INTEGRATION OF ITS USING ADVANCE TRAVELER INFORMATION SYSTEM IN CONJUNCTION WITH DMS FOR JALANDHAR CITY

Submitted in partial fulfillment of the requirements

of the degree of

MASTER OF TECHNOLOGY

in

CIVIL ENGINEERING

by

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2016

DECLARATION

I, Yatender Kumar Singh (1100949), hereby declare that this thesis report entitled **“Integration of ITS Using Advance Traveler Information System in Conjunction with DMS for Jalandhar City”** submitted in the partial fulfilment of the requirements for the award of degree of Master of Civil Engineering, in the School of Civil Engineering, Lovely Professional University, Phagwara, is my own work. This matter embodied in this report has not been submitted in part or full to any other university or institute for the award of any degree.

Date: **Yatender Kumar Singh**

Place:

CERTIFICATE

Certified that this project report entitled "Integration of ITS Using Advance Traveler Information System in Conjunction with DMS for Jalandhar City" submitted individually by student of School of Civil Engineering, Lovely Professional University, Phagwara, carried out the work under my supervision for the Award of Degree. This report has not been submitted to any other university or institution for the award of any degree.

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ACKNOWLEDGEMENT

This report on ITS was developed as part of the activities at the Lovely Professional University, sponsored by the. We thank our mentor. We also thank the Director, Dean (Civil Engineering Department), the Head of the Department, Dr. V. Rajesh Kumar, Department of Civil Engineering for their support and guidance to the Centre. We thank the other coordinators for providing us the opportunity to work on this report. Special thanks to Mr. Rishi Singh Chhabra for the prompt and professional technical editing support.

Signature of Student

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ABSTRACT

This paper gives a concept of installing permanent Dynamic Message Signs (DMS) in a road traffic network. The main job is to achieve a proper planning and achieve our objective to install optimum number of DMS in order to spread in conjunction with Advanced Traveller Information Systems (ATIS). Functioning and upkeep price of DMS, and event-interrelated operator price under casual traffic occurrence situations. The required DMS location design problem is need to be done after a complete survey of location study and choose appropriate location for installing each DMS so that it should be visible from a desired distance. Its visibility should be free from obstacles like building, any road structure and trees. The most congested and with heavy traffic flow area is to be selected in multiple stretches of Jalandhar city. The main city area having higher volume traffic in regular week days and weekends is also viewed. A study is carried over a complete stretch of 5001 m approximately. The complete stretch of approximately 5 Km is broken down in Six stretches for the purpose of ease in data collection. DMS reaction rate, and event characteristics have on the resolution. The expected outcome recommends that designing and installing of DMS and ATIS together is more economic and effectual than the normal separate set out of both the application from the system management point of perception. The implementation of such traffic information and management systems guides users to choose their mode of transportation and facilitate a more effective use of resources and already existed road network structure. Road safety and congestion consequences can be treated as well because risky locations or situations are notified and extenuated on a real-time basis system. Real time services for road user’s information cover the use of permanent Dynamic message signs (DMS) by exhibiting information on traffic for efficient and safe manoeuvring of traffic volume.

Keywords: ATIS, Conjunction, DMS, Real-time, Congestion

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LIST OF ABBREVIATIONS

ITS: Intelligent Transportation System

ATIS: Advance Traveler Information System

DMS: Dynamic Message Sign

LED: Light Emitting Diode

GIS: Geographical Information System

GPS: Global Positioning System

CCTV: Closed Circuit Television

IVHS: Intelligent Highway Vehicle System

APTS: Advance public Transportation System

PCU: Passenger Car Unit

AADT: Annual Average Daily Traffic

LMV: Light Motor Vehicle

NMV: Non- Motorized Vehicles

TMC: Traffic Management Centers

MUTCD: Manual on Uniform Traffic Control Devices

Chapter 1

Introduction

1.1 General

ITS refers to a diversity of tools, such as a concept of traffic engineering, hardware, software and communication technology, that can be useful in an integrated form on the transportation system in order to enhance its effectiveness and safety. ITS offers support to advance services in the transportation system operations, such as traffic supervision, commercial automobile operations, transportation management and information to road users. It provides and alternative or enhancement to traditional solution to transportation problems. Traditionally transportation community attempts to meet the challenges of increasing travel demand by building additional capacity. This resolution might not work in areas that have already been built up and face construction limitations due to strict environment regulation. In such cases, ITS can help as a good alternative to meeting upcoming demand of future travelers.

FIGURE 1.1: Intelligent Transportation System

ITS gives many application and techniques to remove complicated transportation problem. ITS has the capability to improve traffic flow and reducing congestion problem in that particular area, it also improves air quality by reducing current air contamination and travel interruption, and improvise safety by providing advance attention of predicted crash situations and lessening the effects of environmental road, and human elements that leads to crashes. It can also foster economic growth in the improvising vehicle movement and reducing oil or gas consumption.

In addition, Intelligent Transportation system has great capability for making road journey more suitable and more convenient by giving timely and correct information on the online systems as well as on available travel options. More modified information, such as predictable travel times and the shortcut travel route to a destination, can be made available to travelers through handheld or in-vehicle devices and the web connectivity.

Commercial vehicle operator, controlling and taxing vehicles, and highway users can also take advantage from ITS application which support automatic administrative procedures and automatic wayside safety inspection. ITS also provide many application that benefits to the public transit users and operatives. This includes the security improvement on transportation vehicles and at transportation stations, providing real-time scheduled data to transit road users, by guiding alternate directions for transit in case of any incident, and giving transit a favored treatment at the signals.

ITS efforts to improve the effectiveness of the transport facility by means of real-time information and previous info on the systems updated to properly assign resources through all the transportation system mechanisms. ITS applications progress existing transportation facility by permitting it to function more carefully and proficiently. In over-all, ITS application has a potential to reduce total travel time, reduce the regularity and severity of crashes, advance flow of traffic, decrease travel costs and improve traveler's satisfaction, Assessments studies and operative tests have revealed that ITS application are providing noteworthy benefits all through several surface modes of transportation system.

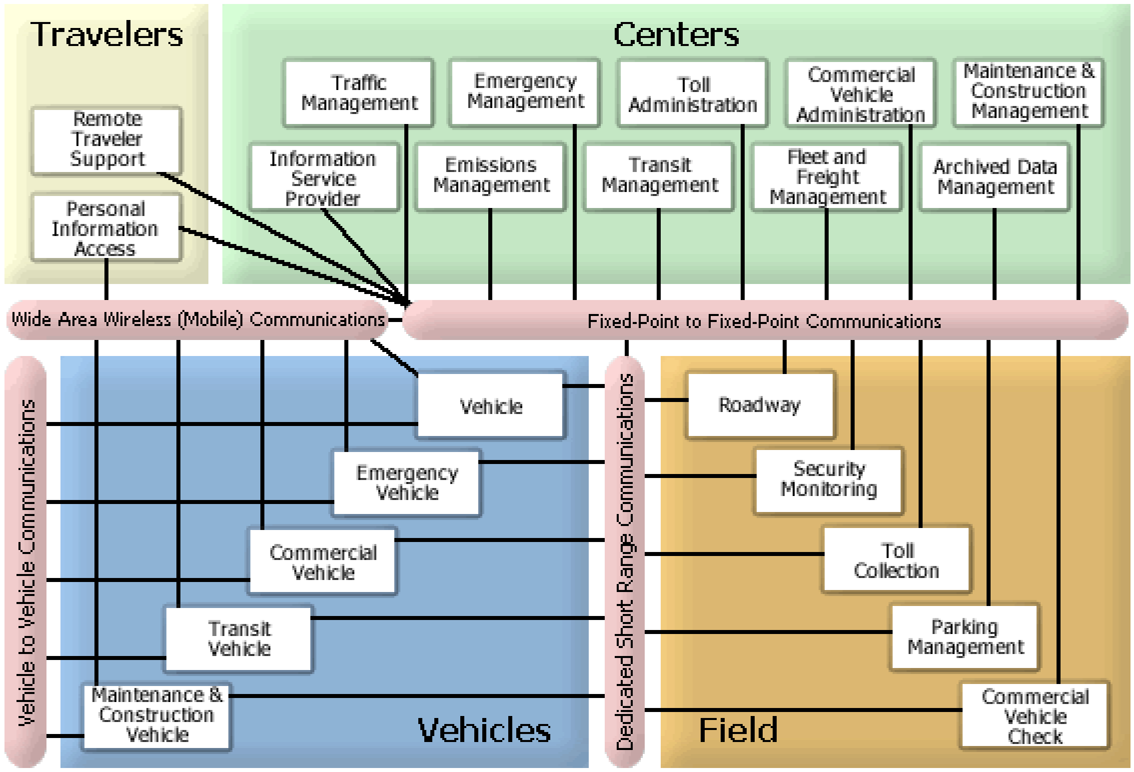


FIGURE 1.2: Broad Overview of ITS

1.2 ITS Now and Tomorrow

In large city parts, ITS projects have turn out to be a part of the transportation system. ITS is currently being implemented, either independently or as part of traditional transportation projects, in many areas in order to support the objectives of a safe and more effectual transportation system. Some metropolitan areas have already seeing the benefits of ITS through improved travel conditions. As a result, many smaller metropolitan and rural areas are also serious by thinking about ITS or, in some cases already implementing it.

ITS technology, however is altering very quickly. New and advance technologies come into part every day, and the demand for a more efficient and safer transportation system lasts to grow. ITS is likely to grow rapidly, both geographically and functionally, to meet future demand on the transportation system.

1.3 ITS Training and Education Needs

ITS is new discipline, Traditional Education agendas in transportation engineering at the nation's universities are not adequate to prepare students to plan, design and operate ITS. In accession to previous transportation engineering courses, ITS masters require training in many diverse ranges, such as system engineering, electronics, communication system, and official issues.

ITS studies and ideas were given thoughtful attention in the around 1990s as an applied way to meet future demands on the transportation system. The components and elements of ITS are still being focused and developed. As ITS proceed to become more prevailing in the transportation sector, transportation professionals are trying to identify the training and education needs to plan, install, function, and evaluate ITS. The national ITS specialized capacity building program identified 10 major critical areas where ITS training and education needs to be concentrated [1]. These are as follows:

- Planning and regional concept of Operation: Planning for ITS is not same as planning for previous transportation projects, such as a highway construction. ITS planning involves a more from construction to another explanation integrating advanced technologies to meet upcoming traffic demand. The challenge to the ITS experts is to merge ITS planning into the previous planning process to bring ITS to mainstream transportation activities.

- System analysis and design: This include the ability to spot users, fix their requirements and design a method which fulfill the requirements. The power to stud and design software and communication system will be necessary in many projects.

- Technology evaluation: ITS experts must be capable to adopt the most suitable and most-cost effective strategy and technology. Furthermore, in addition to bring familiar with various evaluation methods, they should also be familiar with various evaluation methods, they should also know the different technologies and their competences and boundaries.

- Data analysis and managements: ITS application typically involve the collection of large amount of data. ITS experts should know how to analyze these data, how to extracts useful information from them, and how to manage and distribute the information.

- System integration: systems integration involves connecting individual deployments and institution together into a comprehensive local transportation system to optimize service provided to users. It provides maximum benefits by lessening redundancies and maximizing competences through the integration of different components and instructions.

- Organization and institutional issues: For ITS to succeed, ITS professionals must know about organizational and institutional issues related to ITS deployments and challenges the pose. Such problem includes the changes needed in procurement and contracting procedures for ITS in highway construction projects and coordination requirements between different agencies for an ITS project.

- Contract management: ITS professional need to be trained on ITS project management approaches, which are different from those required to manage a construction project. In many cases, construction contractors who may undertake an ITS project lack the background knowledge needed for successful ITS applications.

- Financing: ITS professionals need to know the funding sources for ITS projects. In addition, they should know how to optimize the resources of these funding sources to meet project objectives.

- Coalition building: Building and maintaining consensus among stake-holders is a key to successful regional and statewide ITS deployment. ITS professional Should be able to engage stakeholders and develop consensus in meeting project objectives.

- Writing/communication: ITS professional should be able to write specifications that will help procure the best possible system. common problem in ITS deployment are misunderstanding and miscommunication between the deploying agency and the contractors.

1.4 Advance Traveler Information System (ATIS)

Advance traveler information system uses the collective information and communication technology to provide information data to an extensive range of travelers using different modes of transportation and have an extensive variety of features. Information enable traveler to make better travel choice and supports a better use of existing transportation facilities. Such system, therefore, have the potential to improve the operation of the transportation. When it is prearranged, established, and executed in a thoughtful and well-structured way.

FIGURE 1.3: In Built GPS System in Vehicle

The term advance traveler information system open to appropriate since it is a relatively unfamiliar term to most people.

Let us start by analyzing the expression advance traveler information system word by word.

Advanced: There are many ways to collect data, process it, and disseminate traveler information, some of which require little by way of information and communication technology application.

For example, a telephone network or wireless radio facility connection people in the field back to a central base can relay anecdotal from the public and form a few spotter planes or helicopters where it is disseminated by TV or radio to the public. While this method uses some of information and communication technologies

Traveler: A fairly obvious definition of traveler is the one who travels. Is seems trivial first, but there is a bit more to it when you start to explore the term. Travelers can have a range of characteristics according to the mode of travel chosen, the purpose of the trip being made, and the characteristics of the individual

Information: what do we mean by information? We carried out a quick web search and came up with following two definition for information [2]:

1. Past record data, or instruction in any standard or in any form
2. The sense that a person assign to information with the known resolutions used in the depiction.

Required data also reduce uncertainty by providing additional knowledge and adding to what the user of the information already knows. Definition based on the web searches: Information is the data that has been subjected to processing to analyze the underlying pattern and trends to reveal facts the are useful to the users because the reduce uncertainty and shed light on the subject that in important to the user.

Systems: The preparation of an assembly of methods, measures, or practices combined by controlled communication to form a planned whole. This can be place in additional words as “A cluster or set of related or linked material or immaterial things subject to controls interface creating a unity or complex whole.” [2], [4]

1.5 Dynamic Message Sign (DMS)

Dynamic message sign is referring to the passing unit or a big screen board that give info display technology to inform in formational and instruction to vehicle riders and additional travelers. They can be located at key decision pints in the travel process, such as important intersections along the highway, approaches to parking garages, or at multimodal interchange points, such as airport concourse, bus stops, or railway stations. When the information regarding current traffic situation on road displayed on the dynamic message sign that can be changed rapidly via a connection to controlling system. It is public medium which constraints the comfort and customization of the messages. All viewer of the sign see the same message at any given time. [3]

FIGURE 1.4: Dynamic Message Sign

Road users present traffic information in the form of road traffic messages and announcements, which is conveyed through the use of information opinion and shows mounted sideways of the roadway network. This comprises the dynamic message sign situated at strategic location on the conveyance network, such as main decision locations for direction-finding, transit, halts, posts, shopping hubs and large workplace centers. It is the most predominant application respectively to the surface transportation is the variable message sign also called as dynamic message sign (DMS) or Changeable message sign (CMS) or also termed as moveable message sign depending upon your country.

These signs are characteristically permanent fitting which uses a display technique, such as closed fiber optics, magnetic flip diskette, light emitting diode (LED), or revolving prism to allow the display to be changed as per according to the traffic situation. Few of these signs are completely addressable or few special mapped displays allowing any combination of graphic and text messages to be displayed. Other displays have restricted predetermined set of messages to display. These can be colorless or fully colored. These are castoff at planned positions sideways the road network to send direction choice or information regarding present traffic condition.

1.6 ATIS Operational Concept

In order to achieve our action of data information and communication technology. It is required to deliver a complete image that exemplify in what way the technology skills might be functional in unity to give traveler information through system distribution. We say it operational concept as because We have reserved features and its functions from various number of ATIS to make a projected example that how these techniques can be arranged in order to function together. Below the given figure demonstrate the operational concept of advance traveler information system, that comprise of different four data processing or administration- processing or supervision centers and single private- sector data facility provider.

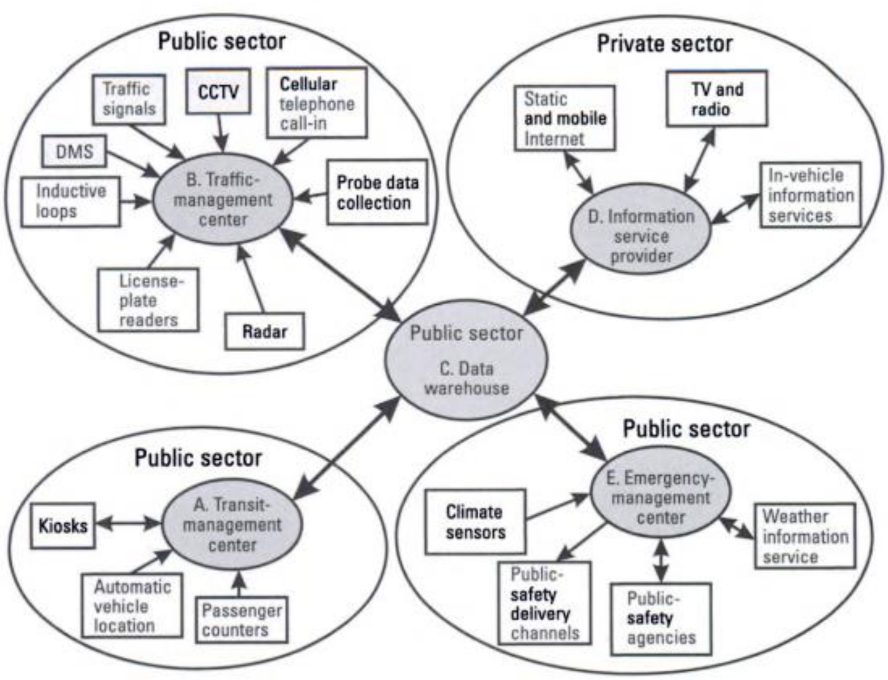


FIGURE 1.5: ATIS Concept

1.7 Scope of The Study

The world of ITS presents many opportunities for collaboration, creation, and mutually beneficial actions involving both the public and private sectors. New mechanism and new application have been applied successfully for a number of years in other application field and just new to Transpiration system. The development and implementation of ATIS are necessary in order to enable us a transportation and business community to make progress towards some ideal situation. Where traveler information is readily available to the public and fully supports positive travel behavior. The future scope of ATIS to deliver a context within which there are no surprises for travelers. Information accessibility should be such that the large majority of the traveling public has easy access to the full range and quality of information required to support informed and intelligent decisions at all stages in the trip and covering all modes.

To make some specific points regarding the operational aspects of the future system. We take a look through the eyes of the operators and managers of the future ATIS. This provides more of a back-office view of the future system by exploring the data collection and information processing facilities that are available and the transportation objective to achieve a smooth flow of vehicles on road network with the minimum delays.

To provide users information which is related to travel in order to guide while making decision on direction choices, approximation of travel time, and dodge congestion. It can be empowered by delivering different information data with the help of using ATIS technologies.

Use of dynamic road message signs real time message of information regarding traffic blockings, blockages, incidents and alternative route guidance in case of any closure of roads and upkeep work.

1.8 Objective of the Study

The objective of ATIS is to deliver a context within which there are no surprises for travelers within the selected stretch of Jalandhar City. Information accessibility should be such that the large majority of the traveling public has easy access to the full range and quality of information required to support informed and intelligent decisions at all stages in the trip and covering all modes of transportation including Non-Motorized vehicles (NMV).

- The implementation of ATIS is mapped to the true objective of saving time, lives, and money, reducing stresses and optimizing use of existing capacity.
- Gives the travel time, transit schedule information, journey time reliability, pre-trip planning information, travel related weather information, Alternate routes and modes and also the description of accident and incidents (Including duration). Which helps to ravel with ease and safety.
- Effective use of Advance traveller system to deliver transit riders a real-time information, to make well informed decisions concerning trips, Information regarding routes and safety, with co-occurrence of Dynamic message sign (DMS).

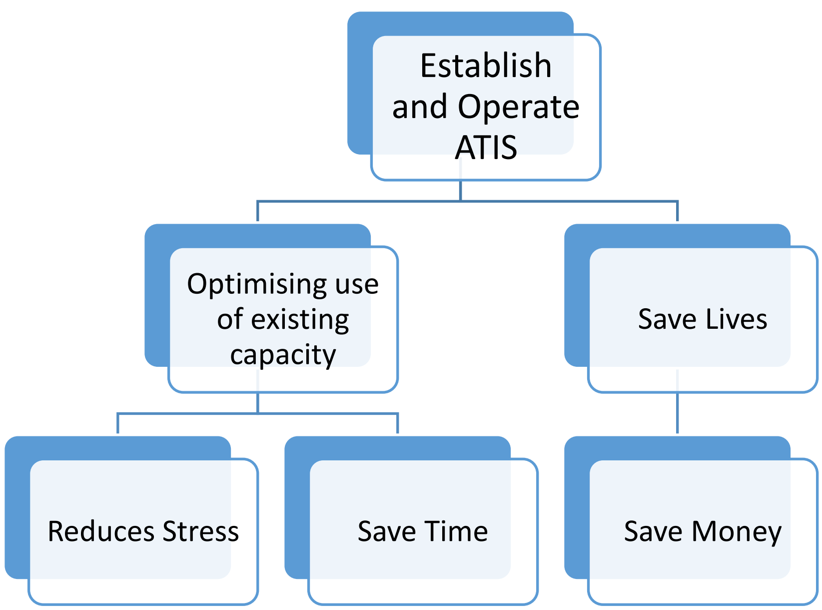


FIGURE 1.6: Flow Chart of ATIS Objectives

With the example that features the use of multiple information delivery channels, such as dynamic message sign as we are working in this thesis, internet and interactive voice response. The traveler information related to roads and driving condition that’s why most of the current deployments of ATIS that take data from multiple sources and then further delivered advance traveler information technologies.

Chapter 2

LITERATURE REVIEW

2.1 Praveen Kumar, ATIS is a one the key application of ITS comprises of compute, technologies and information technology to give the data to road users about the traffic regulation, safe route with the minimum time travel and about the safety aspects along with hazardous situations if any. ATIS requires very detailed and prominent amount of data for the implementation, under this study the author have used the GIS application along with the Advance traveler information system. GIS based ATIS provide most strong and most convenient for storing and graphical depiction for conveying the present traffic information to the road users. ATIS is mostly wide under intelligent transportation system through the fast growth of internet and wireless technology skills from last couple of years. [5]

2.2 Yi-Chang Chiu, this paper gives a method of implantation of permanent dynamic sign (DMS) in a transportation network, the required number of dynamic message sign with the co-occurrence of Advance traveler in formation system. Then further DMS deployment cost is to be estimated for the give defined area. Simulation approach is employed to overcome this situation. The numerical results show that the implementation of DMS and ATIS simultaneously is more efficient and more cost effective. The author further concludes that this methodology of deploying permanent DMS is suitable for both long term planning and short term operations. This paper also addresses the effect the interrelation between ATIS and DMS for it effective impact on best route selection and time travel. Experimental results show the good inter-relation between the two strategies. [6]

2.3 Rijurekha Sen, Bhaskaran Raman. In this paper, the author presents a comprehensive study of all possible ITS application in India as according to the current scenario system of traffic condition which include both research prototype and deployed systems. This paper set a list of private and public organization that plays a major part in traffic management and research. This paper focuses on the Indian traffic conditions and many of the traffic related problems and solutions marked in this paper. In the end, it concludes that currently traffic congestion on Indian roads is the major issue. There is range for examine previous method and ideas in different and disputing traffic conditions, come up with new solutions and mathematically evaluate thought within both private and public sphere. [7]

2.4 Alexis A. Avgoustis, Measuring the Safety effect of Intelligent Transportation Systems. An average of 6.5 million accident are recorded as on yearly basis data in united states. Safety is important factor to consider on a rapid growth of traffic volume in American traffic situation. This thesis explains the development of a safety model having the primary goal is to get the benefits of Intelligent Transportation Systems (ITS) on current road condition. Traffic signal proper coordination helps to smoothens traffic on a road network and reduces its chances for accident risk by generating less vehicle-to vehicle interactions. Also, traffic signal manages to control the design speed properly on that road. The main advantage of this safety model that it can be easily used to get a variety of ITS application and technologies and also the signal coordination which is evaluated in detail in this thesis [8]

2.5 Kay Noyen, in this paper the supposition is made that new Modern smart mobile phones with incorporated GPS device and wireless internet connection are now in trend of becoming basic equipment of individual's life. They provide a commodious user interface to disseminate the users' transportation demands using existing developed infrastructure. The aim of the paper is to develop a system that is capable to process sent off transportation request into as optimal routes for a set of vehicles that can handle large number of request at once in real time basis. The public transportation systems give a cost-effective way to travel more or less freely in urban areas. The outcomes conducted in this thesis project that from a theoretical evaluation it is possible and significant to use the intelligent transportation system specifically in urban areas and the experimentations made indicate high possibilities to later improve the quality of the complex transportation system. [9]

2.6 Jaehoon Jeong. This dissertation considers the Wireless Sensor network technology under Intelligent Transportation system, trimmed and optimized for the selected road networks. For military purposes, the same road networks are used for main movement of military troops in the main cities and other urban areas, they need to be saved for military procedure and proceedings. From civil engineering, point of view the Intelligent Transportation Systems have been formulated and been developing to support the driver's safety and increase efficiency in transportation through the computer information system and good coordination between transportation base and vehicles. Roadways transportations are mainly used for the transportation of people, goods and services and also are nowadays are fitted with intelligent device techniques, such as electronic toll plazas and dynamic message signs for route guidance. Now in this coming era, vehicles are nowadays fitted with GPS based technology for navigation purposes and accident and emergency notification systems for making the trip more efficient and safe. This thesis mainly focused on wireless sensors networking technology for the safety, security and communications purposes for the particular chosen road network. [10]

2.7 Lelitha Vanajakshi Gitakrishnan Ramadurai Asha Anand.Intelligent Transportation Systems (ITS) is a well-defined way to solve, or at least reduce the traffic issues. ITS covers almost every mode of transportation such as airways, subways, roadways and railways, which is interrelated to each other's base structure, communication and operational system. Many countries have working on various schemes and techniques, which is based on their geographic, ethnical, socio-economic and environmental background knowledge, to merge the various ITS elements into a single interrelated system. Generally, any of the ITS applications works with the data which is provided by Traffic Management Centre (TMC) where data is gathered, examine and combined with functional and control concepts to handle the composite transportation troubles. Generally respective agencies contribute the administration of transport system, by a network of traffic controlling centers. There is frequent a localized distribution of gathered data and available information further which is conveyed to main center hub of traffic centers that choose different methods to accomplish their goal to control and manage the traffic. This mutualist trendy operation and making decision is required because of the heterogeneous nature of demand and performance   essential because of the heterogeneity of demand and performance features of interrelating subsystems. In the end conclude they it concludes that ITS in India cannot be completely implemented on existing road structure as of like other developed nation's due to the basic differences between the countries like ethnic, geographical and socio-economic. The existing traffic structure need to be completely understood and modified in order to deploy ITS in Indian traffic system. [11]

2.8 Bhupinder Malik, it is important requirement to achieve traffic issues and road user safety on the National highway in any country. The current National highway system that developed over many years has various lacks. The main and basic aim of the current study is to key out a management system that gives you better and efficient traffic performance on the given road network. An effort was made to was made to know main issues, causes and thinkable solutions for improved traffic the problems, reasons and possible solutions for better traffic supervision.

In many areas in India road traffic condition is complex and non-lane based which is completely different from the western areas. The difference can be easily seen by experience. So, Intelligent Transport Systems (ITS), used in western and in other developed countries for the efficient traffic flow and management cannot be implemented as it is in India. ITS have a requirement to fit the traffic features of Indian roads. In this paper, he has more focused on traffic and road monitoring system of current road conditions. The main problem related to constructing a traffic condition monitoring system on Indian roads have been talked about. [12]

2.9 Subramanian Gopalakrishnan**,** Intelligent transportation can bring a great important part to overcome the traffic congestion issues which faced by the current highway road users. A productive execution of Intelligent transport system is possible only depending on the accurate estimation of expected future generating traffic. An effectual short term future generating traffic assume to be a substantial part in this circumstance. This paper gives an idea to predicted future generation traffic by using multiple regression analysis and technique of neural networking (Intelligent modeling technique) for anticipating the next hour future generated traffic of a Highway. The data has been collected in week days and weekends. The prediction is also carried out for the peak hours (Morning/Evening) and the results shows the heavy commuters traffic flow during the peak hours of morning and evening, which assist for deploying the suitable ITS application. [13]

2.10 P. D. Heermann, under this paper it describes about the Intelligent Vehicle-Highway System (IVHS). This looks for ways to increase the existing road capacity using technological inputs. While private vehicles are the main focus under this program IVHS. It also looks for the new improvisation in public conveyance system. This thesis work comes up to the public transport elements, which we called as Advance Public Transportation System (APTS). The future scope of Advance Public Transportation System is delivered, by giving a merging transportation network for the laid improvements in the services of road users. A bus centre is taken into consideration that will enhance the quality and appearance of the system for both new and old users, operators, and also for those who manages the traffic. In this paper, also the importance of Advance public transportation system to the aim of IVHS are been thoroughly discussed. [14]

2.11 Mohammad Mahmudul Haque**,** the objective of this paper is to create a Real-Time Traveler Information System that will Support the operation of an Advanced Traveler Information System (ATIS). The method will observe the current traffic condition of every single route and inform routinely as per to the collected data. It will also let the road user to inform about any even or incident, weather complaint and any unusual event in the road. The data collected from the roads will be examined in conjunction with the last recorded information. A real-time information will be generated in order to guide travelers to take the best decisions concerning their travel routes to dodge traffic congestions and delay. [15]

2.12 Abhijit Kenjale, In the implementation of a wide-ranging and first-rate road network, the requirement of re-establish, resurface, or change in components of a roadway will always come into play. This ultimately results rise to the current of work areas in which labours complete their maintenance and construction work on an existing roadway network in close separated area with the moving vehicles. The transportation engineer is accountable for setting up these work areas to manage the following tasks: Completion of the construction or maintenance work in stipulated time period, Protection of the capacity of the road network and, the protection of the labours, the goal is to achieve improved safety in highway work zones areas, there are numerous different method that should be measured. These comprise keeping drivers attentive, alert, and wide-awake; making labours and the work areas more noticeable; enlightening the control of traffic in merging areas to allow the lane changes more expectable; Introduce improved safety devices; and controlling vehicle speed and speed variations in the work zone areas. This paper emphases on the last of these methods, by controlling vehicle speed, through the application of a speed monitoring display with variable message sign. [16]

2.13 Vaibhav Rathi, Combination of Intelligent Transportation Systems (ITS) technologies with traffic surveillance has the ability of dropping the delays and costs incurred due to non-recurrent traffic on roadways by the distribution of dynamic route direction to drivers. Variable Message Signs (VMS), installed on expressways or freeways, are used for incident supervision and to give the information regarding the incidents and deviation routes. CMS proved to be an important tool used by the Traffic Management Center (TMC) to improvise the efficiency and reduce delays of the road network by providing alternate route guidance. Dynamic Traffic Assignment (DTA) device can be used to make predictive direction, and the traffic management center can distribute it via VMS to the road users. The on-line assessment of such systems is very expensive and there is a necessity to simulate the actual traffic conditions in order to evaluate the DTA tools before their application in the field area. [17]

2.14 Ning Zhang, Variable Message sign (VMS) has been installed in Minnesota since 1960s. The assessments for the use of the signs are critical for their suitable installation and distribution. Under this paper, five VMS devices were designated along Interstate-94 (Particular location) amid at downtown Minneapolis and St. Paul. The data collection was taken in period from January 2006 to December 2012. Initially, a linear model was used to examine the outcome of variable message sign over speed changes, in the consistent impact areas. The study was conducted using two methods along with the eight different conditions. The result shows that the speed variation, the consequences indicated that the arrangement of variable message sign messages was not likely a hazard factor for crash incidence. The projected odds ratios for both type, warning and informative message types were not expressively different. [18]

2.15 Azadeh Norouzi, Dynamic Message Signs (DMS) are key element in Advanced Traveler Information Systems in order to control transportation networks, decrease congestion problems and increase safety by providing road users a with real-time information concerning downstream traffic conditions. Whereas DMSs are proposed to advance efficiency and safety features of the given road networks, Small scale analysis has been done for checking the effect of the VMS signs on driver safety and their local safety impressions. This thesis gives information of real ground truth data collected on the basis to examine the traffic related problems in State of Maryland for four-year period i.e. (2007-2010). The outcomes show that there are no significant changes in the accident pattern in the proximity of variable message signs and the forward adjacent mid-block road segments. On-and-off analysis was also being conducted on Variable message sign operation status (on/off). The results congregate with the previous analysed data suggesting that there is no expressive relationship between happening of accidents and existence of Variable message sign. This thesis assessed localized safety influences of highway Variable Message Signs (VMS). The recorded accident data from year 2007 to 2010 served as the ground-based data for the study of road crashes in whole State of Maryland. The accident and record of messages data in study duration was taken from the Centre of transportation department for deployment of Advanced Transportation Technology. [19]

2.16 Nedal Taisir Ratrout, The Dynamic Message Signs (DMS) were presented in Saudi Arabia and their consistency under native environment is being experienced. This paper purposes to assess the probable response of the drivers to Dynamic message sign when it is used for messages regarding the present traffic conditions. A main arterial in Al-Khobar city in Saudi Arabia with a large Dynamic Message Sign board was designated for this particular paper. The assessment procedure started by interviewing drivers chosen randomly from the study region. Results shows that there were about 77% of the interviewed drivers showed encouraging attitude toward Dynamic messages guiding change of route. The driver's interviews established statistical connection between the response to messages inviting change of particular route and also displays the reason for such suggestion. The extreme response was for dynamic messages about accidents, roadwork doings, and traffic congestion. A field trial was also conducted along the considered arterial. In results, it was found that Dynamic Message Sign statistically improved the proportion of diverted traffic throughout specific peak duration when traffic count is more. [20]

2.17 Lowisa Hanning, The Dynamic message signs and Dynamic speed limits are today regularly used in many portions of Europe but is not as well used in Sweden. The aim of these signs is e.g. to make a more similar traffic flow and reduce congestion on expressways or freeways. There are many in places of Sweden, the control procedure is outdated and in need of an amendment. In this paper, the capability of more development and execution of an improved control procedure and regulator design for changeable speed limits is examined. There are methods to advance the traffic flow of vehicle, for example upgrade metering or altering the adjacent infrastructure of the road network, has not been inspected. To study the potential and grow a controller design of changeable message signs, with changeable speed limits, for that initially the microscopic model that is called METANET was executed and analysed in MATLAB. Both macro and micro level models were joint to be able to examine the road traffic both as a flow and as a system of separately simulated vehicles. Both the models were used to generate a control design which make variations in the speed limits with the aim at improving the vehicular traffic flow. [21]

2.18 Afzal Ahmed, Precise representation of current traffic conditions is essential to create operative real-time traffic management strategies by using Intelligent Transportation Systems (ITS). The Existing applications of Dynamic Traffic Assignment (DTA) approaches are primarily based on either the forecast from macroscopic traffic flow models or analysing by using the sensors and do not take benefit of traffic state valuation methods, which gives estimation of the traffic states with a lesser amount of uncertainty than that of prediction or analysing it separately. Where the other side, research revisions gives importance to the approximation of real-time traffic state are attentive only on traffic state assessment and have not used the calculated traffic state for Dynamic Traffic Assignment applications. This paper introduces a context which integrates real-time traffic state evaluation with using applications of Dynamic Traffic Assignment to enhance road network performance during inexact traffic situations through Advance traveller information system. [22]

2.19 Niharika Mahajan, Traffic overcrowding is still a serious issue in most of the countries, with important economic and ecological losses. 'Intelligent Transport Systems (ITS)' that use advanced information and communication technology for handling the present road infrastructures which includes vehicles and road users, have revealed excessive potential in dealing with this traffic issue. But, most existing traffic management techniques, like alternate route guidance, ramp metering and dynamic speed limits are planned and executed independently. The main objective of this paper is to integrate a Dynamic speed control technique along with the ramp metering, to function efficiently at an expressways or freeways merging segments. According to the policy viewpoint, this is a task as because freeways and urban road network are controlled by different authorities. This is objectionable for the freeway governor measure. So, the development of the integrated techniques considers both, an enhancement in freeway or expressways effectiveness, and on other hand at the same time line regulation at the on-ramp. [23]

2.20 Rasib Majid, In Highway traffic volume, construction and upkeep works are quite common. Upstream road merging movement and capacity bottleneck can lead from a work area zone end, which pose enlarged safety risk and decrease traffic flow effectiveness. Dynamic Merge Control (DMC) is an application of Intelligent Transportation Systems (ITS) technology in work regions, which is projected to advance the safety and flexibility of the through traffic drive by guiding the lane modification manoeuver of vehicles from closed path to the open path. The main objective of this study is to study the efficiency of the two forms of Dynamic Merge Control in work zones. The goal of this evaluation was to examine the effectiveness of dynamic merge control (DMC) in expressway work zones in a virtual environment. This purpose was assisted by relating the performance of dynamic merge control in comparison with the conventional merge as per according to MUTCD. In accumulation to this, a Particular temporary traffic control plan is also recommended under a specific traffic demand. [24]

2.21 S.K. Mahajan, The Traffic Rotary at intersections is superior form of a grade change of lanes in order to channelize the drive of vehicles in single direction about a chief traffic island i.e. rotary. By fast growth of traffic, it is practiced that broadening of roads and introducing flyovers have now become domineering to overcome main struggles at the intersections such as crash between through and right turning vehicles. In this system, main conflicts are transformed into minor conflicts like merging and diverging of vehicles. The vehicles ingoing the rotary are slightly enforced to interchange their movement in a clockwise direction. Than they weave out of the rotary island to the wanted direction. The passage of vehicles is avoided by permitting all vehicles to join into a stream around the rotary island and then to deviate out to the desired road. Thus, the crossing conflict points eradicate and change into weaving movement or a merging manoeuvre from right and a diverging manoeuvre to the left. In this paper, designing of central rotaries at road the intersections are being examined and a safe movement about rotary island is developed that is to be used in road network. [25]

Chapter 3

EXPERIMENTAL PROGRAMMES

3.1 Methodology

We adopted the methodology for deploying permanent Dynamic Message Signs (DMS) in a given road traffic network. The objective is to install optimum number of DMS to spread with co-occurrence of Advanced Traveller Information Systems (ATIS). functioning and upkeep price of DMS, and event-interrelated operator price under casual traffic occurrence situations. As real time traffic data, will be delivered by traffic management centers, which will help traffic riders to choose best suited route at that particular time. Real time information can be supplied by traffic management centers via internet connectivity. The DMS system, on the other hand to give travelers information about special events. These signs give warning of current traffic condition situation or congestion updates if any, coincidences, disruption, roadwork regions, weather info, or speed restrictions over a particular stretch of highway segment or mid-blocks section in city areas for efficient and safe maneuvering of traffic

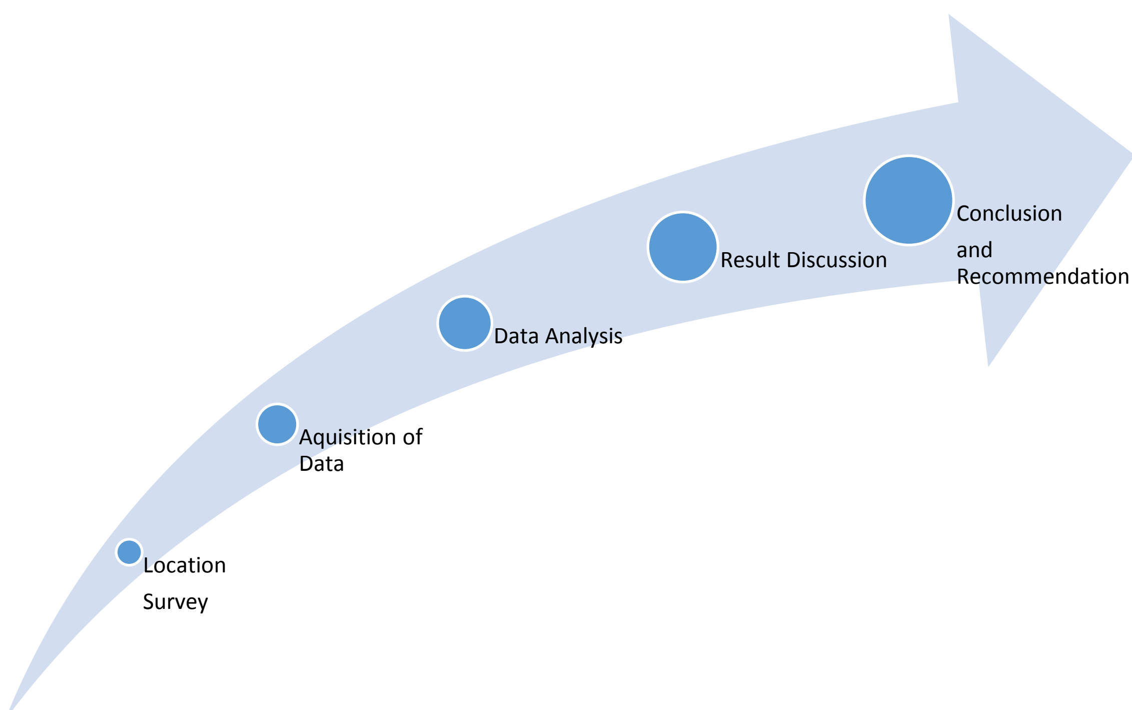


FIGURE 3.1: Research Methodology Process

3.2 Area Taken into Consideration

The most congested and with heavy traffic flow area is to be selected in multiple stretches of Jalandhar city. The main city area having high volume traffic in regular week days and weekends is also viewed. A carried out our study over a complete stretch of 5001 m approximately. The complete stretch of approximately 5 Km is broken down in Six stretches for the purpose of ease in data collection.

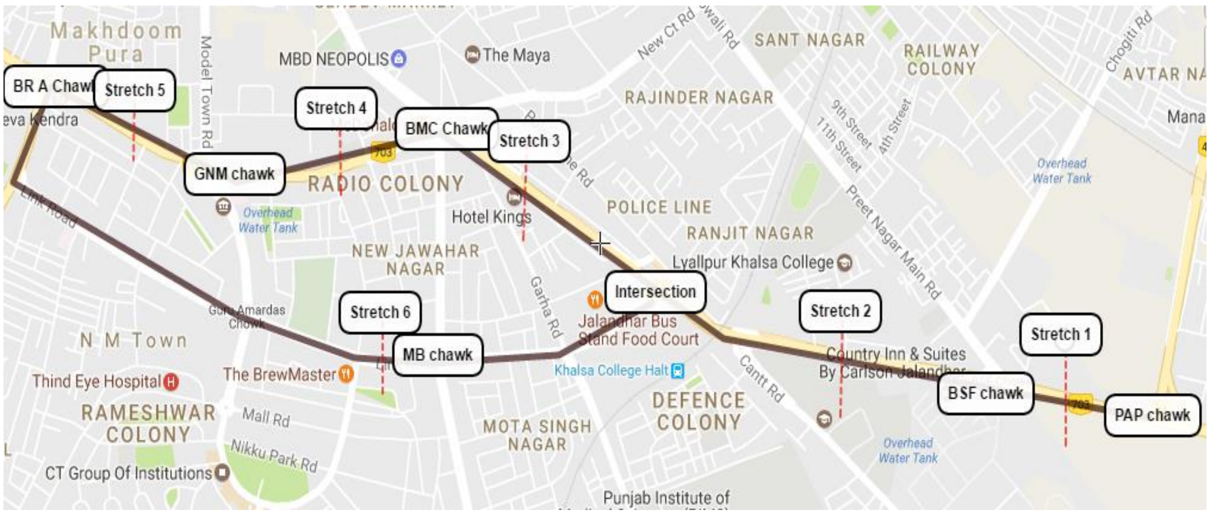


FIGURE 3.2: Area Taken into Consideration

TABLE 3.1: Calculated Distance of 6 Stretches in Meters

Serial No.	**Area Description of Point A**	**Area Description of point B**	**Distance (m)**
Stretch 1	PAP chowk	BSF Chowk	489
Stretch 2	BSF Chowk	Intersection	1007
Stretch 3	Intersection	BMC chowk	396
Stretch 4	BMC chowk	GNM chowk	416
Stretch 5	GNM chowk	BR A chowk	570
Stretch 6	B.R. A. chowk	Intersection	2123 **Total:**5001 m

The length of the total stretch is calculated to be approximate 5 Km.

VOLUME DATA COLLECTION

3.3 Method of Manual Count

In the method, manual count most of the application requires minor trials of data for the certain location. Manual count methods are generally used when the determination and expenditure of automatic equipment are not defensible. Manual count method is essential when the automated device for procedure is not accessible.

Manual counts are characteristically castoff for phases of less than a single day. Standard breaks for manual count was of 20 minutes and then it was calculated on hourly basis.

3.3.1 Methodology Adopted

The volume study was conducted at the mid -section on different stretches

3.3.2 Data Collection

Counting breaks: 20 minutes (Period of short count)
Location of data collection: Jalandhar city
Time period: Six weeks' data on ADT in weekdays and weekends
Observation Data: Vehicular Classified count
Method Used: Manual count Method (Direct Method)
Equipment Used: Record Data Sheet, Stopwatch.

3.4 Observation Tables

1.

TABLE 3.2: Calculated PCU for Stretch 1

Vehicle Classification	Observation in 20 min	Hourly Volume	Vehicle %	PCU	Hourly PCU
Bus (B)	17	58	2.461	3	174
Truck (T)	6	18	0.764	0.75	14
Light Vehicle (LV)	478	1467	62.266	1	1467
Auto Rickshaw (AR)	187	290	12.308	0.5	145
Motorcycle(MC)	201	460	19.527	0.5	230
NMV	36	63	2.674	0.2	13
Total =	925	2356	100	---	2043

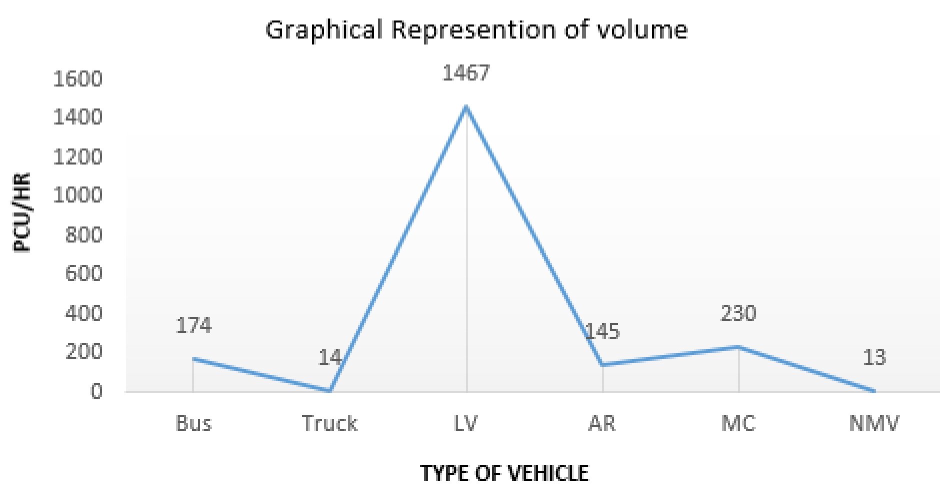


FIGURE 3.3: Graphical Representation of PCU

2.

TABLE 3.3: Calculated PCU for stretch 2

Vehicle Classification	Observation in 20 min	Hourly Volume	Vehicle %	PCU	Hourly PCU
Bus (B)	14	42	2.216	3	126
Truck (T)	3	11	0.609	0.75	9
Light Vehicle (LV)	247	749	41.495	1	749
Auto Rickshaw (AR)	136	446	24.822	0.5	223
Motorcycle(MC)	190	508	28.144	0.5	254
NMV	17	49	2.714	0.2	10
Total =	607	1805	100	---	1371

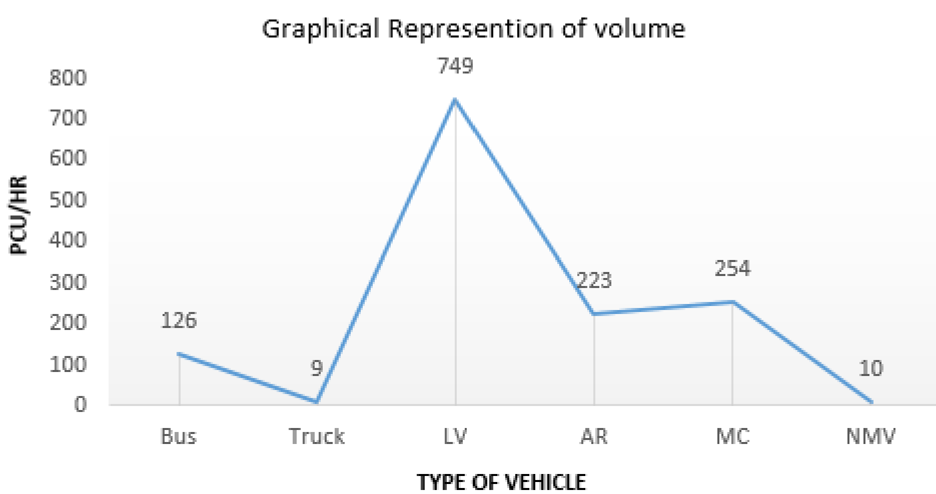


FIGURE 3.4. Graphical Representation of PCU

3.

TABLE 3.4: Calculated PCU for Stretch 3

Vehicle Classification	Observation in 20 min	Hourly Volume	Vehicle %	PCU	Hourly PCU
Bus (B)	19	50	2.696	3	150
Truck (T)	8	23	1.240	0.75	18
Light Vehicle (LV)	396	941	50.755	1	941
Auto Rickshaw (AR)	148	277	14.940	0.5	139
Motorcycle(MC)	248	493	26.591	0.5	247
NMV	38	71	3.778	0.2	15
Total =	857	1854	100	---	1510

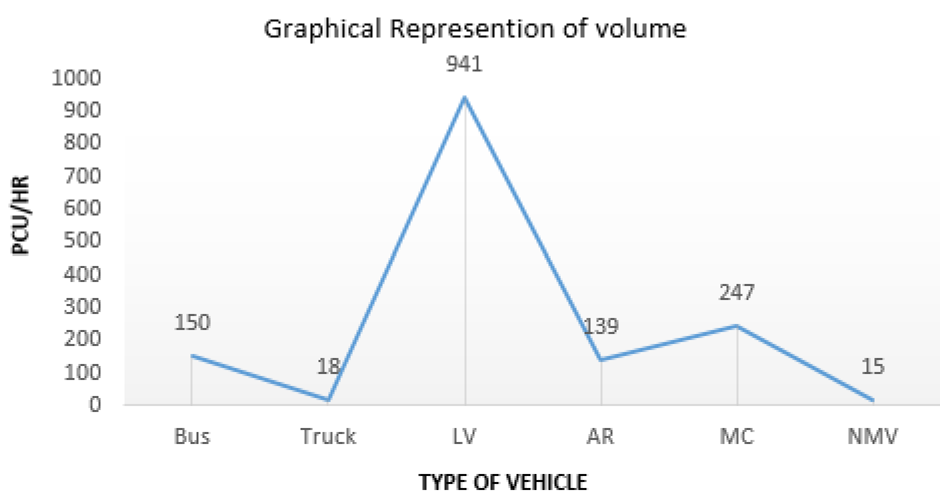


FIGURE 3.5: Graphical Representation of PCU

4.

.

TABLE 3.5: Calculated PCU for Stretch 4

Vehicle Classification	Observation in 20 min	Hourly Volume	Vehicle %	PCU	Hourly PCU
Bus (B)	6	21	0.912	3	63
Truck (T)	4	10	0.434	0.75	8
Light Vehicle (LV)	412	1136	49.369	1	1136
Auto Rickshaw (AR)	159	477	20.730	0.5	239
Motorcycle(MC)	174	518	22.511	0.5	259
NMV	47	139	6.044	0.2	28
Total =	802	2301	100	---	1733

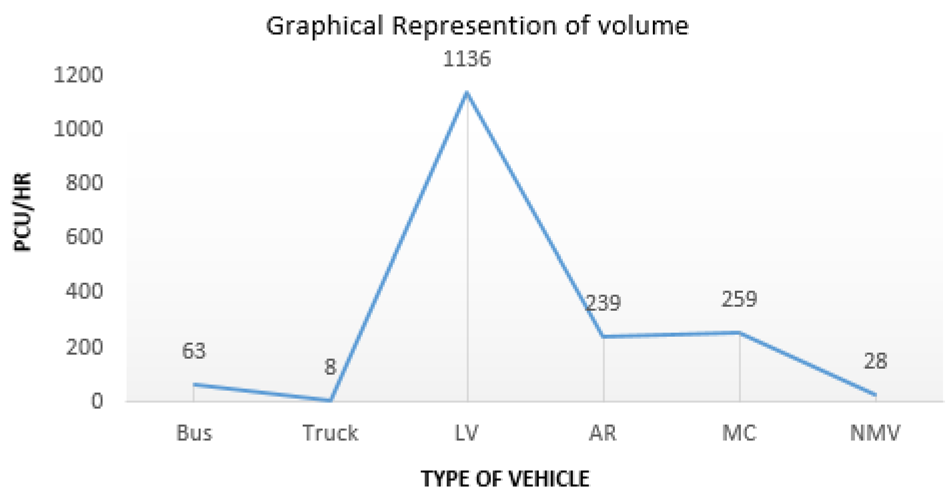


FIGURE 3.6: Graphical Representation of PCU

5.

TABLE 3.6: Calculated PCU for stretch 5

Vehicle Classification	Observation in 20 min	Hourly Volume	Vehicle %	PCU	Hourly PCU
Bus (B)	16	49	2.102	3	147
Truck (T)	9	31	1.329	0.75	24
Light Vehicle (LV)	418	1254	53.796	1	1254
Auto Rickshaw (AR)	132	396	16.988	0.5	198
Motorcycle(MC)	183	541	23.211	0.5	271
NMV	22	60	2.574	0.2	12
Total =	780	2331	100	---	1906

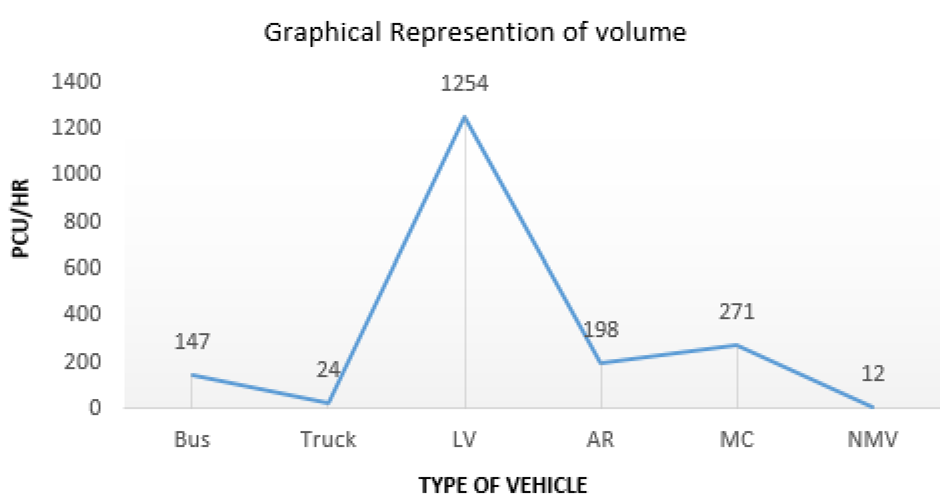


FIGURE 3.7. Graphical Representation of PCU

6.

TABLE 3.7: Calculated PCU for Stretch 6

Vehicle Classification	Observation in 20 min	Hourly Volume	Vehicle %	PCU	Hourly PCU
Bus (B)	15	45	1.822	3	135
Truck (T)	6	18	0.729	0.75	14
Light Vehicle (LV)	393	1179	47.752	1	1179
Auto Rickshaw (AR)	201	603	24.422	0.5	302
Motorcycle(MC)	184	552	22.359	0.5	276
NMV	24	72	2.916	0.2	15
Total =	846	2469	100	---	1921

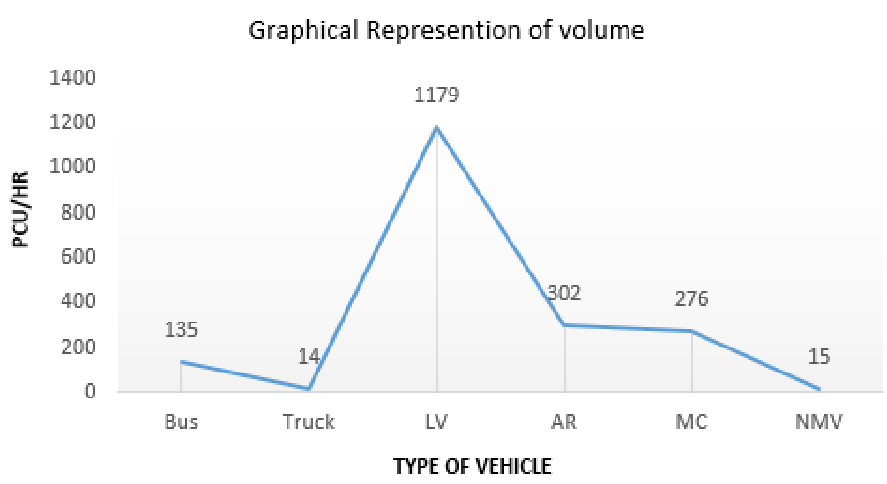


FIGURE 3.8. Graphical Representation of PCU

Average Daily Traffic calculated (ADT) for weekdays on hourly Basis in morning and evening peak hours i.e. 10-11:30 AM and 6:45-8:00 PM

1.

TABLE 3.8: Calculated PCU for Stretch 1

Vehicle Classification	Observation in 20 min	Hourly Volume	Vehicle %	PCU	Hourly PCU
Bus (B)	14	47	1.927	3	141
Truck (T)	9	30	1.230	0.75	23
Light Vehicle (LV)	401	1217	49.917	1	1217
Auto Rickshaw (AR)	204	586	24.036	0.5	293
Motorcycle(MC)	267	490	20.101	0.5	245
NMV	29	68	2.789	0.2	14
Total =	924	2438	100	-	1933

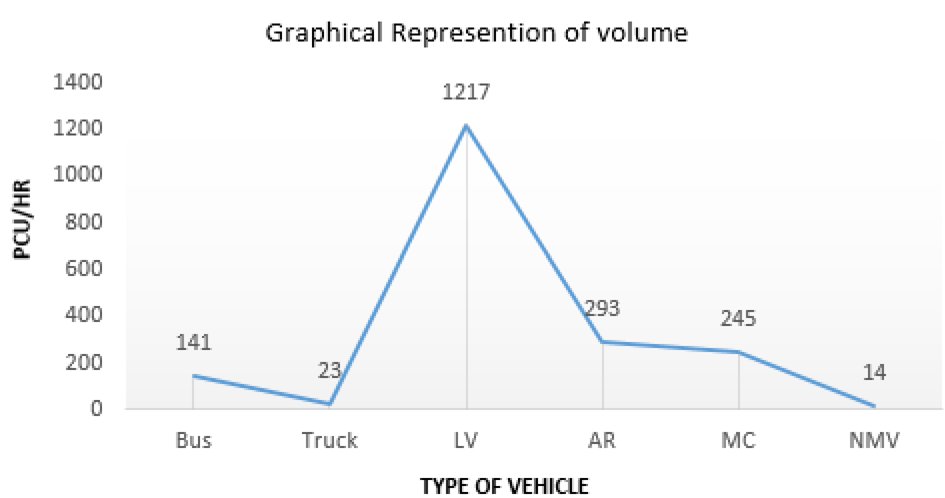


FIGURE 3.9: Graphical Representation of PCU

2.

TABLE 3.9: Calculated PCU for stretch 2

Vehicle Classification	Observation in 20 min	Hourly Volume	Vehicle %	PCU	Hourly PCU
Bus (B)	8	31	1.333	3	93
Truck (T)	6	20	0.860	0.75	15
Light Vehicle (LV)	302	937	40.301	1	937
Auto Rickshaw (AR)	197	595	25.591	0.5	298
Motorcycle(MC)	218	658	28.301	0.5	329
NMV	29	84	3.614	0.2	17
Total =	1367	2325	100	-	1689

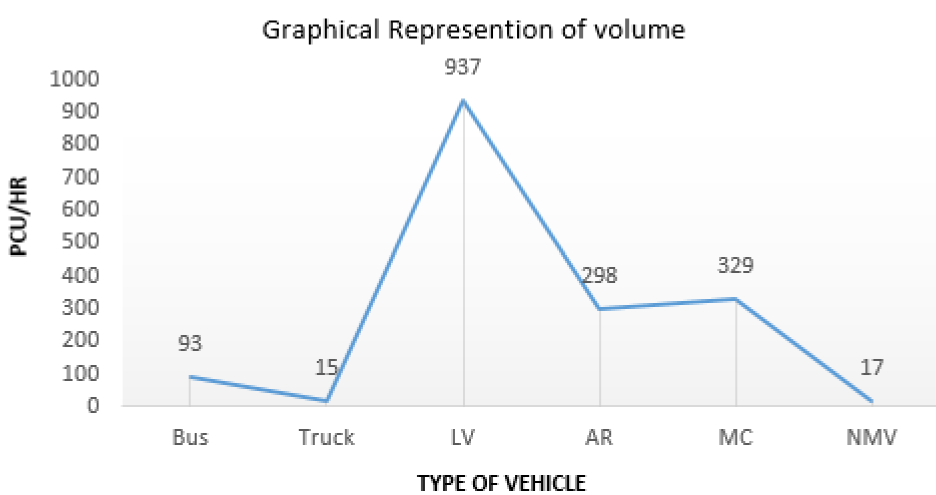


FIGURE 3.10. Graphical Representation of PCU

3.

TABLE 3.10: Calculated PCU for Stretch 3

Vehicle Classification	Observation in 20 min	Hourly Volume	Vehicle %	PCU	Hourly PCU
Bus (B)	23	69	2.631	3	207
Truck (T)	12	36	1.372	0.75	27
Light Vehicle (LV)	364	1092	41.647	1	1092
Auto Rickshaw (AR)	181	543	20.709	0.5	272
Motorcycle(MC)	255	765	29.328	0.5	283
NMV	39	117	4.313	0.2	24
Total =	874	2622	100	-	1905

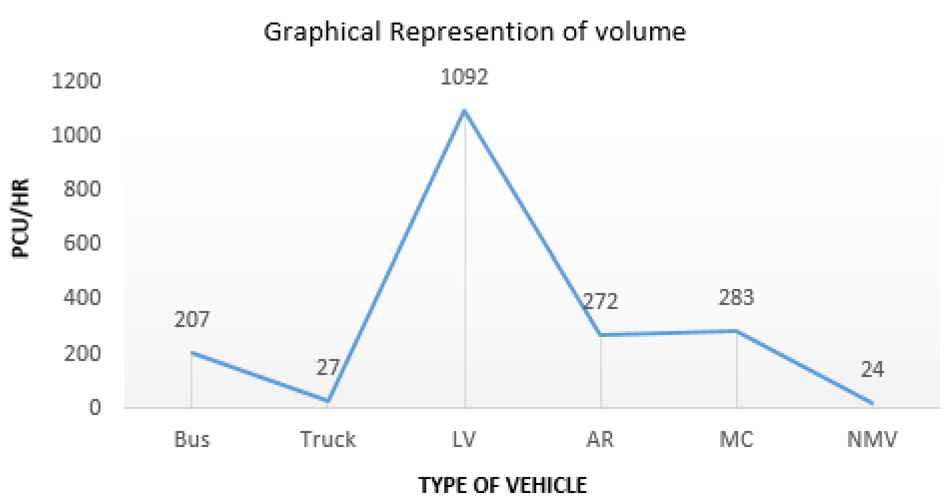


FIGURE 3.11: Graphical Representation of PCU

4.

TABLE 3.11: Calculated PCU for Stretch 4

Vehicle Classification	Observation in 20 min	Hourly Volume	Vehicle %	PCU	Hourly PCU
Bus (B)	6	18	0.746	3	54
Truck (T)	9	27	1.119	0.75	81
Light Vehicle (LV)	390	1170	48.509	1	1170
Auto Rickshaw (AR)	162	486	20.149	0.5	243
Motorcycle(MC)	186	558	23.134	0.5	279
NMV	51	153	6.343	0.2	31
Total =	804	2412	100	-	1858

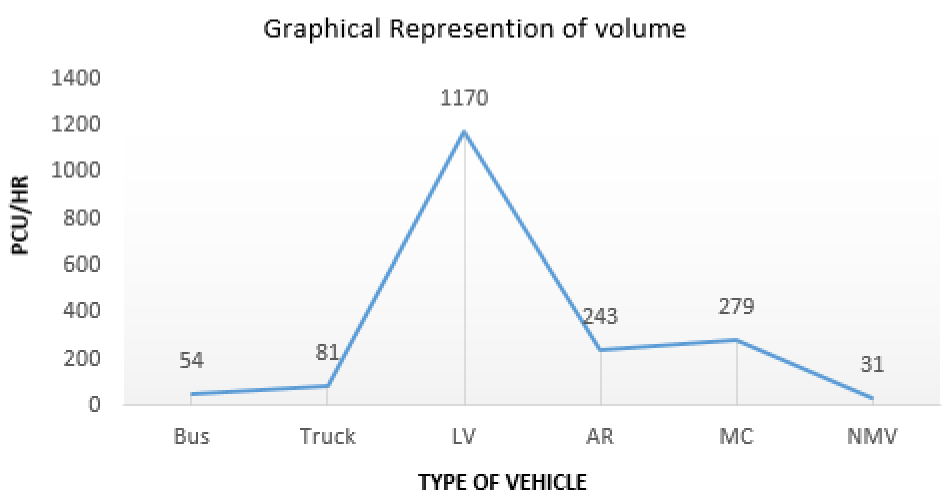


FIGURE 3.12: Graphical Representation of PCU

5.

TABLE 3.12: Calculated PCU for stretch 5

Vehicle Classification	Observation in 20 min	Hourly Volume	Vehicle %	PCU	Hourly PCU
Bus (B)	17	51	1.798	3	153
Truck (T)	13	39	1.375	0.75	30
Light Vehicle (LV)	509	1527	53.866	1	1527
Auto Rickshaw (AR)	167	501	17.671	0.5	251
Motorcycle(MC)	203	609	21.481	0.5	305
NMV	36	108	3.809	0.2	22
Total =	945	2835	100	---	2288

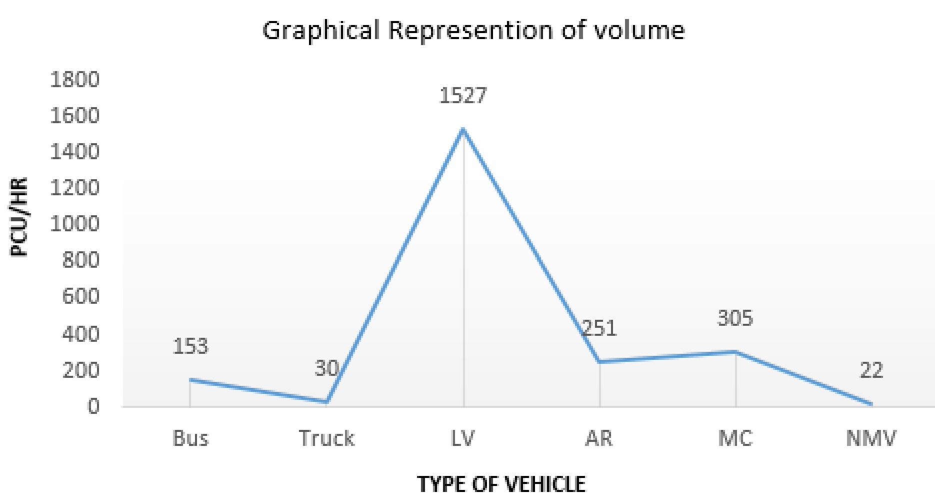


FIGURE 3.13. Graphical Representation of PCU

6.

TABLE 3.13: Calculated PCU for Stretch 6

Vehicle Classification	Observation in 20 min	Hourly Volume	Vehicle %	PCU	Hourly PCU
Bus (B)	14	42	1.513	3	126
Truck (T)	13	39	1.405	0.75	30
Light Vehicle (LV)	407	1221	44	1	1221
Auto Rickshaw (AR)	189	567	20.432	0.5	284
Motorcycle(MC)	246	738	26.594	0.5	369
NMV	56	168	6.056	0.2	34
Total =	925	2775	100	-	2064

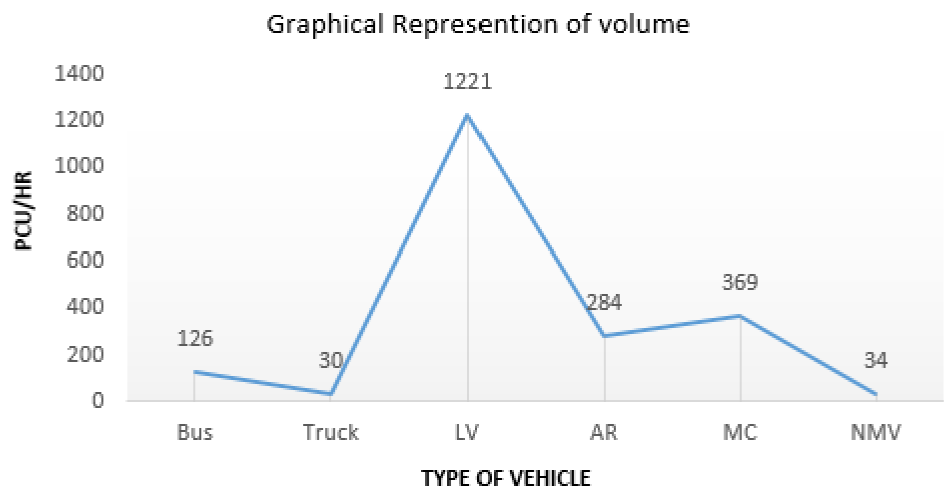


FIGURE 3.14. Graphical Representation of PCU

3.5 Rotary Analysis and Volume Study for Checking its Capacity

Rotaries are basically required to construct when the traffic flow in three or more approaches are relatively same. The entire volume of nearly 3000 vehicles per hour can be taken as the upper limiting circumstance and a volume of about 500 vehicles per hour is the lower limit. Rotaries are suitable when there are additional approaches and no separate lanes are existing for the right turning traffic so making rotary intersection design more compound. The traffic progressions at a rotary are of generally three i.e. Merging, Diverging and Weaving.

Diverging is a traffic process when the vehicles manoeuvring in single direction is detached into different streams as per to their end point or destination. Other side the merging is reverse of the diverging. Merging is referred to the course of linking the traffic approaching from different approaches and moving to a common end point into a one single stream. Whereas Weaving is the joint manoeuvring of both the movements merging and diverging in the same direction

The rotary intersection of B.R. Ambedkar Chowk was studied during morning and evening peak hour when the congestion problem occurs and leads to a slow-moving traffic and delays

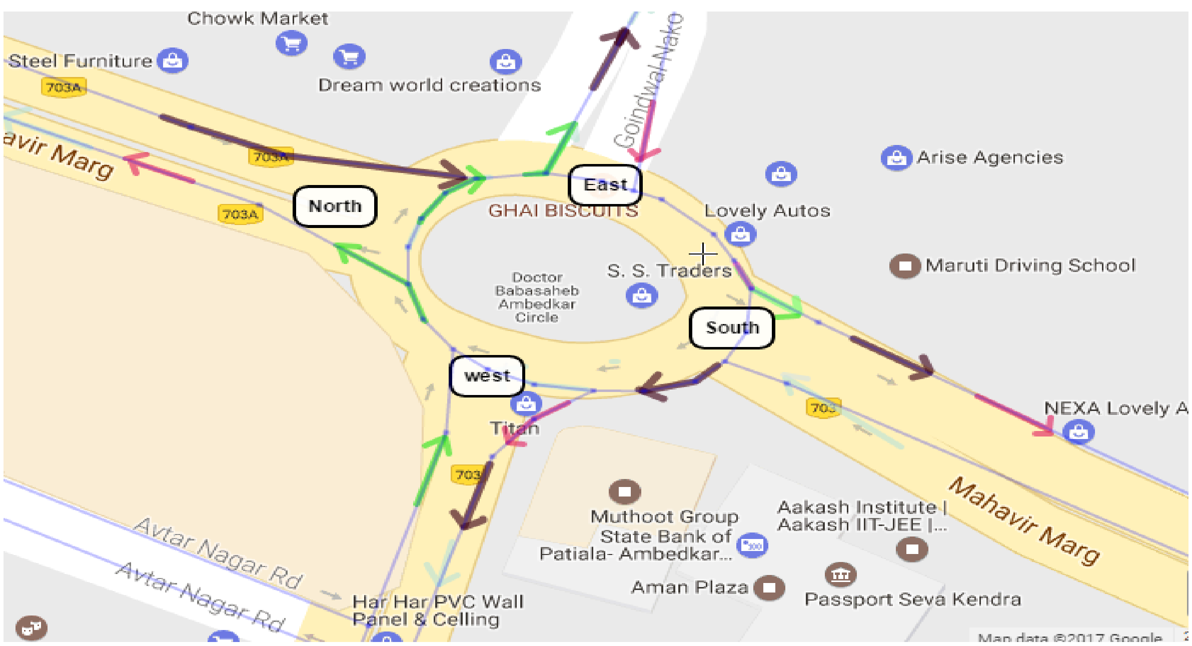


FIGURE 3.15 Vehicles Directional movement at B.R. Ambedkar Chowk

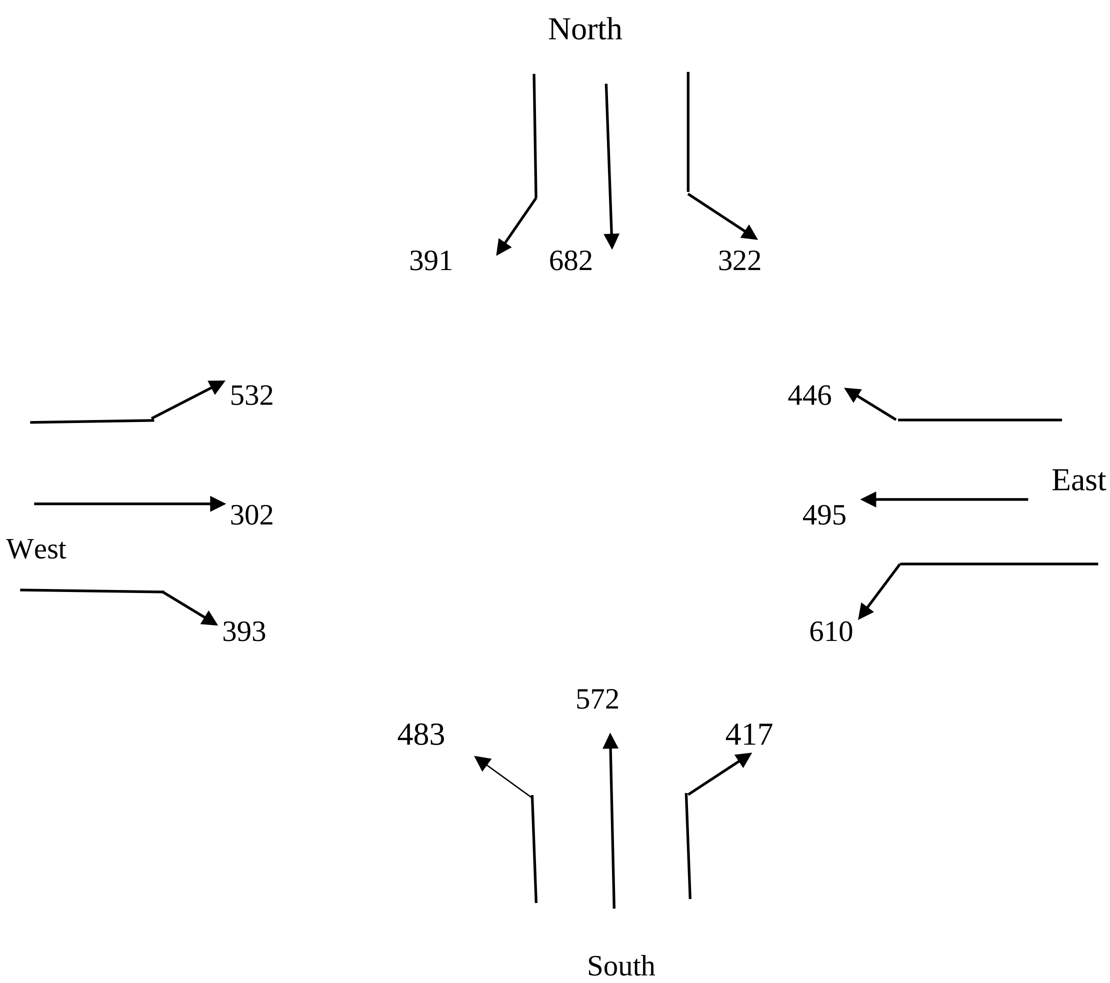
In the above figure the same color arrows show the movement of vehicle in three different approach roads which are left movement, straight movement and right movement. Rotary intersection analysis can be done by collectively calculating the movement of vehicles in only one direction separately.

3.6 Observation Table

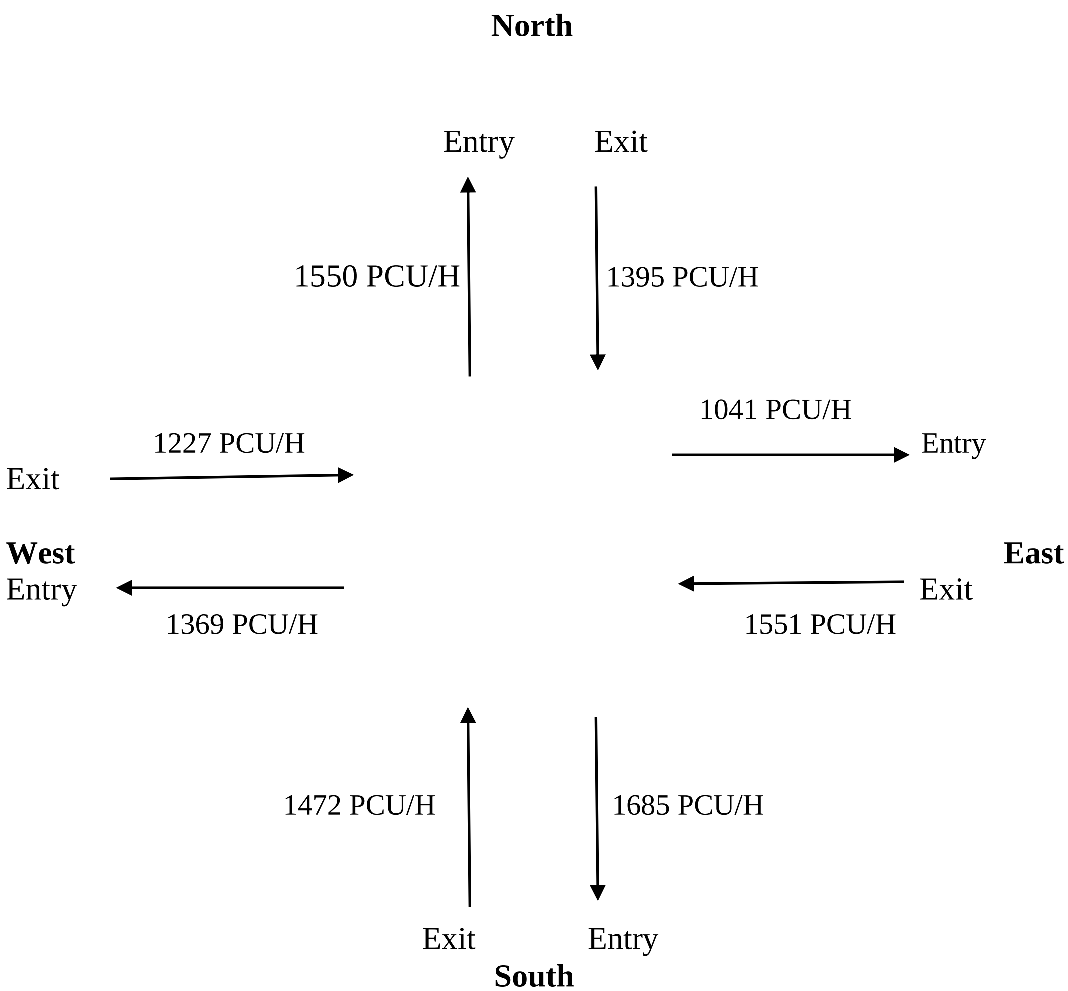
TABLE 3.14: Rotary Analysis Observation

Approach	**Right Turning Vehicle in PCU/h**	**Straight Turning Vehicle in PCU/h**	**Left Turning Vehicle in PCU/h**
North	391	682	322
South	417	572	483
East	446	495	610
West	393	302	532

3.7 Directional Diagram



3.8 Entry and Exit Diagram



3.9 Design Specification for Rotary Analysis as per IRC.

1. The rotary analysis for urban area the design speed is taken for 30 km/h
2. Radius at entry for urban area is taken as 15-20m
3. Radius at exit one and half or twice the radius of entry
4. Radius of central island is 1.33 times of the entry radius
5. Weaving length for urban roads is taken to be 30m.
6. The width of the carriageway at entry and exit is denoted by ‘e’ which depends upon number of lanes, radius of central island.

7. Width of the Weaving section (w) is calculated by $w = \frac{e1 + e2}{2} + 3.5$ where e1 and e2 are the width of entry and exit.
8. Entry angle and exit angle is normally taken to be 60 degree.

9. Capacity of the rotary (Qp) = $\frac{280 * w * [1 + e/w] [1 - p/3]}{1 + w/l}$

Where, Qp, is the practical capacity of the rotary in PCU/HR taken at the weaving section.

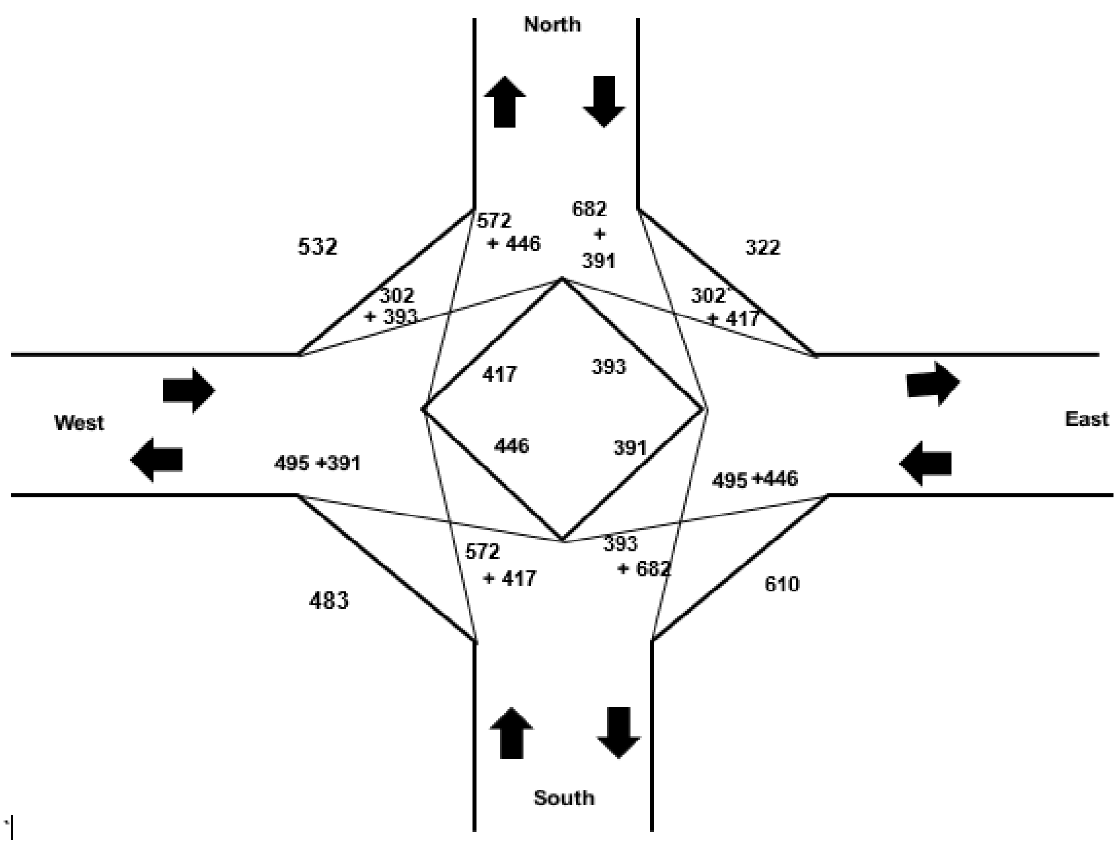
w = Width of the weaving section, that should be in the range of 6m – 18m.

e = Average entry width of the rotary in meters which calculated by taking the average of entry and exit width.

l = length of the weaving section between the length of the channelizing island in meters

p = Proportion of the weaving traffic ratio of the sum of the crossing streams to the total traffic on the congested weaving section.

3.10 Circulation Diagram



3.11 Conditions as Per IRC When Practical Capacity Formula is Valid

1. There should be no standing vehicle in the rotary.
2. The level of the rotary should be at grade and approach gradient should not exceed 1 in 25
3. e/w ratio should be between 0.4 to 1
4. w/l should be between 0.12 to 1
5. Proportion of the weaving traffic ratio of the sum of the crossing streams to the total traffic on the congested weaving section should be between 0.4 to 1
6. Length of the weaving section should be between 18 to 90 meters

3.12 Calculation

Speed = 30 Km/h

Ren = 20 m

Rex = 40 m

Weaving length = 30 m

Radius of the Rotary is 20 meters

With of the carriageway at entry and exit 10 meters

Now, Calculating the width of the weaving section (w)

$$w = \frac{10 + 10}{2} + 3.5$$

$$= 13.5 \text{ m}$$

The entry angle is taken to be 60 degree as per IRC

Now, e/w ratio = e/w = 10/13.5 = 0.74 (Value accepted as per specification)

w/l ratio = 13.5/30 = 0.45, Taking weaving length as 40 m

Now the w/l ratio is coming out to be = 0.33

Calculation of value 'p' = $\frac{682+941}{391+682+941+610} = 0.618$

Now Calculating the practical capacity of the rotary

$$Qp = \frac{280*13.5*(1+0.74)\ (1- 0.618/3)}{1+0.33}$$

$$= 3926.53 \text{ PCU's/HR}$$

The above value shows that the rotary is beyond capacity and required geometric changes need to be done.

3.13 Dynamic Message Sign

Maryland Manual for Uniform Traffic Control Devices (UTCD) defines the Variable Message Signs. A sign that is able of exhibiting more than single message for road users, changeable physically, by using remote control or by using automatic regulator. These signs are referred to the term Dynamic Message Signs in the Nationwide Intelligent Transportation Systems (ITS). Dynamic Message Signs (DMS), also called as Variable Message Signs (VMS) and also Changeable Message Signs (CMS), Which can be used by various transportation bodies and operating departments to give travel information to vehicular traffic on a nearby real-time basis.

3.14 DMS Process and Operations

The information showed on DMSs is collected from a various traffic controlling and surveillance systems and means with video detection technology, magnetic loop detection, automatic automobile identification and toll identifiers and is conveyed to Traffic Management Centers (TMC). Travel time required to be examined which computes the distance covered to calculate the approximate travel times from a located DMS location to desired destination. The destination is generally taken into consideration as a main intersection or main interchange. In most of the authorities, the travel time data is displayed during morning peak travel time and evening peak travel times and the system is usually scheduled to begin and finish certain time of whole day. The Traffic management center operator is accountable for monitoring, controlling, interpretation and choice making for displaying the messages on DMS board.

3.15 DMS Types

Dynamic Message Signs are further divided into two categories i.e. permanent and portable dynamic message sign with respect to its installation. They also can be fitted with beacon and or can also have blinking messages.

3.15.1 Portable vs. Permanent Signs

DMSs generally located (overhead or roadside) or portable. Either immovable location or moveable DMSs are castoff to support any road incident supervision and other useful and informative functions. Fixed DMSs can be positioned above the arterial roads and highways, bridges, tunnels or toll booths. The moveable truck or trailer mounted Dynamic message sign are sometimes forwarded by the highway departments to inform or warn road users of incidents such as accident happening or work zones areas in the areas where permanent Dynamic message sign are not obtainable or nearly adequate to inform drivers to slow down speed and prevent secondary coincidences. Trailer-mounted Dynamic message signs are used to adjust traffic patterns nearby work regions and to control traffic in special events like sporting events, any natural tragedies and other impermanent changes in standard traffic patterns. Most of constructers produce trailers that obey with the National Transportation Communications in use with Intelligent transportation system

3.16 Dynamic Features

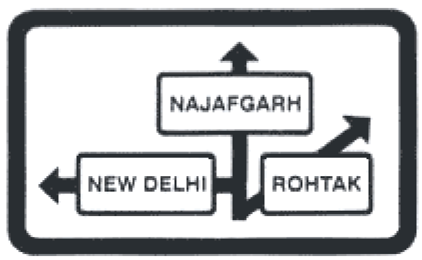
Dynamic message sign can be equipped with blinking beacons, which are usually fitted on top of the message panel board. They are generally yellow in color and would meet the necessities as directed by suitable standards in terms of size and shape. The exhibited messages on Dynamic message sign can be blinking or can also be flashing particularly in the school regions, but meanwhile blinking line messages might have an adversative effect on understanding of messages.

DMSs inform motorists concerning different conditions and provide a real-time information to the traffic, roadway and ecological conditions, location and anticipated duration of happening related to delays, provided alternate routes for a roadway closing, readdressed routes for diverted motorists and passable shoulders in the event of a major event occurrence to bring back the traffic flow safely to normal condition.

TABLE 3.15: Message Classification

Message Grouping	Displayed Messages
Form 1: Danger/Warning	Incidents, Incapacitated Vehicles, Non-recurring Slow- Downs, Roadway Wreckage, Accidental
Form 2: Informative/Public Road	Roadwork Closings, Major & Minor Delays, Congestion Ahead, Travel Time, Other travel
Form 3: Regulatory/ Related Non-Traffic	Work Zone Speeds, Buckle up Seatbelt, Cell Phone Use Regulations, Two-wheeler Awareness, Amber

Warning / Cautionary Sign



Informative Sign

Regulatory Sign

FIGURE 3.16: Traffic Sign Categorization

13.17 Traffic Control Center

The Transportation Management Centre (TMC) is the centre or main control unit of most throughway management systems. It is the information about the roadway system is collected and then deal with, attached with other working and regulating data, created to produce "information", and disseminated to stakeholders such as like media, other concerned agencies, and the traveling community. Traffic management centre staff uses the data to monitor the movement of the freeway and to introduce control tactics that affect variations in the operation of the roadway network. It is also where transportation department and other government bodies can coordinate their replies to traffic conditions and other incidents.

FIGURE: 3.17 Traffic Management Centre (TMC)

The main role of traffic management centres often drives outside the roadway network and the specific accountable agency, functioning as the main technical and official centre to take together the various authorities, modal interests, and other facility providers to emphasis on the public goal of enhancing the performance of the whole surface transportation system. Because of its critical part in the fruitful operation of a roadway management system, it is important that the Traffic management centre must be planned for, designed, custom-made and well maintained to allow workers and other consultants to be able to control and also manage the functional essentials of the roadways management system.

3.18 Operations

The Traffic management centre would obtain the data/information from the ground and the similar would be received and understood for taking further decisions which would be made and the decisions that are made from the centre will be communicated to the end user to act on it to attain the required result.

In direction to allow better understanding of the condition, field experts in the form of Transportation Engineers will also be held in the Traffic management centres to deliver their experts in analysing and interacting with the required output on the field area.

3.19 Traffic Signals

The traffic signal, a stable flow of traffic indication timings, traffic movement data etc. would be established and this real-time data will to be treated instantly to achieve an optimized effect on the chosen road networks. The Traffic management centres will receive the real-time data from the ground and the same will be observed on a screen and then enhanced plan will be created. The plans so produced then will be linked to the native police officers on the field either by the wireless system present in the Traffic management centres or by the controlling team.

3.20 Road Traffic Surveillance cameras

The cameras positioned at selected locations across the city would displaying live images into the TMC. The traffic management team will see at the live feeds approaching in from the ground and then based on certain constraints like bearable queue length, congestion or an accident/event that has happened on the filed would be able to interconnect to the field officers and required action will be initiated. Also, violations happening on the filed can be perceived through the system and recorded for additional use as an evidence.

3.21 Traffic Enforcement Cameras

The enforcement cameras positioned at desired locations across the city in selected area network which would be taping and beaming the violations to the Traffic management centres. The law enforcement team should have to transfer the violations and then handover the data to the automatic enforcement system unit.

3.22 Wireless Communication Network

The decision thus made after the Traffic management centre (TMC) will be communicating to the officer's present on the field and for operating this the wireless devices are available with the Police will be made use of to control the situation.

3.23 Allocation for Installing Dynamic Message Sign

DMS positions are normally established through previous experience with the native traffic problems. Recently scholars have tested with computer programs that can more exactly locate signs. These approaches have not yet been executed by any native traffic management department responding to the inspection, probable locations were chosen and examined. Best locations were chosen so that the long-run expectancy of benefits was fulfilled under stochastically happening incident situations and the main benefit of appropriately locating Dynamic Message sign was the reduction in entire users travel time. In the below figures the red dots representing the out-going traffic from PAP chawk to Jalandhar city whereas blue dots representing the incoming traffic from city to PAP.

FIGURE 3.18 Location for DMS Installation

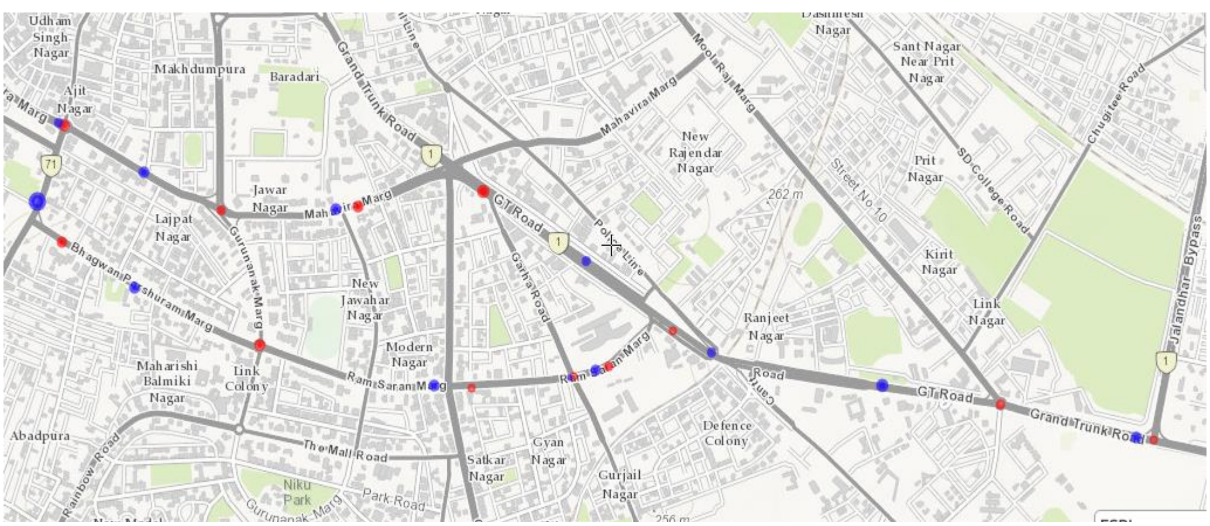


FIGURE 3.19 Location for DMS Installation (Street view)

3.24 Measures Should be Taken Care During DMS Installation

1. Graphic messages are significantly more effective and better than text messages in terms of road uses reaction time and correctness and must be used as much as possible.
2. The color Red is not usually recommended for Dynamic Message sign messages.
3. More Aged driver's performances were expressively improved by using graphic-aided messages.
4. Graphic-aided DMS messages improved message understanding time for non- native or outside English speakers.
5. More study is essential to find out the proper specifications and design rules of such graphical images to be used in DMS messages.
6. The required number of lines on DMS should be set to a minimum.
7. Bilingual signs would only be used when it is unquestionably necessary.
8. If we use the bilingual signs, the different colors or type fonts should be taken care to separate the languages.
9. The adequate number of information units should be correlated to DMS reading time duration than the number of lines that is to be displayed.
10. A blank "off-screen" with small duration may improve information processing when consecutive DMS frames are cast-off.
11. The Right-justified text on DMS should not be used to display.
12. Abbreviations can obstruct understanding of DMS if they are not very regularly known.
13. The Luminance of class L3 is better for symbols on Dynamic Message Sign.
14. Three-diode symbol width leads to well legibility compare to one or two diodes thickness.

3.25 Dynamic Message Sign Cost Analysis

TABLE:3.16 Cost Analysis of Dynamic Message Sign

Unit Cost Component	Unit Cost Module	Description	Cost Type	Reported Units	Capital Cost/Unit in INR	Total Cost in INR
Dynamic Message Sign-Permanent	Dynamic Message Sign	Permanent Dynamic Message Sign, Full Overhead LED panel (21*4 ft.)	Estimated	9	422500	3802500
Dynamic Message Sign-Permanent	Dynamic Message Sign	Permanent Dynamic Message Sign, Half Overhead LED panel (10*4 ft.)	Estimated	14	260000	3640000 **TOTAL** 7442500

TABLE:3.17 Cost Analysis of Dynamic Message Sign Tower

Unit Cost Component	Unit Cost Module	Description	Cost Type	Reported Units	Capital Cost/Unit in INR	Total Cost in INR
Dynamic Message Sign Tower	Dynamic Message Sign Support Structure	Dynamic Message Sign Support Structure, Furnish &Install. Span 51-100 ft.	Estimated	9	136500	1228500
Dynamic Message Sign Tower	Dynamic Message Sign Cantilever Overhead	Dynamic Message Sign Support Structure, Furnish &Install. Span 51-100 ft.	Estimated	14	120250	1683500 **TOTAL** 2912000

The dynamic message sign cost analysis includes the initial cost i.e. the cost of the equipment and after installation in contains the operation cost as well as maintenance cost which includes the power consumption and its upkeep cost. The above cost analysis show the Equipment cost per unit and DMS tower cost per unit. The approximated gross amount of Dynamic Message Sign with its tower cost is coming out to be ₹ 10354500 approximately.

Chapter 4

RESULTS AND DISCUSSION

The results show the heavy commuters traffic flow during the peak hours of morning and evening, which assist for deploying the suitable ITS application This recommend that DMS and ATIS recompense each other in relations of traffic management advantage and that merging ATIS services with DMS distribution yields improved system performance than installing these systems independently. The benefit of the collective DMS and ATIS approach comes from different progressive and three-dimensional traffic distribution that the two strategies mutually produce to alleviate the impact of an occurrence. Existing Geometric design of roads studied to for the deployment of DMS at the desired locations. The location chosen for the installation is selected after multiple visit survey of complete stretch in day and night visibility in order to check and ensure that the dynamic message sign should be visible from desired distance and must be free from any visual hindrance. After detailed survey six stretches total twenty-three dynamic message sign required to be installed which include eleven the DMS boards for outgoing traffic from the PAP chowk to Jalandhar city represented with red dot where twelve DMS board for incoming traffic flow that is coming from the city to PAP chowk as mentioned in above given figure 3.18 and 3.19.

The swiftly growing automobile population in the city, encouraged by the population rise and financial improvement places a critical load on mixed road traffic management in the major cities and townships of the nation. Though India has previously made show interest into intelligent transport systems in establishing traffic, more extensive and immediate addition of advance technology and ideas into normal traffic administration is authoritative. The implementation of location and data based technology in the road traffic circulation.

In study area traffic movement is very heavy during specific durations throughout the day and goes higher in morning and evening peak hours which results into the road users to suffers from overcrowding traffic or congestion with the resulting loss of journey speediness. The effective use of ATIS technologies in presence of Dynamic Message sign might help the road users to overcome from the daily traffic mobility issues, trip delays and guide travelers to take alternate routes to their destination in order to avoid slow maneuvering of traffic flow.

Chapter 5

CONCLUSION AND RECOMMENDATION

The execution of such traffic information and management systems guides users in to choose their mode of transportation and facilitate a more effective use of resources and already existed road network structure. Road safety and congestion consequences can be treated as well because risky locations or situations are notified and extenuated on a real-time basis system.

Real time services for road user's information cover the use of permanent Dynamic message signs (DMS) displaying exhibiting information on traffic for efficient and safe manoeuvring of traffic volume. As because traffic is major problematic issue in Indian cities. The existed road infrastructure makes it challenging to resolve the problem. The is possibility for evaluating previous methodologies in different and thought-provoking traffic condition, which modernize solution and evaluate them empirically in collaboration with both the sectors i.e. public and private. Implication ATIS application with the co-occurrence of Dynamic message sign with benefit to overcome from congestion issues in vehicular traffic.

ATIS service amenability rate in addition with DMS also advances system performance. This recommend that DMS and ATIS recompense each other in relations of traffic management advantage and that merging ATIS services with DMS distribution yields improved system performance than installing these systems independently. The benefit of the collective DMS and ATIS approach comes from different progressive and three-dimensional traffic distribution that the two strategies mutually produce to alleviate the impact of an occurrence. The ATIS info supports users to change route choice or leaving times at the commencement of their trips in response to the event, while DMS guide users to make native en-route route change to dodge n the complex traffic incidents.

Concept of ATIS in Jalandhar city is challenging to implement completely modelled on the current effective ITS of other countries due to basic social, topographical and applied differences between the countries. The prevailing concepts have to be systematically understood in order to change them to acceptable in the Indian road traffic situation. The proposal of an ATIS program with co-occurrence of DMS stands on the following expansions:

- Technology: The progress and execution of advance skills is important for the effective supervision and operation of ATIS in the city. The technologies comprise automated equipment such as wireless sensors, vehicular detector, surveillance cameras, dynamic message sign and communication techniques for the accurate delivery of required information. This automated real time traffic operation possible with the supportive effort among the state Government, academic exploration institutions, technology manufacturer and concerned transportation agency of city.

- Modelling of road traffic – A appropriate comprehension of the traffic circulation system is significant for the successful operation of reliable ATIS system. The standing replicas, established for the western road traffic situations might not be fit for our Indian road traffic and therefore there is a necessity to alter or advance models that can describe the Indian traffic flow in an improved way.

Some of definite actions obligatory to encounter the challenges for implementation of ATIS in Indian cities

- Founding ITS standards which are applicable through the city and rural sectors of India.
- Scheming smart transport that includes the mixed vehicular traffic movement.
- Emerging a complete data information gathering structure.
- Founding of a Traffic Management Centre.
- Set out of an active communication between research academic, manufacturing industries and government bodies concerning transportation department.
- Management setting up guidelines and rules of traffic flow which will be helpful in the implementation of Intelligent Transportation System.

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