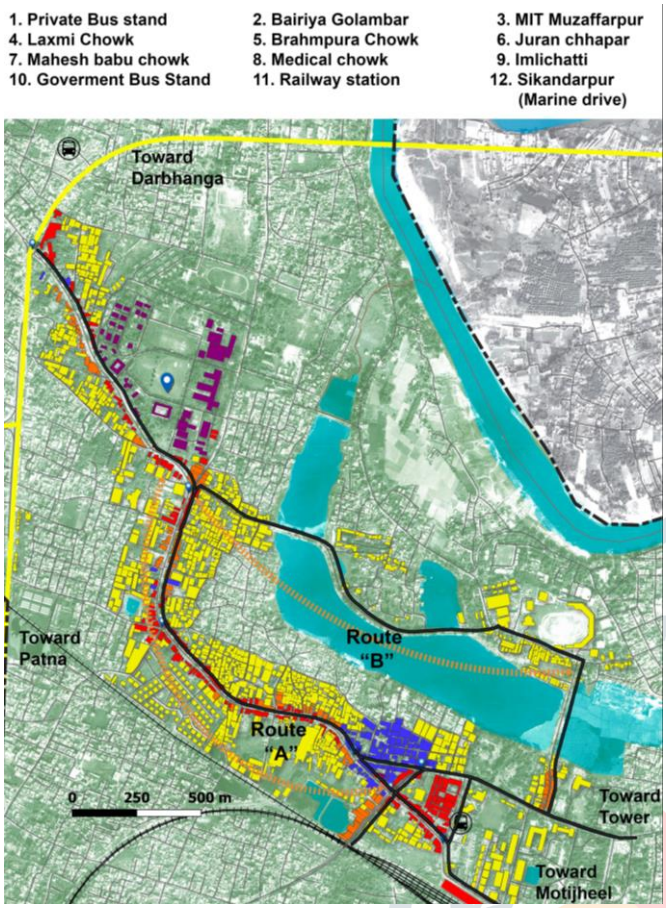
Fig 5. 2021-2041 year-wise vehicle registration forecast

INFERENCES

Till 2041 the number of registered vehicles will reach approx. 35 lakhs. And the major share will be 2-wheeler vehicles.

5. *Proposal*

5.1 *Route Diversion*



Map 8. Route Diversion map.

Table 7. Average PCU per hour on both routes

Volume of the Road				
Sno.	Location	Way	AVG PCU per hrs	Time (Hrs)
Route B	Sikandarpur Road	Laxmi ckowk to Ramgadh chowk	180	1
	Sikandarpur Road	Ramgadh chowk to Laxmi ckowk	200	1
Route A	Barhampura Road	Bariya bus stand to Imillichatti bus stand	1178	1
	Barhampura Road	Imillichatti bus stand to Bariya bus stand	1308	1

Table 8. Level of Service (LOS) calculation after route diversion

Theoretical Maximum Capacity					
Sno.	Location	Way	AVG. PCU	GRADE	STATUS
Route B	Sikandarpur Road	Laxmi ckowk to Ramgadh chowk	2473	B	Stable flow with unaffected speed
	Sikandarpur Road	Ramgadh chowk to Laxmi ckowk	1308	B	Stable flow with unaffected speed
Route A	Barhampura Road	Bariya bus stand to Imillichatti bus stand	4123	B	Stable flow with unaffected speed
	Barhampura Road	Imillichatti bus stand to Bariya bus stand	4578	B	Stable flow with unaffected speed

INFERENCES

Route A (Barhmpura road) have approx. 5000 to 5500 average PCU per day. Which have a D level of service (High density but stable flow).

Due to social behaviour patterns in lifestyle, transportation, and local communities. It causes a regular traffic gridlock at the government bus stop since there isn't an adequate ROW for bus turning.

But at the same time, Route B Sikandarpur road has a LOS B at all times due to very low traffic movement. So, we can divert traffic from Route A to Route B, which saves time and cost.

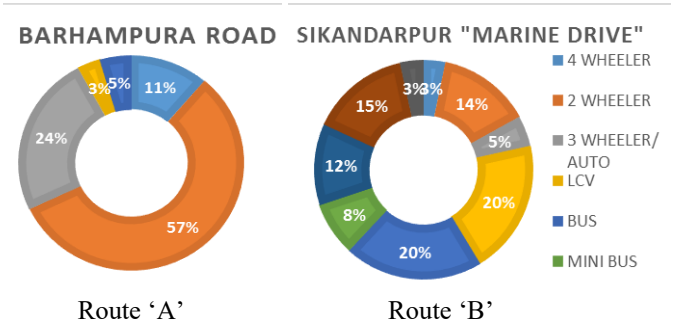


Fig 6. Types of vehicle distribution on both routes A and B.

INFERENCES

The number of vehicular growth from 2021 to 2041 is approx. 70k to 250k forecast of vehicular growth calculated by "Based on Trend analysis (Based on Vehicle Registration Data)"

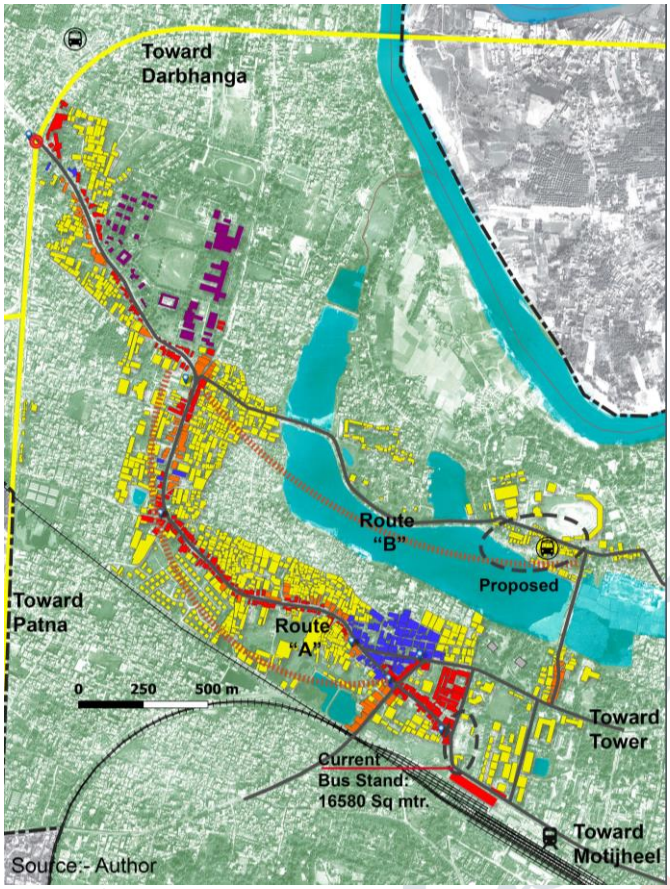
Analyzing the after-proposal LOS based on route diversion of a different mode of transport from "Route A to Route B".

Table 9. The capacity of base sections of urban roads

CAPACITY OF BASE SECTIONS OF URBAN ROADS			
S.NO	Typology of the Road	Capacity	Lane Capacity
		(PCUs/hr)	(PCUs/hr)
1	Two - lane Undivided	2400	1200
2	Four - lane Divided	5400 (2700)	1350
3	Six - Lane Divided	8400 (4200)	1400
4	Eight - lanes Divided	13600 (6800)	1700
5	Ten - lane Divided	20000 (10000)	2000

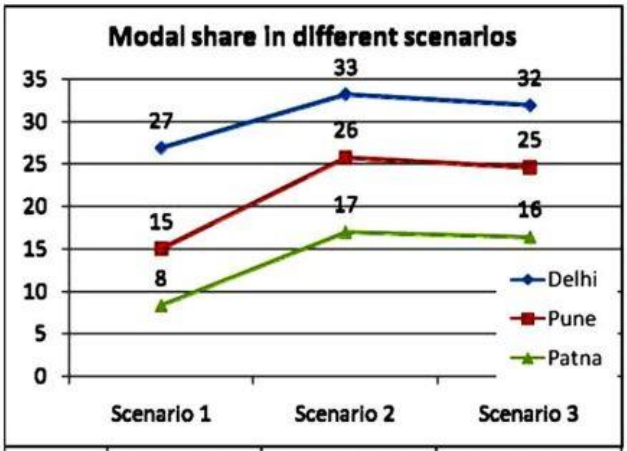
SOURCE: Highway Capacity Manual

5.2 Shifting Gov. Bus Stand



Map 9. Shifting Gov. Bus Stand location map

Map 10. Proposed government bus stand map



	Scenario 1	Scenario 2	Scenario 3
Delhi	0.44	0.59	0.57
Pune	0.14	0.28	0.27
Patna	0.075	0.17	0.16

Fig 7. Model shearing at different scenarios.

Scenario 1- assumes the continued usage of a bus. However, with the improved bus service, people will likely shift from other modes to buses.
Scenario 2-Maximum number of buses is required.
Scenario 3- is sustainable with more short trips being made by NMT and long trips by public transport. [4]

Table 10. The capacity of bus w.r.t to population and area requirement.

YEAR	POPULATION
Bus Required in 2041*(population/1000)*0.17	138
Area Required	For 150 Buses
Land Area (in acres)	6.89
Land Area (in Sq. mtr)	27,875
Land Per Area (in Sq. mtr)	186

[4]

INFERENCES

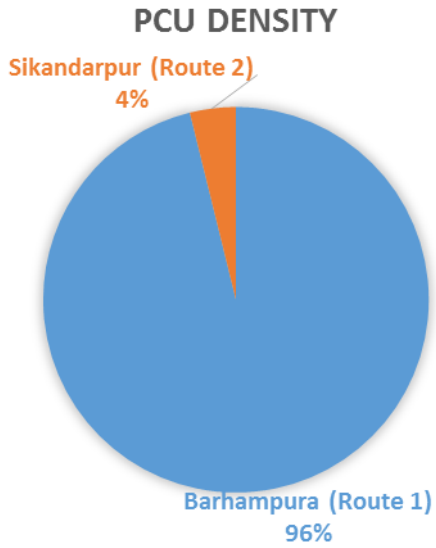
In the above map, 9 shows the current location of the government bus stand. It is located in the city centre which causes traffic congestion and traffic jam during pick time in the city.

The above map, 10 shows the new location of the government bus stand. According to the "Manual for Planning, Design and Implementation of City Bus Depots Training Module" by "The Ministry of Housing and Urban Affairs Government of India Manual" the current government bus stand will not be able to serve the population demand in 2041. To extend the bus capacity and facilities for the future population 31000 sq. mtr space requirement. Which current location will not too able to fulfil.

The new location of the government bus stand has enough space and supports the further extensions of the faculties. And It connected with Route B. Which diverse the major traffic from route A to route B.

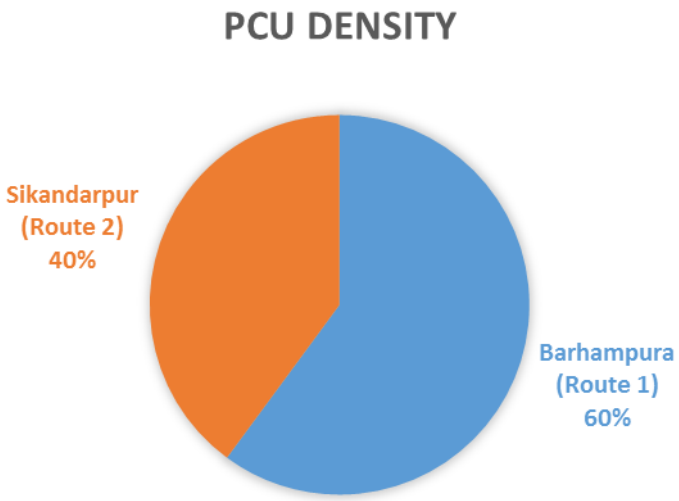
5.3 Analysis of the Post-Intervention Scenario

Current Scenario



INFERENCES
Route A and Route B will share 96% and 4% respectively, of the total traffic density.
Which shows the hierarchy of the users on route A.

After Diversion



INFERENCES
Route A and Route B will share 60% and 40% respectively, of the total traffic density.
Which represents the diversion of traffic and its users.
After route diversion, the traffic level of Service will improve from D to B.

5.4 Other Issues Regarding Traffic

- Lack of parking places causes haphazard parking all around the city, which is neither provided by the government norms by commercial store owners.
- The right of way is diminished and the pedestrian route is eaten up by commercial vendors and shops encroaching on public streets.
- Poor solid waste collection practices result in the ROW not being used to its fullest extent since rubbish covers half of the carriageway.
- Rain-related flooding and wastewater spill caused by blocked drainage slow down traffic practically everywhere in the city.
- Insufficient street illumination makes it challenging for nocturnal cyclists and pedestrians to use the road.
- There is always traffic in the city since there is no traffic light, even on a very busy route or crossroads.
- Unorganized taxi and auto rickshaw parking causes drivers to stop and park their vehicles everywhere, which slows down traffic throughout the town.
- Internal routes are in poor shape; there are many potholes on the roadways.
- Since there aren't enough lanes for four-wheelers in the inner town area, traffic is backed up since the vehicles are using the narrow lanes.
- Major junctions' irregular geometry since this, traffic moves more slowly because roads and their intersections are not laid out in a grid-iron pattern or cross at a straight angle.
- There are constant traffic jams in Muzaffarpur because the city's traffic is heterogeneous, consisting of both slow-moving motorized vehicles like automobiles and motorbikes and rickshaws as well as fast-moving motorized vehicles like those.
- In the city, there is an unchecked conversion of residential to commercial purposes, excessive mixed land use, and shops and hawkers encroaching on the streets. Traffic congestion results from the lack of control over traffic and automotive mobility.
- Numerous private automobiles are on the roads as a result of inadequate mass transit services.

6. *CONCLUSION*

In this paper, it is observed that the management of traffic and transportation is the primary cause of problems. Many problems may be remedied with little or no expense if the executing body and maintaining authority function well. Street sellers, overflowing drains, open drains, electric poles, and other problems.

According to the demand for traffic or vehicular which in near future will increase rapidly, in 2021 total vehicle registered in the city is approx. 11 lakhs but in 2041 the number of registered vehicles in goes up to 35 lakhs. Current road infrastructure and the number of the line will not be able to handle that much traffic load. The whole transport infrastructure will collapse. Some proposal was given which help to sustain the infrastructure with less interference in the city shape.

- The number of lane increase with the current ROW.
- Route diversion for the mass number of public and public transport.
- Route A and Route B will share 60% and 40% respectively, of the total traffic density.
- Which represents the diversion of traffic and its users.
- Route A and Route B will share 96% and 4% respectively, of the total traffic density.
  Which shows the hierarchy of the users on route A.
- Implement road infrastructures like Traffic lights, Traffic signs, Smart Cameras for Traffic Surveillance, and Public parking and the implementation of an Artificial Neural Network.

- After route diversion, and improving all traffic infrastructure the level of Service will improve from D to B.

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