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NEED OF INTEGRATED TRAFFIC MANAGEMENT PRACTICES FOR INDORE CITY

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Abstract
During past few years every city scenario is ready to develop in Smart city. Smart city referred to a city having better facility in terms of Food, Textile, Housing, Education, Health, Transportation, , Economic conditions.
Aim of present study is based on traffic management practices and challenges facing year by year for Indore.Certain trial practices are used to ensure the safety of every citizen, the smooth flow of traffic, the reduction of congestion and delays, the expansion of road capacity, and most importantly, the prevention of road crashes (accidents). Traffic management is concerned with the implementation of a variety of traffic engineering and administrative techniques, whereas integrated traffic management could be seen as a systematic and sustained effort aimed at directing and controlling all traffic on our roads to make them free of the detrimental effects of the transportation system.

Keywords:Indore Integrated, Parking, Sustainable Development, Traffic Management Practices etc.

I. Introduction

Every urban centre must priorities traffic assessment, planning, and management because many daily activities now rely more on moving a vehicle (road transportation). All road users rush for the right-of-way during routine activities like leaving for work, school, or the grocery store. produces "traffic friction" frequently (traffic bottlenecks or crashes). In order to ensure that traffic flows freely and that driving is safe, traffic planning and management are necessary. There are several techniques that can be used to control the flow of traffic through the work zone. The common techniques are given below, and planning requires choosing the best strategy of Work Zone Traffic Management Practices (WTMPs) for a safe work zone.

1.1 Need For Present Study

Past studies and data show that there are various methods that can be used as traffic management practise but are old, poorly assessed and not revised yearly as per present scenario. It is crucial for good traffic management that the practitioner bases their decisions on true information and takes proper cognizance of the outcomes. The more popular traffic study types, such as volume and composition of the traffic, origin and destination, speed, travel time and delay, accidents, and parking, are detailed studies. Road inventory and statistical methods are also used.

1.2 Traffic Management Practices for Metropolitans City

Traffic congestion, pollution, longer travel times, and an increase in traffic accidents are all effects of the phenomenal growth of vehicle traffic in developing nations. Indian metropolitan areas have rapidly urbanized, seen unprecedented increases in industry, commerce, and employment over the past two decades, and as a result, millions of new vehicles have been added. Today, there are more than 15 million vehicles spread across the Indian metropolises of New Delhi, Mumbai, Kolkata, Chennai, Bangalore, and Hyderabad. However, the infrastructure of the roads has not increased in a similar manner. The end result is a situation where there are too many cars using up precious space on the road. Traffic management, rather than offering citizens civic amenities and security, is thus the biggest challenge facing local government and the police in these cities.
Traffic management is frequently discussed in the context of a planned strategy to make sure that drivers follow the law. Some see it as both traffic enforcement of laws and rules and traffic policing and monitoring. The control, coordination, and supervision of vehicle movement on a specific road network, such as a citywide, residential estate, or neighbourhood, are the focus of traffic management.

This is done to ensure smooth traffic flow, lessen congestion and delays, increase road capacity, and most importantly, minimize traffic accidents (accident). According to some, traffic management involves using a variety of administrative and traffic engineering methods. It is possible to think of traffic management as a methodical, ongoing endeavour to guide and control all traffic on our roads so that they are free from the unfavourable impacts of the transportation system.
As per IRC: SP 55-2014 [38] Traffic management is the planning, organizing, directing, and supervision of both stationary and moving traffic, including pedestrians, cyclists, and all kinds of vehicles. Its clear objectives are to ensure the efficient, safe, and effective movement of people and goods as well as to safeguard and, whenever possible, improve the quality of the local environment on and around traffic facilities.

1.3 Primary Objective For Study

Among the different metropolitan cities, Indore a cleanest city of India is selected for following objectives:-
Provide safety for every road users and workers.
Minimize hindrance or delay to road user.
Provide clear and positive guidance to road users.
Ensure road side safety maintenance.
Provide good public relation.
Pay more attention to problems of pedestrian and non-motorized vehicles.
Survey and identification on traffic control devices.
Canalizing devices.
Night Construction.

1.4 Selection Of Observation Station

It is to be noted Indore city first master plan towards the sustainable city development was planned and published as, “A REPORT TO THE DURBAR OF INDORE” by Sir Patrick Geddes in 1918. About 103 years of glorious journey this master plan helpful for selecting our traffic locations.
Traffic studies for Patnipura intersection is carried for heavy peak hours due to congested roads. The longer travel times on this busy route have an impact on the passengers' mental and physical well-being. Passengers may experience psychological effects from longer journey times, which adds stress to everyday life. It worsens existing health problems. We've conducted a combined field and analytical study for a smart traffic management system to overcome this and improve the efficiency of the route by reducing traffic flow.

II. Literature

This focused on traffic assessment, planning and management which is an important and essential, for every urban centers as life relies more on vehicular movement (road transportation) for various daily activities. On daily basis people go to work, school, shopping etc., creating scrambling for the right-of-way among all road users. Often creates what is referred to as “traffic conflict” (traffic bottlenecks, jamming & crashes).
Lubna S. et.al, [23] explained about Advanced Traffic Management System and Possible Solutions for Traffic Congestion. In. which they explained about Rising Traffic congestions on urban road networks has become an inescapable and increasingly problematic condition as it is characterized by decreased speeds, loss of travel time and increased vehicular queuing. Rapid growth of urbanization and economic development has resulted into growth in urban population due to which there is a remarkable increase in urban travel demand. Over last few decades with advancement of technology new luxurious vehicles have captured the market which has increased the demand of the private vehicles. Thus, due to increase in urban population and growth in private vehicle ownership even the cities with sufficient infrastructures and well-planned road networks are facing the problem of traffic congestion. Traffic congestion has resulted in the saturation of the transportation infrastructures, increase in number of road accidents and air pollution due to harmful vehicular emissions. Various solutions were

implemented for the mitigation of traffic congestion and its outcomes. Construction of better and efficient road networks, building new transportation infrastructures, encouraging the use of public transport facilities, implementing taxes for controlling growth of private vehicle ownership, introducing new traffic controlling solutions and safety systems are some of the solutions utilized for the purpose of reducing traffic congestion on the roads. However, these conventional solutions are not sufficient enough to control the increasing traffic congestion problems.

Balwani, et al, [25] tried to model about smart city and its role. The smart city is planned in this way that it's provide a better facilities in terms of transportation, education, economic condition and ICT-Information and communication is enable for development in the city. We are reviewing different work already done or draft by some research in the field of traffic control system for better monitoring, tracking and managing using a computer vision. Nowadays, most of the city install with C.C.T.V. camera for monitoring the traffic related activity. Aspects of future work on transportation management service for Indian smart cities and give some solution regarding problem related to traffic management. Different research paper read in the context of transportation management service, explain different algorithms already used, different project and systems working related to TMS, smart-phone involvement regarding improvement in traffic monitoring as well as tracking and in other applications also. Most of the work explained or designed in a foreign country for smart city and what's actually required as per our Indian government, they are trying to develop smart city concept step by step.

USAID [36] funded Building Healthy Cities (BHC), ISCDL carried out a study on; Planning for a Smart City is intrinsically linked to health: transportation, environment, sanitation, education, recreation, technology, and the built environment all influence the health of an urban population. Partnering closely with Indore Smart City Development Limited (ISCDL), BHC has engaged with sectors that contribute, directly or indirectly, to citizens' health and quality of life. This multi-sector engagement aims to provide all municipal sectors a common understanding of how they contribute to health. In Indore these sectors include: health, urban planning and development, information and communications, education, waste management, pollution, food safety and hygiene, women and child development, traffic, and road safety. The project is also committed to helping ISCDL in its efforts to create more bicycle- and pedestrian-friendly infrastructure in Indore. The result of road safety and providing clean air are basic rights of citizens of Indore. Since the COVID-19 lockdown, there has been a 40 % increase in the sale of bicycles in Indore city. The reasons are many include fear of using public transport, and a need for a fitness alternative due to the shutdown of gyms, and sport clubs. This increase in popularity is a clear indication that Indore citizens can adopt green transport and might even cycle to work on most days. To make this a reality the city has to focus on improving cycle friendly infrastructure as currently there is a dire need of cycle lanes, cycle stands, and better traffic management. To make cycling infrastructure more inclusive, the city would need to focus on women's safety, comfort, convenience, and affordability in sustainable transport. In order to increase women's cycling shares, the city needs to provide a safe cycling environment, i.e. paved roads with dedicated, well-lit cycle tracks, patrolling in secluded areas, and reduced motor vehicle speed where bicycles share the way with other motor vehicles.

Yaduvanshi, et.al. [29] Studies on various Traffic Management Systems involves and in process of application in India. As an extension to the current traffic control approaches, advanced technologies in the field of communication, control, and information systems have been combined with the existing transportation infrastructure and equipment, which improves traffic management. This advancement in technology and problems in managing the traffic manually leads to the development of new advanced traffic control and management strategies, which could use the on-time real data from the vehicles such as speed, congestion, could track the condition of roads, and forecast or predict the traffic situations and could guide and alert in situations of incidents, over speeding or any other traffic rules and regulations violation is proposed as Integrated traffic management systems (ITMS).

Datta et.al. [21] concludes that in their work about traffic execution, versatility, wellbeing, open transport management, vitality utilization and contamination. A most troublesome result to anticipate is conduct change by street clients because of the framework after presentation, discrediting its advantages. ITS will be executed for all uses in growing influence in the high pay countries and for individual favorable position of rich vehicle owners. It will reduce the congestion, and bring control over the road and accidents; it will provide us the real time information about the vehicles and passengers and will also help the vehicles not to violate the traffic laws. ITS plays an important role by securing the future of mobility by going against of economics, environmental mishaps. New generations of traffic management systems will integrate data from vehicles, to provide dynamic control of traffic flows.

Mandhare et.al. [26] shows that in their work about the effect of raise in vehicle count grows the traffic congestion. It results in wastage of energy, time and environmental pollution. In recent years traffic congestion has become apparent as one of the major challenges for engineers, planners, and policymakers, not in all urban setting, but worldwide. In this regard with the help of Intelligent Transportation Systems (ITS), several attempts were made to automate the traffic lights based on the density of vehicles on the road. This paper reviews different sensor frameworks by analyzing the pros and cons of each in cost, reliability, accuracy, efficiency, and maintenance overhead. This paper reviews different sensor frameworks by analyzing the pros and cons of each in cost, reliability, accuracy, efficiency, and maintenance overhead.

Rahman et.al. [1] did the research is to Ensure free flow of traffic, reduce congestion and delay, Increased Road capacity, Reduced Road traffic crashes (accident). Improvement towards modified traffic management system that improves traffic flow. Traffic congestion is properly managed, traffic will flow steadily, delay will be reduced, and more vehicles will use the road facility. More importantly, when traffic is managed with appropriate measures, especially at traffic nodes, conflicts are eliminated. Every vehicle will have a safe passage. Safety of road users is an important goal of traffic management on which other considerations depend.

Khalif [4] provides the objective and need of IMS and also tried to develop a digital system to make processes regarding Traffic Management easier. To provide direct access to drivers through web application system, to view current status of all cars, tax or car information, to decrease Speed car as to avoid accidents and Jams. This web application provides facility to conduct Online Traffic Management System world wide. It saves time as it allows number of cars to be registered at a time and store their information as the test gets over, and easily information. It is automatically generated by the server. The Online Traffic Management System was developed using JSP with MySQL fully meets the objectives of the system for which it has been developed. The system has reached a steady state where all bugs have been eliminated. The system is operated at a high level of efficiency and the administrators associated with the system understand its advantage.

U.S. Department of Transportation [37] Traffic incident management (TIM) is a planned and coordinated program to detect and remove incidents and restore traffic capacity as safely and as quickly as possible. Over time, various tools and strategies have been developed and implemented in an effort to improve overall TIM efforts. The nature and extent of tools and strategies in use are highly variable across the Nation, reflecting different priorities, congestion effects, levels of program maturity, and investment. As a direct result, the reported effectiveness of individual or combined strategies is inconsistent. Task-specific tools and strategies generally reported to be most effective in enhancing TIM efforts include the Detection and verification, Traveler information, Response, Scene management and traffic control, Quick clearance and recovery. Tools and strategies generally reported to be most effective in addressing cross-cutting TIM challenges include the Agency relations, Training, Communications, Technology, Performance measurement, Program resources and funding.

Samal [30] Globally, traffic congestion has been a major source of concern. The existing infrastructure is incapable of meeting the increased traffic demand. Furthermore, space constraints and outside activities influence traffic congestion. In an emerging country like India, where traffic conditions are

heterogeneous and there is no lane discipline, the researcher faces even more complicated scenarios. A significant portion of working hours are lost due to traffic congestion, which has a negative impact on the economy as a whole.There has been a lot of literature and research done on traffic congestion and its effects. However, the outcome has been unsatisfactory. The current study aims to forecast congestion in mixed traffic with no lane discipline in order to identify the inherent viability of the diversified traffic situation and present better recommendations for controlling and avoiding these prolonged traffic jams. The urban highway systems were chosen as a research topic. A licence plate matching method using a video graphic survey was used to collect the required particulars for the day rush timing considered from 8:00 AM to 10:00 AM and off-peak hours to estimate the travel time of a distinct class of motorised vehicles for selected sections of the urban roadway. The data collected from the video recording was used to calculate congestion indices for both up and down traffic on a specific road. The effects of traffic congestion were studied, and potential mitigation measures were proposed. The study focused primarily on traffic jam indices in relation to travel time reliability measures in order to assess the functional effectiveness of the urban road network.

T.Krishna [32] The spectacular growth of vehicular traffic in developing countries has resulted in traffic congestion, pollution, longer journey time and increased road accidents. In the last couple of decades, Indian Metropolitan Cities have experienced rapid urbanization, unprecedented growth of Industry, Commerce and Employment and thereby adding millions of vehicles. Today the Indian Metros like New-Delhi, Mumbai, Kolkata, Chennai, Bangalore and Hyderabad have between them more than 15 million vehicles. But there has been no commensurate growth in the road infrastructure. The resultant scenario is that there are too many vehicles on the road occupying a limited space. Therefore, the greatest challenge for civic authorities and Police in these cities is Traffic Management, more than providing civic amenities and security to citizens.

Prof. Shilpa. Madhavanavar [31] study shows that traffic jam mainly occurs in urban areas, due to traffic jam there are several problems arise such as increase in noise pollution, air pollution, accidents and delay in travel time etc. The present traffic signals deployed in all parts of the cities are not enough to solve above mentioned problems because these have specific pre-determined time for red and green signals. In this view various attempts were done for traffic lights to behave smartly based on density of vehicles on the road. Therefore many techniques have been used in traffic control systems. This paper summarizes different techniques of traffic control system that were used for the improvement of conventional traffic control system.

Shreeram Marathe [3]explained how to control the traffic on roads in indian cities or any other part of the world. In most of the cities in India, congestion of roads due to vehicular traffic has become a chronic problem with practically no solution coming from Urban Planners or Municipal Corporations and other Government bodies. A slow moving traffic adds up to cost of travel due to reduction in productivity, late delivery of goods and material adds up to cost of delay, in case of emergency the slow moving traffic is fatal. Imagine a critically wounded patient in an ambulance stuck in slow moving traffic; such person can die due to delay in reaching hospital. The various Root Causes of traffic congestion are Roads & Infrastructure, High number of vehicles, Indiscipline Drivers of the Vehicles, Lack of knowledge & skill in the drivers, Bad Weather etc.

Smarter Cambridge Transport [34] Reducing Traffic Congestion and Pollution in Urban Areas as can be seen, these begin with interventions requiring only a low level of capital investment, before moving on to those which require an increasing degree of public and/or private sector investment. We will look at each in turn, before finishing by looking at the role of transport in health and welfare and providing some concluding thoughts. The one-hit solution, It is often incorrectly suggested that congestion may be solved with one big idea, such as ban cars from city centers, close through-routes to private vehicles, close car parks. Build more car parks, build more park-and-rides, make buses free, make park-and-ride free, introduce a congestion charge/road pricing, widen roads, add bus lanes, build tunnels, build a new ring road.

Zambrano Martínez [19] Studies about Efficient Traffic Management in Urban Environments. The main objective is to propose and implement a centralized route manager for autonomous vehicles able to optimize the flow of traffic with a high effectiveness so as to reduce the travel time of vehicles. To achieve this, the proposed route manager determines the route of each particular vehicle based on traffic congestion predictions. This route server aims to achieve traffic balancing, and we relied on specialized tools for vehicular traffic simulation and control to validate it.
Trafiksol [35] UTMS, traffic jams at congestion is the major problem in urban area, which causes increase in travel time and sometime accidents and rages. The key problem which causes this situation is the manual interference in the traffic signal and sometimes users purposefully does this. UTMS was introduced to ITS to manage the traffic flow and traffic signaling in the urban area to manage the traffic flow and penalize the persons who tries to break the signals. This system will also indicates the road users about the traffic status through the variable message sign placed through the urban area. It will also have the incident detection system which will identify any kind of accident, unwanted objects and rages and notify to the control room which can be communicated to the users through radio and VMS. All the major areas will be covered by the CCTV surveillance system to provide live status view at UTMS control room. UTMS will also have RLVD included within it.
Annette Dobson et. al. [2] Studies on women drivers' behaviour, socio-demographic characteristics and accident. The purpose of this study was to examine factors which affect driving behaviour and accident rates in women in Australia. Two groups of women (aged 18–23 and 45–50 years) participating in the Australian Longitudinal Study on Women's Health, completed a mailed questionnaire on driver behaviour and road accidents. Most accidents involved damage only, not injury. Mean scores for lapses obtained using the Driver Behaviour Questionnaire, were similar in the two age groups and similar to those found in other studies. In contrast, scores for errors and violations for the young women were higher than for the mid-age group and previous reports using the same instruments. Riskier driving behaviour among young women was associated with stress and habitual alcohol consumption. In the mid-age group, poorer driver behaviour scores were related to higher levels of education, feeling rushed, higher habitual alcohol consumption and lower life satisfaction scores. Accident rates in both groups were significantly related to lapses. These findings support the need for road safety campaigns targeted at young women to reduce dangerous driving practices, such as speeding, 'tail gating' and overtaking on the inside. There is also a need for further research to understand how lifestyle characteristics are associated with higher risk of accidents and to explore factors which might account for the higher risk for women drivers who were born overseas.
IRC: SP: 55-2014 [38], TRAFFIC MANAGEMENT PRACTICES AT WORKSITES is described to manage the traffic flow through the work zone; a number of practices are available. Common practices are described below, and selecting the appropriate strategy is crucial to planning of WTMP for a safe work zone. The primary purpose of the Work Zone Traffic Management Plans (WTMPs) is to provide for the reasonably safe and efficient movement of road users through or around the work zones while reasonably protecting the workers and equipment. When the normal function of the roadway is affected with the presence of workers and equipment, the WTMP provides for continuity of the movement for motor vehicle, bicycle, and pedestrian traffic, transit operations, and access to properties and utilities. The WTMP should be considered at the planning phase and continue through the design, construction, and restoration phases. Implementation of WTMPs shall be the responsibility of the road authority or a public body having jurisdiction over the work zone. The road authority through its Concessionaire/Contractor shall have statutory right for the implementation and enforcement of needed regulations and controls, speed zoning, and the management of traffic. Proper training of workers is necessary for effective implementation. Such statutory rights shall provide sufficient flexibility in the application of WTMP to meet the needs of changing conditions in the work zone.
Ministry of Road Transport & Highways, Government of India [22] Explains causes of road accidents driver behaviour road. Accident is most unwanted thing to happen to a road user, though they happen quite often. The most unfortunate thing is that we don't learn from our mistakes on road. Most of the

road users are quite well aware of the general rules and safety measures while using roads but it is only the laxity on part of road users, which cause accidents and crashes. Main cause of accidents and crashes are due to human errors. We are elaborating some of the common behaviour of humans which results in accident. mainly they are as follows over speeding, drunken driving, distractions to driver, red light jumping, avoiding safety gears like seat belts and helmets, non-adherence to lane driving and overtaking in a wrong manner.

III. Methodology

Detailed Traffic studies performed considering major aspects for Indore Commercial hub Patnipura square, where there is heavy traffic during rush hour. We conducted a analysis of the cause of congestion due to the geometrical parameters and other traffic congestion parameters.

3.1 Proposed transport system

The road structure of any city determines the future form and urban structure of the city. The number of vehicles, public transport system and the statistics of accidents show that the future traffic structure is safe, reliable and takes care of the structure of the city should be determined. Systematic public transport system should be started soon so that the number of private vehicles can be reduced.

Methodologies are as following: Site visit & survey

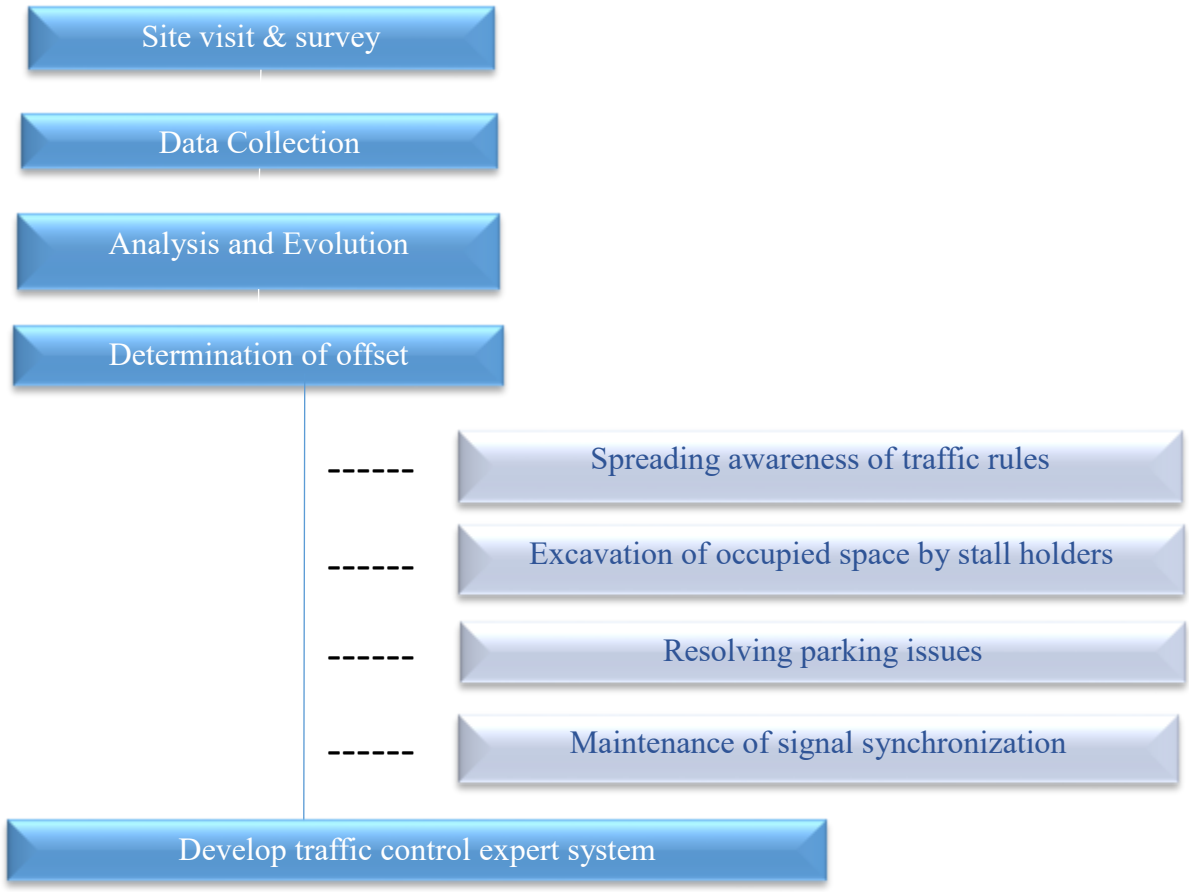

Figure 1: Progression of methodology

3.2 Proposed Traffic Structure for Indore

Vehicles do not move themselves, but humans drive them. Transport infrastructure is one of the basic needs of the city. The working efficiency of the transport system is assessed on the basis of the following components:

Intra-city traffic

Urban Traffic city.

Intra-city traffic, which Meter gauge and broad-gauge railway line is available in Indore city. It is connected to Khandwa and Ratlam by meter gauge line and with broad gauge line this city is connected to metropolitan cities like Ujjain, Ratlam, Bombay, Delhi and Madras. This city is also connected to the state and many metropolitan cities of the country by regional road infrastructure. National Highway No. 3 (Agra-Mumbai Highway) is the main transport infrastructure of this city. Opportunities for public and goods traffic have become available through this route. Other main routes are as follows:

1. Indore-Ahmedabad (National Highway No. - 59) N
2. Indore - Dewas (NH-3) Bhopal (NH 86)
3. Indore-Ujjain (Highway No.-29)
4. Indore-Khandwa (Highway No.-27)
5. Indore - Nemavar (Highway No. 22)

All the above-mentioned inter-city roads connect Indore city with the main cities of the state and country, which has contributed in improving the economic condition of the city and has opened the doors for the development of the city.

Indore city marked on the aerial map of India Is. This city is connected by air to many metropolitan cities of the country. is connected. intracity air traffic Expansion of transport facilities to increase capacity and modernization is essential.

Indoor urban traffic, the standard of living of the city and the efficiency of its functioning depends on how well the city functions and transports There is an interrelationship established in the structure. The planned traffic structure is designed in such a way that the residents of the city have to cover the shortest possible distance in the shortest possible time. For this, coordination between traffic and land-use has been established. Development Plan (The proposed transport system has been partially developed in the outskirts of the city. The planning policy adopted for the traffic structure is based on the following points:

Development of convenient and safe transport system to the populated areas and main activity areas of the city.

Development of footpaths in main work centers and activity areas such as transport centers, commercial centers, educational centers and other work centers.

To develop a mutually effective transport system between different planning units.

The. Initiative for efficient traffic management techniques to solve problem areas.

Reliable, efficient and sound public transport system arrangement.

In order to maintain continuous traffic mobility on the main roads, as far as possible restricting the junction of access roads on these routes.

year	Two-wheeler	Three-wheeler	Car	Bus (mini bus)	Good vehicle (LCV &HCV)	Other	total
11-12	954332	29166	134760	38774	165561	42732	1365325
12-13	1004332	30366	147418	41730	184463	44878	1453187
13-14	1056332	31402	158528	44931	200445	47438	1539076
14-15	1106332	32658	171518	47916	217303	49894	1625621
15-16	1156696	33433	184168	50566	234201	52458	1711522
16-17	1209028	34933	200150	53461	250790	54459	1802821
17-18	1258593	36497	216138	55917	267379	56561	1891085
18-19	1317593	38053	233373	58902	285615	58862	1991588
19-20	1376593	39952	248323	62152	305513	61512	2094045
20-21	1437189	40975	261308	65050	318172	63977	2186671

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3.3 Traffic Survey & Study

Various types of traffic surveys such as traffic volume, origin destination survey etc. have been conducted by CES, Delhi for the assessment of traffic in the investment area. Based on the above studies, the current traffic and transport related information is given below.

Highest Traffic related studies have been carried out by CES, Delhi in the outer and inner periphery of the city, the details of which are as follows:

Outer perimeter route

The traffic data at various points along the outer perimeter routes (regional routes) is given in Table 1.2.

Table 1.2: Highest Traffic on Outer Perimeter Routes

Number	Road Name	Peak Hour Traffic PCU (%)
1	Ujjain Road (SH-29)	1470
2	AB Road (NH 3)	2742
3	Kanadia Road	456
4	Bicholi Road	771
5	Bicholi Mardana Road	634
6	Devguradiya Road (SH-22)	1352
7	Khandwa Road (SH-27)	2090
8	AB Road (South)	3422
9	Rau-Pithampur Road	1602
10	Dhar Road (NH-59)	2270
11	Depalpur Road	879
	Total	17688

It is seen from the above table that on an average 9561 PCUs (vehicles) move in and out of the city during peak hours of which A.B. The percentage of traffic entering and exiting the road and Dhar road is 48. Ujjain Road has the highest traffic density among highways.

3.4 Inner perimeter route

S. No	Road	Direction	Vehicle	Pcu	Pcu Peak	Passenger	Passenger Peak (%)
1a	Airport Road Near Manpasad Colony	Airport To Ram Chandra Nagar	20354	16785	8.81%	48982	8.53
1b	Airport Road Near Manpasad Colony	Ram Chandra Nagar To Airport	20638	17761	8.32%	50003	9.32
2a	Annapurna Mandir	Ket To Mhow Naka	11363	7533	9.29%	21806	9.95
2b	Annapurna Mandir	Mhow Naka To Ket	11178	7421	9.39%	20904	9.03
3a	BAN GANGA	BAN GANGA TO GANESH DHAM COLONY	19079	15438	9.05%	48257	10.56

3b	BAN GANGA	GANESH DHAM COLONY TO BAN GANGA	19000	15136	10.13%	51591	11.52
4a	Bhanwar Kuwa Chouraha	University To Tower Chouraha	33150	23935	10.41%	77088	10.62
4b	Bhanwar Kuwa Chouraha	Tower Chouraha To University	31914	23132	9.05%	77046	8.92
5a	G.D.College	Mhow Naka To Collectorate	44123	32587	8.03%	116490	9.03
5b	G.D.College	Collectorate To Mhow Naka	44581	33965	8.50%	112322	9.13
6a	Dhar Road Near Gangwal Bus Stand	Gangwal Bus Stand To Sirpur Tank	15859	14270	9.09%	63460	9.31%
6b	Dhar Road Near Gangwal Bus Stand	Sirpur Tank To Gangwal Bus Stand	17913	16091	8.43%	67909	9.36%
7a	Jawahar Road Near Gurudawar	Mal Ganj To Nanda Lal Chouraha	27648	22146	9.21%	90503	10.25%
7b	Jawahar Road Near Gurudawar	Nand Lal Chouraha To Mal Ganj	27206	21937	9.06%	86393	8.77%
8a	Kandia Road Near Savind Nagar	Bengali Chouraha To Palasia	23997	17353	8.94%	63598	8.79%
8b	Kandia Road Near Savind Nagar	Palasia To Bengali Chouraha	24375	17937	10.32%	63975	10.04%
9a	Khajrana Chouraha	Bengali Chouraha To Malivya Petrol Pump Malivya Petrol	22570	19092	8.69%	61316	8.94%
9b	Khajrana Chouraha	Pump To Bengali Chouraha	21834	18369	9.41%	60571	9.09%
10b	M.G Road Near Indra Bhawan	Palasia Chouraha To Shastri Bridge	44567	33872	9.72%	110336	9.95%
11a	M.G Road Near Starting Rajwada	Shastri Bridge To Tori Corner	15432	11488	10.88%	35657	9.87%
11b	M.G Road Near	Tori Corner To Shastri Bridge	17968	12836	8.32%	39530	8.56%

	Starting Rajwada						
12a	Patnipura Chouraha	Malwa Mill To Bhamori	23355	18264	9.42%	52556	9.19%
12b	Patnipura Chouraha	Bhamori To Malwa Mill	22145	18168	9.36%	51902	9.40%
13a	Race Course Road Near Ida	Y.N. Road To A.B.Road	46491	33081	8.54%	85143	8.82%
13b	Race Course Road Near Ida	A.B.Road To Y.N.Road	45455	32188	9.28%	86593	9.85%
14a	Rajendra Nagar Crossing	Choith Ram Mandi To Rau	14727	13390	9.41%	36889	9.58%
14b	Rajendra Nagar Crossing	Rau To Choith Ram Mandi	15611	13691	10.55%	39325	9.78%
15a	Scheme No.114 A.B. Road	Mangal City Vijay Nagar To Devas	12349	11060	10.28%	34391	13.93%
15b	Scheme No.114 A.B. Road	Devas To Mangal City Vijay Nagar	12264	11623	10.26%	35113	10.06%
16a	Shastri Bridge	Nehru Park To M.G.Road	57044	42232	11.01%	142699	10.88%
16b	Shastri Bridge	M.G.Road To Nehru Park	58665	42666	11.42%	144893	10.71%
17a	Sukliya Gram Chauraha Main Road	Bharat Mata Mandir To Ujjain	19403	23465	9.76%	79226	10.27%
17b	Sukliya Gram Chauraha Main Road	Ujjain To Bharat Mata Mandir	18622	22605	9.60%	79290	10.09%
18a	A.B. Road Near Gurudawar	Amba To Delhi Road	26304	23087	11.52%	64341	11.50%
18b	A.B. Road Near Gurudawar	Delhi Road To Amba	31029	27819	13.34%	74507	12.96%
19a	Tori Corner	Rajwada To Airport	13961	11840	9.80%	20885	10.67%
19b	Tori Corner	Airport To	14344	11932	9.19%	21772	8.79%
20a	Yashwant Road	Rajwada To Collectorate	11517	8944	10.99%	30726	10.81%
20b	Yashwant Road	Collectorate To Rajwada	10298	8335	8.95%	30298	9.92%

* Source: Traffic pre-feasibility study for Indore metro 2013

3.5 Screen Line Route

From the point of view of the city's traffic studies, the railway line passing from the centre of the city in the north-south direction has been considered as the north-south screen line. It has been found from the above studies that on an average per day about 340319 PCU vehicles cross the railway line out of which the percentage of vehicles crossing Shastri Bridge is 26.6.

Khan river and railway line parallel to Subhash Marg in east-west direction have been considered as screen line. The traffic volume studies on the above screen line were carried out at 18 locations and it was found that on an average the number of vehicles crossing the east-west screen line is about 225773 PCU.

3.6 Traffic survey on main roads

The traffic data at two places mentioned in Table has been collected by CES, Delhi for traffic estimation on such routes which are not covered under screen line or inner/outer perimeter routes.

3.7 Origin Destination Survey

Origin-destination surveys of commuters show that about 8 percent of traffic is unrelated to the city. Whereas in respect of goods vehicles this percentage is around 42.

TABLE : MODE SHARE OF PASSENGERS ON ROAD (2011)

MODE	CBD	MIDDLE	OUTER	ALL
Car	25.51%	16.07%	16.14%	20.75%
2ws	31.56%	28.17%	28.16%	29.84%
Mini Bus	6.09%	13.77%	11.74%	9.42%
Bus	14.40%	23.53%	30.41%	20.91%
Auto P 3Ws	5.69%	5.07%	2.84%	4.77%
Cycle	2.37%	2.48%	2.87%	2.53%
Magic	14.37%	10.91%	7.83%	11.78%
Personal	59.44%	46.72%	47.18%	53.13%
Public	40.56%	53.28%	52.82%	46.87%
Bus	20.50%	37.30%	42.15%	30.33%

3.8 Traffic Studies at Crossroads

From the study of traffic at various intersections of the city, it is found that almost all the intersections are carrying more traffic than their capacity. To solve the traffic problems at these intersections, it is necessary to expand/develop all the intersections. The details of the studies conducted at various intersections are given in Table below;-

Serial No.	Location	PCU	Peak%
1	Shastri Square	34902	12.3
2	Bada Ganpati Square		
3	Rajwada	11488	10.9
4	Vegetable Market Tiraha	13691	10.6
5	Gurdwara Square	22146	9.2
6	Gangwal Bus Stand	14270	9.1
7	New Palasia	17937	10.3
8	Palasia	34902	12.3
9	Regal Square	33872	9.7

*Traffic moving (Peak Hours) at major city square

3.9 Parking Studies

Parking surveys are conducted to assess the parking requirements. In the traffic related studies conducted by CES, Delhi, necessary data was collected in respect of main parking spaces under central zone. The major routes on which parking data was collected are as follows:

1	Mahatma Gandhi Road	15 Place

2	Jawahar Road	13 Place
3	Siyaganj	14 Place
4	River Side Road	2 Place

3.10 Off-Road Parking

In addition to studies on roadside parking Studies on off-road parking have been carried out at three locations. These are Subhash Chowk (about 1240 sq. m.), Rajwada Car parking (about 380 sq. m.), 3. Kothari Market (620 sq. m.). Square meter)

Maximum number of vehicles Parking located at Railway station out of the above locations maximum numbers of vehicles (163) were plying in Subhash Chowk, 35 in Rajwada and 47 in Kothari Market. The above vehicles have been found in the period between 5 to 7 pm.

Types of vehicles in parking areas: - In Subhash Chowk and Rajwada areas, two wheelers have been found to be 64 percent and 40 percent respectively, whereas in Kang areas located in Rajwada and Kothari market, the percentage of cars is found to be 74 and 66 percent respectively. Railway station parking area auto rickshaws have been found in about a third of the total wants.

Average parking time: - Average parking time is found to be 90 to 264 minutes for two wheelers and 44 to 283 minutes for cars.

3.11 Parking turn over

The parking turnover rate reflects the usefulness of the parking spaces. This rate is relatively in the parking areas located at Rajwada and Kothari Market. Found more than Subhash Chowk

3.12 Vehicle Speed and Interruption Specifications

Vehicular speed is an important aspect of traffic. For estimating the route structure, it is necessary to know the speed of the vehicles. The studies conducted by CES, Delhi show that 71 per cent of the routes in the central zone have vehicular speed above 20 kmph. Less than per hour. On 77 per cent of the routes located outside the central zone, the speed of vehicles exceeds 20 kmph more than per hour on the ring road Speed 40 kms per hour and AB 32 kms on the road found per hour. The speed of vehicles is less on urban routes as compared to regional routes. In urban roads, the maximum (31.6 km per hour) on Annapurna road and M.G. The minimum speed (16.9 km/h) has been found on the road. MG Maximum delay (108 seconds) has been found on the road under normal conditions.

Features of Mass Transport: - Public transport system has an important place in the traffic related structure of any city. In the form of urban public transport system, mini bus services run by private organizations are working in the city and tempo services also play an important role in this system. Intra-urban public transport system is mainly in MP. It is operated by the State Road Transport Corporation.

3.13 Features of Mass Transport System

At present, there are around 300 minibuses operating in the city with a capacity of 12 to 18 passengers. these mini buses on designated routes. Apart from these, about 150 tempos are also in circulation on different routes of the city. It is proposed to rationalize these city service routes from time to time by the district traffic, along with this, an efficient and efficient public transport system is not developed in the city. For this institutional effort is necessary.

Characteristics of Different Locations

Locations where searched to study the proper impact on the surrounding development and other transport facilities. If the space is reserved for these places by systematically selecting them in the development plan, then the traffic pressure on the urban roads can be reduced to some extent. Therefore, it is necessary that by selecting the appropriate place for these places, those places should be connected with the road structure of the city.

3.14 Present Bus Stop available in Indore city - At present there are six bus stations in the city, illustrated here as follows.

Sarwate Bus Station

Gangwal Bus Station

Teenimli Bus Station
Navlakha bus stand
AICTSL Bus Stand
ISBT , Indore

About 25000 passengers visit the above Six stations every day, out of which maximum (75.33 percent) come at Sarwate & AICTSL Bus station. The details of the passengers arriving at the above places are as follows:

About 200 truck operators conduct their structure mapping activities at the location. Three wheelers are mainly used for distribution of local traffic structure from this point.

AB In the village of Lasudia Mori on the road, the activities related to the movement of goods is conducted uncontrollably, which is controlled by the planned National Rajma.

3.15 Proposed transport system

The road structure of any city determines the future form and urban structure of the city. The number of vehicles, public transport system and the statistics of accidents show that the future traffic structure is safe, reliable and takes care of the structure of the city should be determined. Systematic public transport system should be started soon so that the number of private vehicles can be reduced.

The future traffic structure of the city has been planned keeping in view the regional, intra-city and local traffic. Various workstations and investment units have been connected through efficient transport system. The proposed traffic structure for Indore investment area. The following points have been mainly included in the proposed traffic structure:

3.16 Regional Routes

3.16.1 National Highways

National Highway No. 3 (Agra-Mumbai Road) and No. 59 (Indore-Ahmadabad Road) pass through the city and there is heavy pressure of regional and local traffic on these routes. In order to separate the regional and local traffic on these routes, it is necessary that the buildings located along the roads should be given entry only through service routes. These routes are proposed outside the city expansion. The width of 60 to 75 meters and the width of 30 to 60 meters have been proposed as per the availability of space inside the urban area.

3.16.2 State Highway

Khandwa Road, Nemavar Road and Ujjain Road pass through the city which is both highways. Necessary measures should be taken to separate the regional and local traffic on these routes also.

3.17 Proposed Routes

The width of the routes and their cross sections for different routes are proposed as follows:

3.18 Main city road

Heavy intra-city traffic flows on these routes. These routes connect various investment units with each other and with urban centres. The width of these gardens has been proposed as 30 to 60 meters according to the availability of space and future requirements.

3.19 Circle block road

These routes for movement inside investment units inside are important. The proposed width of these routes has been proposed to be 30 meters in new width 30 areas and 18 to 24 meters in existing developed areas depending on the availability of the site.

3.20 Sub circle section route

This route is important for traffic inside residential circle sections on the roads. Their proposed width is proposed to be 18 to 24 meters in new areas, these routes and 12 to 18 meters in existing developed areas.

3.21 Local route

These routes are proposed inside residential complexes and colonies. Through these routes direct traffic should be banned. The proposed width of these routes is 18 meters in new areas and 12 to 18 meters in existing areas.

3.22 Problem statement

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According to Traffic Police, shopkeepers and Pedestrians near WTMP Areas

Observation	Parking	Jamming Frequency	Operating Methods
Driver's unawareness of lanes.	Randomly parking on roadside.	Morning 10am – 1pm.	Signals during non-peak hours.
Rush drivers.	Not utilizing parking space properly.	Evening 5pm – 10pm.	Manually and signal during peak hours.
Divider opening.	Random stall vendor occupying parking zone.		
Service road	Blocking service lane. .		
Lack of unawareness of signals			
Bottle neck situation.			
Stall vendor occupying the road.			

IV. Intersection patnipura square

4.1 Introduction

Patnipura square is a four-legged intersection. It is a channelized, unsignalized At- Grade intersection. The square connects 4 routes:

Astha Talkies Road (Towards Bhamori Bridge)
MIG Main Road (Towards Teen Puliya Square)
Patnipura road (Towards Malwa Mill Square)
LIG Main Road (Towards LIG Square)

Other Details:

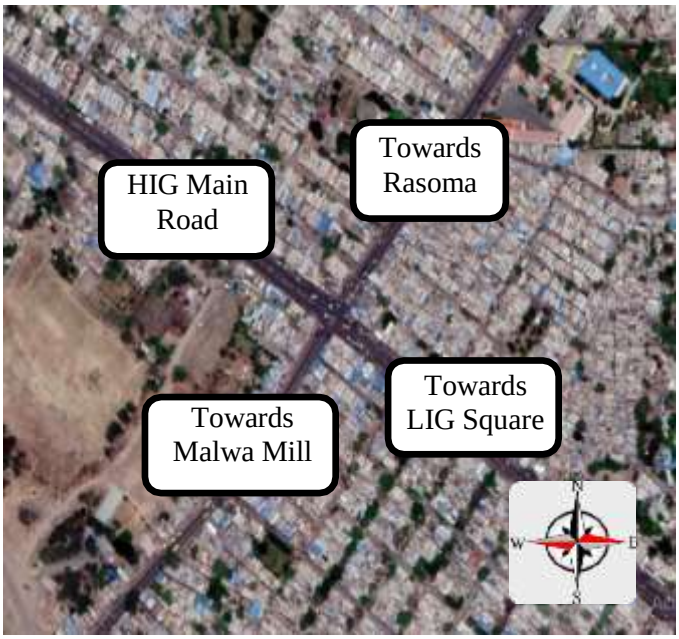

Figure 2: Patnipura square

Co-ordinates	22.73 N 75.84 E
Central Island perimeter	22.8 m
Central Island Diameter	7.25 m
Rotary	Yes (Unchannelized)
Number of Legs	4
Area	CBD, Business district
Traffic nature	heterogeneous
Traffic Enforcement Camera	Available
Enforcement	Traffic Police where available

Approach	Green Time (sec)	Red Time (sec)
From Malwa Mill Square	65	130
From Teen Puliya Square	24	172

From Raasoma	58	135
From LIG Square	30	165

Table from patnipura square towards malwa mill

Features	Remark	Dimension s (If Applicable)	Pictures (If Any)
Median	Available		
Left turn islands	Not available		
Footpath	Inadequate Width with encroachment over it	Width = 2.5 m Shoulder Width = 2 m	
Bus Stop	Not available		
Service lane	Not available		
Green Land	Available	Width = 2 m	 Figure 6.2
Signal	Available		
Sign Boards	Not available		
Lane Marking	Available but dim		 Figure 6.3
Lighting	Available		

Encroachment	Yes, illegal parking, street vendors and shops occupy shoulder and lane portion		 Figure 6.4
Pedestrian Signal and Signs	Not available		
Crosswalk and Stop Line	Available only on one side of road	Crosswalk Length = 8 m	 Figure 6.5
Foot over Bridge/ Underpass	Not available		
Road Surface Condition	Good		
On Street/ Illegal Parking	Illegal Parking in front of shops		
Parking Facility	Not available		

Kerbs	Provided (colored)		 Figure 6.6

Table Calculated flow and density data Ptanipura mill to Malwa Mill square

Time Period	Volume of individual vehicles in PCU/5min					Total Flow (veh/hr)	Density veh/km
	2Wheeler	Car/Van	3Wheeler	Bus	Total Volume (PCU/5m)		
5.30:5.35	170.25	38	45.6	0	253.85	3046.2	152.29
5.35:5.40	179.25	44	52.8	3	279.05	3348.6	168.94
5.40:5.45	165	41	49.2	6	261.2	3134.4	161.11
5.45:5.50	175.5	36	43.2	0	254.7	3056.4	157.87
5.50:5.55	179.25	43	51.6	6	279.85	3358.2	175.09
5.55:6.00	189.75	38	45.6	9	282.35	3388.2	177.21
6.00:6.05	189	35	42	3	269	3228	169.89
6.05:6.10	181.5	43	51.6	0	276.1	3313.2	176.24
6.10:6.15	177	48	57.6	6	288.6	3463.2	186.24
6.15:6.20	183	39	46.8	6	274.8	3297.6	177.26
6.20:6.25	190.5	33	39.6	3	266.1	3193.2	170.10
6.25:6.30	180.75	41	49.2	9	279.95	3359.4	182.21
6.30:6.35	189	37	44.4	0	270.4	3244.8	177.30
6.35:6.40	183	39	46.8	6	274.8	3297.6	179.59
6.40:6.45	197.25	32	38.4	6	273.65	3283.8	179.37
6.45:6.50	189.75	38	45.6	3	276.35	3316.2	181.55
6.50:6.55	185.25	42	50.4	6	283.65	3403.8	188.05
6.55:7.00	183.75	46	55.2	0	284.95	3419.4	188.46
7.00:7.05	197.25	41	49.2	6	293.45	3521.4	194.97
7.05:7.10	179.25	38	45.6	9	271.85	3262.2	180.08
7.10:7.15	186.75	42	50.4	3	282.15	3385.8	187.69
7.15:7.20	181.5	46	55.2	3	285.7	3428.4	189.42
7.20:7.25	177.75	43	51.6	6	278.35	3340.2	183.07
7.25:7.30	188.25	40	48	6	282.25	3387	185.16
Total	4399.5	963	1155.6	105	6623.1	79477.2	

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Problem Statements:
No left turning island (channelizing island) available.
Encroachment on footpath by shops.
Illegal parking on road reduces road width.
Zebra crossing is missing on LHS of road.
No pedestrian sign or signal available.
No Information (Direction and Place Identification), Regulatory (Parking Prohibited & Speed Limit) or Cautionary (Cross Road) Sign available.
Absence of reflector units.

Table from patnipura square hig main road (towards teen puliya chauraha):

Features	Remark	Dimensions (If Applicable)	Pictures (If Any)
Median	Available	Width at bottom = 1.7 m Shoulder Width = 2 m	 Figure 6.7
Left turn islands	Not available		
Footpath	Available but only 0.8 m available due to encroachment when moving away from Square. No footpath on side when moving towards square.		
Bus Stop	Not available		
Service lane	Not available		
Green Land	Available	Width = 2 m	
Signal	Not available		
Sign Boards	Available		
Lane Marking	No shoulder marking		
Lighting	Available		

Encroachment	Yes, illegal parking occupies shoulder and lane portion		
Pedestrian Signal and Signs	Not available		
Crosswalk and Stop Line	Available but dim	Towards Square Crosswalk Length Available = 8.3 m Away from Square Crosswalk Length = 14.5 m	 Figure 6.8
Foot over	Not available		
Bridge/Underpass			
Road Surface Condition	Fair with some unevenness		 Figure 6.9
On Street/ Illegal Parking	Illegal Parking in front of shops		 Figure 6.10
Parking Facility	Not available		
Kerbs			

Figure: Calculated flow and density data patnipura square hig main road (towards teen puliya chauraha)

Time Period	Volume of individual vehicles in PCU/5min					Total Flow (veh/hr)	Density veh/hr
	2Wheleer	Car/Van	3Wheleer	Bus	Total volume (PCU/5min)		
5.30:5.35	171	34	44.4	0	249.4	2992.8	168.75
5.35:5.40	174.75	44	39.6	3	261.35	3136.2	176.82
5.40:5.45	166.5	41	45.6	3	256.1	3073.2	175.45
5.45:5.50	179.25	36	34.8	0	250.05	3000.6	171.53
5.50:5.55	184.5	43	37.2	6	270.7	3248.4	187.56
5.55:6.00	168	38	33.6	9	248.6	2983.2	171.12
6.00:6.05	189	35	43.2	3	270.2	3242.4	186.84
6.05:6.10	181.5	43	40.8	0	265.3	3183.6	184.52
6.10:6.15	177	48	44.4	6	275.4	3304.8	192.70
6.15:6.20	171	39	34.8	6	250.8	3009.6	175.61
6.20:6.25	183	33	32.4	3	251.4	3016.8	175.15
6.25:6.30	156	41	39.6	9	245.6	2947.2	172.44
6.30:6.35	186.75	37	44.4	0	268.15	3217.8	186.98
6.35:6.40	174	39	33.6	6	252.6	3031.2	178.17
6.40:6.45	192.75	32	36	6	266.75	3201	188.47
6.45:6.50	168	38	32.4	3	241.4	2896.8	172.57
6.50:6.55	189	42	42	3	276	3312	197.64
6.55:7.00	183.75	46	45.6	0	275.35	3304.2	198.87
7.00:7.05	184.5	41	40.8	6	272.3	3267.6	197.69
7.05:7.10	178.5	38	31.2	9	256.7	3080.4	187.77
7.10:7.15	186.75	42	34.8	3	266.55	3198.6	193.14
7.15:7.20	172.5	46	38.4	3	259.9	3118.8	187.45
7.20:7.25	180.75	43	43.2	6	272.95	3275.4	196.11
7.25:7.30	174.75	40	46.8	6	267.55	3210.6	190.94
Total	4273.5	959	939.6	99	6271.1	75253.2	

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Problem Statements:
Illegal parking on road and footpath reduces available road and footpath width.
Street vendors and shops occupy available road width.
No Informatory (Direction and Place Identification), Regulatory (Parking Prohibited & Speed Limit) or Cautionary (Cross Road) Sign available.
Absence of reflector units.
Crosswalk is available but the marking had faded a bit.
No pedestrian sign or signal available.
No refuge island.
No left turning island (channelizing island) available.
Lack of public awareness as people don't turn around the central island and directly move towards their RHS.

Table : 6.7 Astha talkies road towards bhamori bridge

Features	Remark	Dimensions (If Applicable)	Pictures (If Any)
Median	Not Available		
Left turn islands	Not available		
Footpath	Available But occupied due to illegal parking	Width = 2.2 m	 Figure 6.11
Bus Stop	Not available		
Service lane	Available (merging). Lane has deteriorated (cracks).		

Green Land	Available	Width = 1.1 m	 Figure 6.12
Signal	Available		
Sign Boards	Available.		
	Roadside left and informatory (direction) sign board are provided		
Lane Marking	Available		 Figure 6.13
Lighting	Available		
Encroachment	Yes, illegal parking, shops and street vendors occupy shoulder and lane portion		
Pedestrian Signal and Signs	Not Available		

Crosswalk and Stop Line	Available only on route towards square	Crosswalk Length = 10.5 m	
Foot over Bridge/Underpass	Not available		
Road Surface Condition	Good		
On Street/ Illegal Parking	Illegal Parking in front of shops		 Figure 6.14
Parking Facility	Not available		
Kerbs	Provided		

Table: Calculated flow and density data Astha talkies road towards bhamori bridge

Time Period	Volume of individual vehicles in PCU/5min					Total Flow (veh/hr)	Density (veh/hr)
	2Wheleer	Car/ Van	3Wheleer	Bus	Total volume (PCU/5min)		
5.30:5.35	169.5	41	33.6	3	247.1	2965.2	142.05
5.35:5.40	174	29	22.8	9	234.8	2817.6	133.63
5.40:5.45	191.25	17	37.2	6	251.45	3017.4	143.42
5.45:5.50	178.5	32	31.2	6	247.7	2972.4	142.20
5.50:5.55	191.25	24	25.2	0	240.45	2885.4	137.80
5.55:6.00	185.25	31	45.6	3	264.85	3178.2	152.75
6.00:6.05	175.5	42	39.6	3	260.1	3121.2	150.80
6.05:6.10	178.5	33	34.8	6	252.3	3027.6	146.51
6.10:6.15	169.5	28	32.4	9	238.9	2866.8	138.56
6.15:6.20	179.25	24	40.8	0	244.05	2928.6	141.92
6.20:6.25	175.5	32	43.2	6	256.7	3080.4	150.78
6.25:6.30	189	27	37.2	9	262.2	3146.4	153.87
6.30:6.35	171	23	33.6	3	230.6	2767.2	135.17

6.35:6.40	166.5	38	28.8	3	236.3	2835.6	138.83
6.40:6.45	184.5	36	34.8	9	264.3	3171.6	155.64
6.45:6.50	188.25	27	39.6	6	260.85	3130.2	153.92
6.50:6.55	175.5	24	45.6	0	245.1	2941.2	144.77
6.55:7.00	169.5	34	38.4	6	247.9	2974.8	147.67
7.00:7.05	184.5	27	32.4	3	246.9	2962.8	146.53
7.05:7.10	177	30	37.2	3	247.2	2966.4	146.63
7.10:7.15	170.25	35	39.6	6	250.85	3010.2	149.89
7.15:7.20	179.25	28	32.4	9	248.65	2983.8	149.07
7.20:7.25	190.5	37	38.4	9	274.9	3298.8	164.66
7.25:7.30	185.25	40	44.4	3	272.65	3271.8	162.28
Total	4299	739	868.8	120	6026.8	72321.6	

Problem Statements:
Illegal parking on road and footpath reduces available road and footpath width.
Street vendors and shops occupy available road width.
No Informatory (Direction and Place Identification), Regulatory (Parking Prohibited & Speed Limit) or Cautionary (Cross Road) Sign available.
Absence of reflector units.
Crosswalk is available only on RHS of road, but the marking had faded a bit.
No pedestrian sign or signal available.
No left turning island (channelizing island) available.
Kachori shop located at the turning is a major cause for illegal parking.
Magic van loads/unloads people at left turning on LHS causing congestion.

Table : from patnipura square towards lig square:

Features	Remark	Dimensions (If Applicable)	Pictures (If Any)
Median	Available	Width at bottom = 1.1 m Shoulder Width = 1.6 m	 Figure 6.15
Left turn islands	Not available		
Footpath	Not available		
Bus Stop	Not available		
Service lane	Not available		
Green Land	Available	Width = 2 m	

Signal	Available		 Figure 6.16
Sign Boards	Available. Informatory Sign (direction)		
Lane Marking	Not Available		
Lighting	Available		
Encroachment	Yes, illegal parking and street vendors Occupy shoulder and lane portion		 Figure 6.17
Pedestrian Signal and Signs	Not available		
Crosswalk and Stop Line	Available only on one side of road when moving towards square	Towards Square Crosswalk Length Available = 8.5 m	
		Away From Square Crosswalk Length = 10.5 m	
Foot over Bridge/Underpass	Not available		

Road Surface Condition	Fair with some rutting.		 Figure 6.18
On Street/ Illegal Parking	Illegal Parking in front of shops		 Figure 6.19
Parking Facility	Not available		
Kerbs	Not available		

Table: Calculated flow and density data Patnipura to Lig

Time Period	Volume of individual vehicles in PCU/5min					Total Flow (veh/hr)	Density veh/hr
	2Wheleer	Car/ Van	3Wheleer	Bus	Total Volume (PCU/5min)		
5.30:5.35	136.5	21	16.8	0	174.3	2091.6	146.78
5.35:5.40	129.75	17	21.6	0	168.35	2020.2	143.96
5.40:5.45	147	13	26.4	0	186.4	2236.8	160.79
5.45:5.50	140.25	19	12	0	171.25	2055	150.54
5.50:5.55	143.25	22	19.2	0	184.45	2213.4	163.07
5.55:6.00	133.5	26	25.2	0	184.7	2216.4	165.75
6.00:6.05	131.25	18	20.4	0	169.65	2035.8	155.55
6.05:6.10	144	21	14.4	0	179.4	2152.8	166.04
6.10:6.15	123	13	9.6	0	145.6	1747.2	135.90
6.15:6.20	135.75	17	15.6	0	168.35	2020.2	159.40
6.20:6.25	129.75	14	22.8	0	166.55	1998.6	156.25

6.25:6.30	141.75	20	14.4	0	176.15	2113.8	169.53
6.30:6.35	126.75	23	10.8	0	160.55	1926.6	151.77
6.35:6.40	129.75	18	18	0	165.75	1989	155.51
6.40:6.45	135.75	13	24	0	172.75	2073	163.23
6.45:6.50	132.75	24	16.8	0	173.55	2082.6	166.02
6.50:6.55	138	21	26.4	0	185.4	2224.8	175.40
6.55:7.00	143.25	16	22.8	0	182.05	2184.6	177.00
7.00:7.05	130.5	18	19.2	0	167.7	2012.4	161.86
7.05:7.10	120.75	24	26.4	0	171.15	2053.8	162.91
7.10:7.15	129	28	30	0	187	2244	176.79
7.15:7.20	126.75	19	21.6	0	167.35	2008.2	155.20
7.20:7.25	133.5	23	16.8	0	173.3	2079.6	165.81
7.25:7.30	141	21	27.6	0	189.6	2275.2	180.06
Total	3223.5	469	478.8	0	4171.3	50055.6	3865.12

Problem Statements:

No left turning island (channelizing island) available.

Illegal parking on road and footpath reduces available road and footpath width.

Street vendors and shops occupy available road width.

No Informatory (Direction and Place Identification), Regulatory (Parking Prohibited & Speed Limit) or Cautionary (Cross Road) Sign available.

Absence of reflector units and no pedestrian sign or signal available.

Crosswalk is available only on RHS of road, but the marking had faded a bit.

V. Recommendations for all locations of Intersection PATNIPURA SQUARE as per IRC codes

The traffic control system may be enhanced, the volume of traffic will decrease, and congestion will be lessened if this proposed study plan is installed and successfully implemented. Widening the road would be more effective in the future and lead to better outcomes.

5.1 Solutions:

5.2 IRC 30:

Minimum 1.8 m width and 2.2 m height of walking zone should be clear of all obstructions.

Footpath should generally be designed for LOS B with width 1.8 m. Frontage/Dead Width of minimum 1 m ahead of shops should be available.

Minimum width of Pedestrian refuge 1.2 m & minimum width of 2 m in staggered crossing allowing wheelchair users to pass.

Bollards can be provided to prevent entry of vehicle on footpath. But it should not affect people on wheelchair. Gap between them of about 120 cm and having a height of 100 cm.

Pedestrian Facilities-parking can be provided as per section 6.16.

Zebra crossing with Thermoplastic paint +5 mm embossed texture should be provided. Pedestrian crossing must be minimum 3 m wide.

5.3 As per the IRC 103 the Pedestrian Refuge Island width is given in below Table.

Medians (Pedestrian Refuge/Island)	
Width of Median	Absolute minimum 1200mm
Centre of a staggered crossing	Minimum clear width between guard rails 2 m to allow two wheelchair users to pass one another.

5.4 IRC 70:

Traffic Calming measures like speed hump, speed bump, plateau, etc. should be used near shopping areas.

Plaza shall be considered for retail streets.

The profile of circular shaped hump is based on the shape of a circular arc with a radius varying from 11 m to 113 m and a chord length varying from 3.0 m to 9.5 m to achieve desired speed of 20 km/h to 50 km/h.

5.5 IRC 35:

Section 5 gives details about Road Studs. Their technical specifications can be found from Clause 804 of Specifications for Road and Bridge Work of MoRTH. They are placed 500 mm outside shoulder line on paved shoulder and on unpaved shoulder they are placed on the line.

Red color studs are provided at left hand edge line while yellow color studs are provided at median edge line. Their spacing can be found from section 5.5.

Stop lines to be provided as per section 6.

Section 9 gives At-Grade intersection markings.

Section 11.3 states that stop lines should be placed 1 meter before crosswalk on signalized intersection. If crosswalk length>10.5 m then refuge island is a must. Road studs can be used to make crossing visible at night.

Kerbs to be mounted by pedestrian should not be higher than 50 mm. It may be advantageous to provide flash signal about crosswalk 3-55 ahead of marking.

Pedestrian crossing marking .

5.6 IRC 67:

No parking sign (section 14.8.5) should be present at an interval of 30 m at maximum parallel to kerb in areas with restricted parking. Parking not allowed on footpath sign (section 14.8.5.1).

As per section 14.9.9 speed limit sign should be provided at exit arm of junction and should be placed 25 m before intersection.

Cross road sign before intersection to be provided as per section 15.11.

Pedestrian crossing cautionary sign as per Fig. 15.33

5.7 IRC:SP:12

No parking is allowed up to a distance of 50 m from intersection and up to 8 m from pedestrian crossing.

Section 6.6 shows parking vehicle layout for different vehicle.

Section 8 deals with enforcement. The increase in penalty for wrong parking through Amendment Motor Vehicle Act 1988 should be done to prevent illegal parking.

5.8 IRC 99

Design Speed breakers at the section.

5.9 IRC 93

Section 6.2.2 recommends lateral segregation of pedestrian-by-pedestrian Traffic Signal.

5.10 IRC:SP:43

Section 10 explains several Public Interaction techniques like large display, electronic hoarding, mobile messages, leaflet, press notes, TV and Radio, Communities, Student participation, etc. to increase public awareness about traffic rules and regulations.

5.11 IRC:SP:41

Section 2 suggests conflict point can be reduced by introduction of Channelization.
Section 4.11.2 gives requirements for channelizing island.
Foot over bridge, pedestrian Subway (IRC 103-Table 3) and Sky walk.

Width of side-walk (meter)	Capacity in number of persons per hour	
	All in one direction	In both directions
1.50	1200	800
2.00	2400	1600
2.50	3600	2400
3.00	4800	3200
4.00	6000	4000

5.12 IRC 93:1985

Section 5 deals with Pedestrian Signal. It consists of lens with colored human figure. Green Figure ready to move indicates permission to cross the road. Red standing figure indicates prohibition of crossing. Flashing signal (4 to 6 section) urges people already on carriageway to reach the nearest refuge island.
Section 22 deals with the determination of pedestrian green timing. Road width divided by pedestrian walking speed (1.2 meter/second) will give required green time. It must be increased by 7 section. The value mast be increase to nearest multiple of 5. Maximum cycle length recommended is 120 section.

5.13 IRC:SP:83

Guidelines for maintenance, repair and rehabilitation of cement concrete pavement.

Complete Street Design Workbook (Ministry of housing and Urban Affairs):

National Street Vendors (Protection of Livelihood and Regulation of Street vending) Act 2014 makes it compulsory to accommodate vending areas in street designs.
They should be located such that they do not obstruct/encroach on footpath and cycle tracks. A clear pedestrian zone of 1.8 meter should be provided beyond the vending spaces. It is preferable to provide vending spaces in MUZ (Multi-Utility Zone consist of space for vending, street furniture, landscape, bus stops).

5.14 Outcomes

As per study and data observed for the locations, these point are expected outcomes
After studying travel time reliability measures, we will be able to find maximum delay and the flow delay.
We'll be able to find the congestion patches along the route for every km of length to develop the priority basis of improvement for the route on short term and long-term basis.
It can also be used for identifying reliable path and make better routing decision.
We'll be able to find measures to improve traffic movement.
Fuel consumption of vehicles will be reduced.
Air and noise will reduced efficiently.
The result may be helpful for road planning and traffic parameters management to reduce jam density and increase flow of road.
Traffic Management can significantly relieve traffic congestion.
Traffic Management can make urban mobility more environmentally friendly.

Traffic Management can reduce demand for private motor vehicle travel.
Traffic Management can reduce fuel consumption and air pollution.
Traffic Management can defer infrastructure investment by increasing existing transport efficiency.

VI. Conclusion

In present scope of work, following points may be concluded.
Indore city has heterogeneous traffic conditions. Therefore, at intersections, the situation became critical while crossing, merging, and diverging at the intersection. Heavy vehicles and cars must compete with each other to get their turn.
After this proposed studied plan is installed and carried out successfully, the traffic control system may be improved, the volume of traffic will decrease, and congestion will be reduced.
Better results can be obtained in the future by widening the road, which would be more efficient.
The monitoring and control of traffic will be improved with better results if this process is started wherever there is heavy traffic and narrow roads.
The main outcomes are decreases in road accidents and congestion, a decrease in time and fuel consumption, an improvement in safety, and a sustainable environment that will boost our economy.
After successful installation and execution of this proposed studied plan may improve traffic control system, traffic volume will get reduced and conjunction will be minimized, better results can be obtained by widening the road in future which would be more effective. Initiating this process in every place where traffic congestion is heavy and the road is narrow will give better result in monitoring and controlling of the traffic in cost effective way. It mainly results in reduction of fuel and time consumption, increase in safety and sustainable environment which will enrich our economy.

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