U LOOP SYSTEM

STUDENT NAME

1)RAHUL KASHINATH KUNDARIYA
2)DARSHAN ANIL SHIRSATH
3)PRANJAL RAMNATH GODSE
4)SHIVRAJ RAJU JADHAV

GUIDE:-PRAVIN CHAVANKE
CO GUIDE:-GAURAV AHIRE

STUDENT DEPARTMENT OF CIVIL ENGINEERING
GURU GOBIND SINGH POLYTECHNIC, NASHIK

HEAD OF DEPARTMENT :- P G CHAVAN

ABSTRACT

Vehicle is the main constituent of the transportation system. Vehicle is used for convenience and for time saving purpose .Therefore vehicles are increasing day by day in number because of communication social purpose also. Our Nashik city in Maharashtra is vastly growing city among the country as well as world and it is declared as metro city before some years. The present situation bans the BS-3 engines increased sudden traffic. And like kumbhmela sudden increase in traffic in kumbhmela period. So need the management of traffic and supporting the safe driving and to solve the problem oftraffic.

Keyword: **-** Transportation Management, Kumbhmela, Sustainability, BRTS.

CHAPTER 1

1.1. Introduction

INTRODUCTION

In order to facilitate the assessment of present and future traffic demands, for the development of need based infrastructure accurate information and continuous monitoring of traffic by appropriate methods is necessary. Implementing authorities must therefore ensure that sufficient and appropriate data is available to undertake necessary planning, design, construction and maintenance of the country's road network, which is aimed at meeting the prevailing traffic flow, future traffic growth and loading without considerable deterioration in the quality of service. This guideline has therefore been prepared with the main aim being to provide basic information, concept and principles with respect to traffic data collection and analysis. There are various methods of data collection available and used by different organisations/institutions. This guideline, therefore, is only intended to provide guidance in respect of data collection and analysis, and allows for variation in the methodologies adopted by different users, planners, developers, funding authorities, etc. The beneficiaries of this guideline are Roads Department, other Ministries/Departments, local authorities, educationalinstitutions.

Fig.1.1 Dwarka circle on map

Vehicle is the main constituent of the transportation system. Vehicle is used for convenience and for time saving purpose. Therefore vehicles are increasing day byday in number because of communication social purpose also. Our Nashik city in Maharashtra is fastly growing city among the country as well as world and it is declared as metro city before some years. The present situation bans the BS-3 engines increased sudden traffic. And like kumbhmela sudden increase in traffic in kumbhmela period. So need the management of traffic and supporting the safe driving and to solve the problem oftraffic.

In India, the traffic lights for vehicles commonly have three main lights, a red light that means stop, a green light That mean go and yellow that means ready to go. the pedestrians, there have only two lights, a red light and a green light that mean go and stop respectively. Besides reducing the number of accidents, it made the traffic flow smoothly and possibly could save peopletime.

1.2. ProblemStatement

In the Nashik in Maharashtra state various types of vehicle's like four wheeler's, three wheeler's, two wheeler's, cycle's, etc. Nashik has grown city from a population

of 1077236 in 2001 to 15 lakh's in 2011. The current population is approximately 1.48 million Nashik city growth rate are maximum as compare to other so that population effect are traffic so daily traffic are increases.

1.3. Objective

- To control traffic volume atdwarka.
- Planning design and regulation of traffic atdwarka
- Planning and design of new street and flyover atdwarka.
- Established properties and schedule for trafficimprovements.
- To developed transportsystem.
- To control the local traffic at dwarkajunction.

1.4. Scope of Project work

The In order to facilitate the assessment of present and future traffic demands, for the development of need based infrastructure accurate information and continuous monitoring of traffic by appropriate methods is necessary. Implementing authorities must therefore ensure that sufficient and appropriate data is available to undertake necessary planning, design, construction and maintenance of the country’s road network, which is aimed at meeting the prevailing traffic flow, future traffic growth and loading without considerable deterioration in the quality ofservice.

The scope of study was limited to following

There is need to conduct survey on the traffic flow of vehicles on the study area to determine the number of vehicles moving in a given interval of time. The major objective involved preparation of replica of proposed Intelligent Transportation System along with an algorithm suitable for the same f ramework that could be easily implemented on station area and could be replicated on other Streets of Dwarka junction, Nashikcity.

This guideline has therefore been prepared with the main aim being to provide basic information, concept and principles with respect to traffic data collection and analysis. There are various methods of data collection available and used by different organisations/institutions. This guideline, therefore, is only intended to provide

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1.5. ResearchMethodology

Traffic surveys were carried out to establish the traffic flow characteristics, travel pattern, delays on the corridor and user’s willingness to pay toll. The following surveys were conducted at different locations of Nashik at Dwarka circle Following were the main types of traffic surveys carried out by theConsultant.

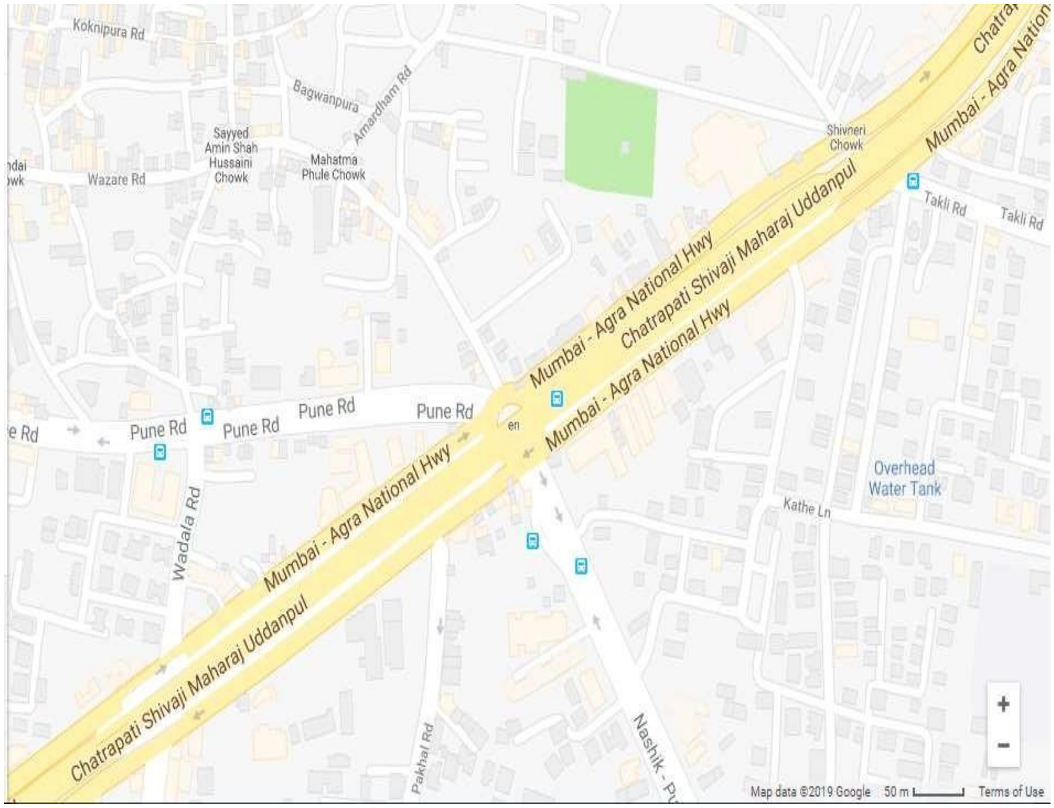

Fig.1.4 Study area location: dwarka circle, Nashik

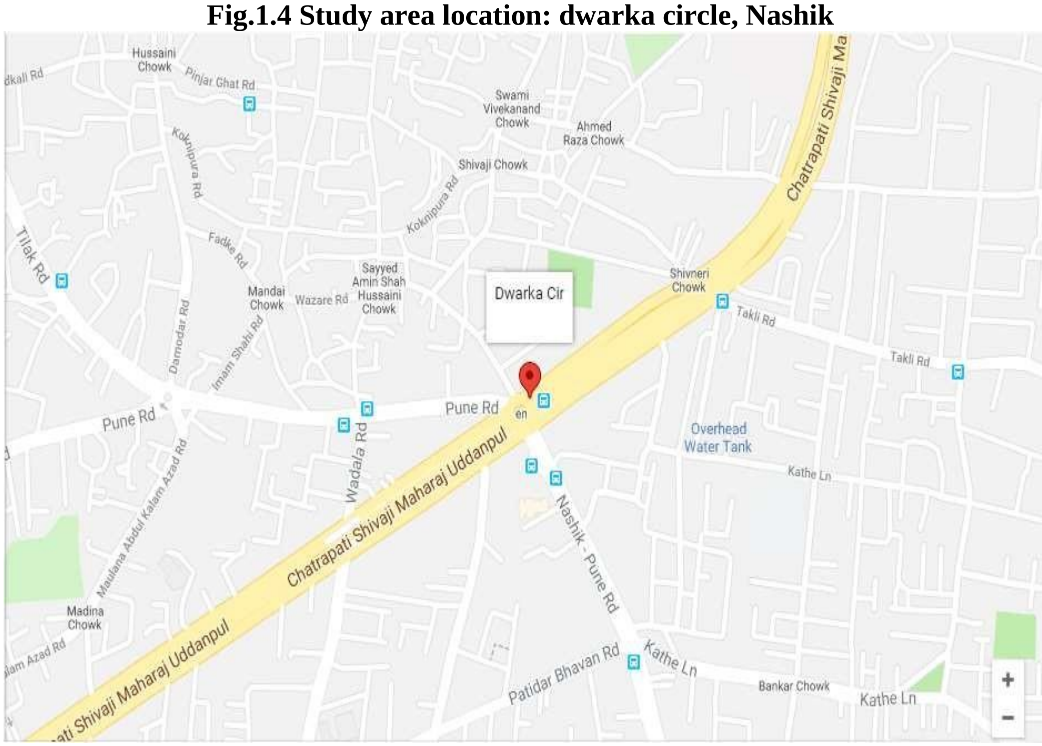

Fig.1.5 dwarka circle Location

The current system of traffic light

The traffic jams are the common problem in most of the city in the world. The one of the main cause of this problem is accident. To find the way to maximize the traffic flow smoothly can reduce the numbers of the accident and can reduce the people time in road. The government has carried out a few rules to overcome this problem. Beside take the punishment to all the traffic offenders, the traffic lights have been made at the location that high risk in accident. However, increasing the numbers traffic lights have contributed some contraissues/problems:

Fig.1.6 Traffic survey at dwarka junction

(a) Traffic light cause the heavy trafficjams

Increasing the number of vehicle in road, have cause the heavy traffic jams. This happened usually at the main junctions commonly at the morning, before office hour and at the evening, after the office hour. The main effect of this matter is increasing time wasting of the people at theroad.

Fig.1.7 Traffic survey at dwarka junction during evening time

(b) No traffic, but the road user still need towait

The traffic light has contributed more wasting time people at road. At the certain junction, sometime there have no traffic. But because the traffic light still red, the road users should wait until the light turn to green. If they run the red light, unfortunately they maybe should pay the fine about RM300.

(c) Emergency car stuck in trafficjam

Usually, during traffic jam, the emergency vehicle, such as ambulance, fire brigade and police will be stuck especially at the traffic light junction. This is because theroaduserswaitingforthetrafficlightturntogreen.Thisisverycriticalproblem becauseitcanpreventtheemergencycasebecomecomplicatedandinvolvinglife.

1.6 ExpectedOutcomes

The proposed approach will reduces the traffic congestion cost and increase the smoothness of flows which ultimately reduces mental stress and environmental effects.

CHAPTER 2

LITERATURE REVIEW

[1] Traffic Scheduling Simulation: The Case of Dhaka City-Md. Sanowar Hossain, Moudud. Ahmad, Md.Asadujjaman,

Increasing rate of vehicles on the road, as well as faulty and manual traffic signaling systems, causes a huge traffic congestion which exacerbates during peak hour and makes city roads standstill. Traffic congestion not only causes mental stress and environmental effects but also snatches a large amount of money from the economy. The economic losses are: firstly, the travel time cost caused by losing working hours because the time spent on traveling has an opportunity cost and secondly, the vehicle operating cost by running vehicle during congestion period. In this paper, these two costs have considered for designing the optimal traffic management system. We have found a solution without installing new infrastructure to the existing road capacity. A simulation analysis was performed using PTV VISSIM software for analyzing different scenarios to design the optimal traffic management system. Dhaka, the capital city of Bangladesh is the most densely populated cities in the world. Traffic congestion in Dhaka city is very problematic. The residents are experienced to undergo physical stress and suffer financial losses in terms of manhours lost the working day. The print and electronic media, as well as social media, cover some news related to traffic congestion. In order to minimize the intensity of the traffic jam in Dhaka city, present and previous government have taken a number of attempts like the construction of roads, highways and over bridges including the special meeting with theagencies.

Dhaka city compelled the rise of increased development without appropriate monitoring within a glimpse of last few decades which resulted in huge urban transport system difficulties. Inadequate transportation system has noticeably affected the physical form and performance of the city. Traffic congestion is now one of the main problems in our daily life. Major causes for this congestion are infrastructure problem, system problem, and human behavior problem etc. Dhaka city's traffic congestion problem has considered an alarming proportion. People are timidto get out

of their houses because the journey from home to office or business place takes away the vital hours that he could devote to his work. Other than being late in the offices, work places or on any scheduled appointments, mental stress, exhaustion and loss of effectivemanhoursareanunavoidablelossoftheresourcesofthewholecountry.

[2] A Multiple Inductive Loop Vehicle Detection System for Heterogeneous and Lane-Less Traffic S. Sheik Mohammed Ali, Boby George, Lelitha Vanajakshi, and JayashankarVenkatraman

This paper presents a novel inductive loop sensor that can detect vehicles under a heterogeneous and less-lanedisciplined traffic and thus can be used to support a trafficcontrol

management system in optimizing the best use of existing roads. The loop sensor proposed in this paper detects large (e.g., bus) as well as small (e.g., bicycle) vehicles occupying any available space in the roadway, which is the main requirement for sensing heterogeneous and lane-less traffic. To accomplish the sensing of large as well as small vehicles, a multiple loop system with a new inductive loop sensor structure is proposed. The proposed sensor structure not only senses and segregates the vehicle type as bicycle, motor cycle, scooter, car, and bus but also enables accurate counting of the number of vehicles even in a mixed traffic flow condition. A prototype of the multiple loop sensing system has been developed and tested. Field tests indicate that the prototype successfully detected all types of vehicles and counted, correctly, the number of each type of vehicles. Thus, the suitability of the proposed sensor system for any type of traffic has beenestablished.

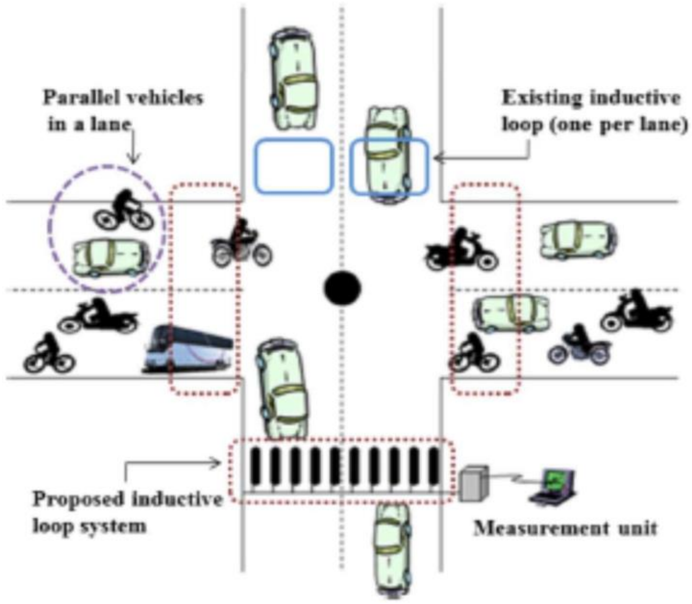

Fig.2.1 Illustration of an inductive loop-based vehicle detection scheme at a junction

[3] A Traffic Control System Using Inductive Loop Detector-Rakesh V.S1, Shaithya.V2,

This paper presents the development of an inductive loop traffic sensor device that can detect the vehicles under heterogeneous and lane less traffic conditions. The existing available loop systems are only suitable for lane based and homogeneous traffic conditions. The developed multiple loop system has a new loop structure that can detect large vehicles like bus, truck etc., as well as small vehicles like bicycle, motorcycle etc., occupying any available space in the road. The proposed system detects, segregates the vehicle type and also counts the number of vehicle even in mixed traffic flowcondition.

[4]A Survey on Urban Traffic Management System Using Wireless Sensor Networks
Kapileswar Nellore and Gerhard P. Hancke,

Nowadays, the number of vehicles has increased exponentially, but the bedrockcapacitiesofroadsandtransportationsystemshavenotdevelopedinan equivalent way to efficiently cope with the number of vehicles traveling on them. Due to this, road jamming and traffic correlated pollution have increased with the associated adverse societal and financial effect on different markets worldwide. A static control system may block emergency vehicles due to traffic jams. Wireless Sensor networks (WSNs) have gained increasing attention in traffic detection and avoiding road congestion. WSNs are very trendy due to their faster transfer of information, easy installation, less maintenance, compactness and for being less expensive compared to other network options. There has been significant research on Traffic Management Systems using WSNs to avoid congestion, ensure priority for emergency vehicles and cut the Average Waiting Time (AWT) of vehicles at intersections. In recent decades, researchers have started to monitor real-time traffic using WSNs, RFIDs, ZigBee, VANETs, Bluetooth devices, cameras and infrared signals. This paper presents a survey of current urban traffic management schemes for priority-based signalling, and reducing congestion and the AWT of vehicles. The main objective of this survey is to provide a taxonomy of different traffic management schemes used for avoiding congestion. Existing urban traffic management schemes for the avoidance of congestion and providing priority to emergency vehicles are considered and set the foundation for furtherresearch.

Fig.2.2 WSN-based Urban Traffic Management System.

3.1 Methodology

CHAPTER 3 METHODOLOGY

The study will follows following steps.

1. The first step is to study and identification of study arealocation.
2. Various literature research paper, book, thesis report, related to study are referred.
3. Study area profile give existing situation of dwarka junction w.r.t study corridor.
4. Portion of road is selected to suggest U-loop traffic designsystem.
5. A proposed replica of the system has beenprepared.

3.2 DataCollection

- Road Width=100ft
- No. of Vehicles= 1000vehicle/Hour
- TrafficArea
  - Nasik Pune ExpressHighway
  - Dwarka
  - Peak TrafficPeriod
  - 1000vehicle/Hour

3.3 Check List For SignalDesign

Step 1 - Identify Traffic Flow Volumes

Traffic flow volumes are identified, including turning movements.

Step 2 - Identify Junction Layout, Lane Geometry and Site Characteristics

The junction layout, including lane geometry and site characteristics are identified. It may be necessary, if revealed in Step 4 or Step 7, to modify the layout to cater for turning movements, pedestrians or to enhance capacity and/or safety.

Step 3 - Identify Signal Phasing and Method of Control

The method of control to be used for analysis is identified.

Step 4 - Check Turning Movements and Pedestrians

Adequate provision for turning movements and pedestrians should be checked. It may be identified at this stage that the assumed method of control would need adjustment before continuing. Adequate allowance in calculations for parallel pedestrian minimum green crossing times should bemade.

Step 5 - Estimate Saturation Flows

The saturation flows for various approaches/movements are identified. In critical cases the saturation flows for important movements may have to be measured onsite.

Step 6 - Compute Y, L,

The lost times, flow factors and sum of the critical flow factors are computed.

Step 7 - Compute Reserve Capacity

The maximum reserve capacity of the intersection is then calculated as a measure of operating performance. If this is not satisfactory, then it may be necessary to go back to Step 2, modify data and layouts and recalculate. A minimum provision of 25% reserve capacity should be provided wherever possible for new junctions. A lower standard may be adopted for existing junctions where further improvement is restricted by spacelimitations.

Step 8 - Compute Co, Cm, and Cp.

The optimum, minimum and practical cycle times for operating the junction are then computed for further analysis, ifnecessary.

Step 9 - Select C

It is then necessary to select a cycle time for operating the intersection. Sometimes, for reasons of linking, the selected cycle time may be different from the values calculated in the previous step.

Step 10 - Compute Green Times, Degree of Saturation

The green times of the various phases are then computed. Degree of saturation may be computed as well if detailed analysis of signal operation is required. If good linking to other junctions requires a cycle time that results in very low degree of saturation and a very high reserve capacity, consideration should be given to double cycling this junction within the linking group, i.e. running it at half the linking cycle time.

Step 11 - Determine Offset and Other Controller Settings

Offset and other controller settings such as minimum green, maximum green, etc. are then finalized. Offsets for linking signals may be prepared with the aid of time-distance diagrams. Or programs such asTRANSYT.

Step 12 - Prepare Documentation

For record purposes, drawings showing the junction layout, method of control, stage/phage diagram, traffic flow, etc. need to be prepared and maintained. Standard symbols should be used wherever applicable.

Classified Traffic Volume Count Survey:

The 7 day (6 hour, both directions) classified traffic volume count survey was carried out at three locations as mentioned in Table. Data collected from site was analyzed to study daily variation and hourly variation of traffic, peak hour share, traffic composition and Average Daily Traffic (ADT) at all the survey locations. The various vehicle types having different sizes and characteristics were converted into equivalent passenger car units. The Passenger Car Unit (PCU) factors recommended by Indian Road Congress in "Guidelines for Capacity of Roads in Rural Areas (IRC :64-1990) were used. Data collected from site was analyzed to study daily variation and hourly variation of traffic, peak hour share, traffic composition and Average Daily Traffic (ADT) at all the survey locations. The various types having different sizes and characteristics were converted into equivalent passenger car units. The Passenger Car Unit (PCU) factors recommended by Indian Road Congress in "Guidelines for Capacity of Roads in Rural Areas" (IRC: 64-1990) were used. (Table 1.2, Values of passenger car units Factor for Different vehiclecategories).

Table1.1: Values of Passenger Car Unit Factor for different vehicle categories

Vehicle Types	PCU FACTOR
Two Wheeler	0.50
Auto Rickshaw	0.75
Car/ Jeep	1.00
Van / Tempo (passenger)	1.00
Mini Bus	1.50
Standard Bus	3.00
LCV	2.00
2xAxle Rigid Truck	3.00
3xAxle Rigid Truck	3.00
MAV	4.50
Tractor	3.00
Tractor Trailer	4.50
Animal / Hand Drawn Vehicle	4.00
Cycle	0.50

Average Daily Traffic (ADT):

Daily traffic volume by vehicle type and direction were added separately and averaged to determine the Average Daily Traffic. Average Daily Traffic (ADT), at all the three locations, by vehicle type is presented in Table 10, Average Daily Traffic (ADT) on the Project Corridor.

Fig.1.7 Traffic survey at dwarka junction at afternoon time

Table1.2: The average of 7 day's Traffic Volume Count.

Vehicle Types	Dwarka
Two Wheeler	16113
Auto Rickshaw	11521
Car/ Jeep	16249
Van/Tempo (passenger)	9025
Mini Bus	6045
Standard Bus	9005
2xAxle Rigid Truck	8721
3xAxle Rigid Truck	9525
Tractor	4515

Fig.1.7 Traffic survey at dwarka junction

Table1.3 Total passenger car unit factor

Vehicle Types	Dwarka
Two Wheeler	8056.5
Auto Rickshaw	8640
Car/ Jeep	16249
Van / Tempo (passenger)	9025
Mini Bus	9067.5
Standard Bus	27015
2xAxle Rigid Truck	26163
3xAxle Rigid Truck	28575
Tractor	13545
Tractor Trailer	8415

Animal / Hand Drawn Vehicle	3780
Cycle	3260.5
Total Vehicles	161792

The main purposes of traffic survey are traffic monitoring, traffic control and management, traffic enforcement, traffic forecasting, model calibration and validating etc.

CHAPTER 4

DESIGN OF TRAFFIC SIGNAL

The conflicts arising from movements of traffic in different directions is solved by time sharing of the principle. The advantage of traffic signal includes an orderly movement of traffic, an increased capacity of the intersection and requires only simple geometric design. However the disadvantages of the signalized intersection are it affects larger stopped delays, and the design requires complex considerations. Although the overall delay may be lesser than a rotary for a high volume, a user is more concerned about the stoppeddelay

4.1 Definitions andnotations

A number of definitions and notations need to be understood in signal design. They are discussedbelow:

- **Cycle:**Asignalcycleisonecompleterotationthroughalloftheindications provided.
- **Cycle length:** Cycle length is the time in seconds that it takes a signal to complete one full cycle of indications. It indicates the time intervalbetween the starting of green for one approach till the next time the green starts. It is denoted byC.
- **Interval:**Thusitindicatesthechangefromonestagetoanother.Therearetwo types of intervals -change interval and clearance interval. Change interval is also called the yellow time indicates the interval between the green and red signal indications for an approach. Clearance interval is also called all red is included after each yellow interval indicating a period during which all signal

facesshowredandisusedforclearingofthevehiclesintheintersection.

- **Greeninterval:**Itisthegreenindicationforaparticularmovementorsetof movements and is denoted by Gi. This is the actual duration the green light of a traffic signal is turned on.
- **Red interval:** It is the red indication for a particular movement or set of movementsandisdenotedbyRi.Thisistheactualdurationtheredlightofa traffic signal is turned on.
- Phase: A phase is the green interval plus thechange and clearance intervals that follow it. Thus, during green interval, non conflicting movements are assigned into each phase. It allows a set of movements to flow and safely halt the flow before the phase of another set of movementsstart.

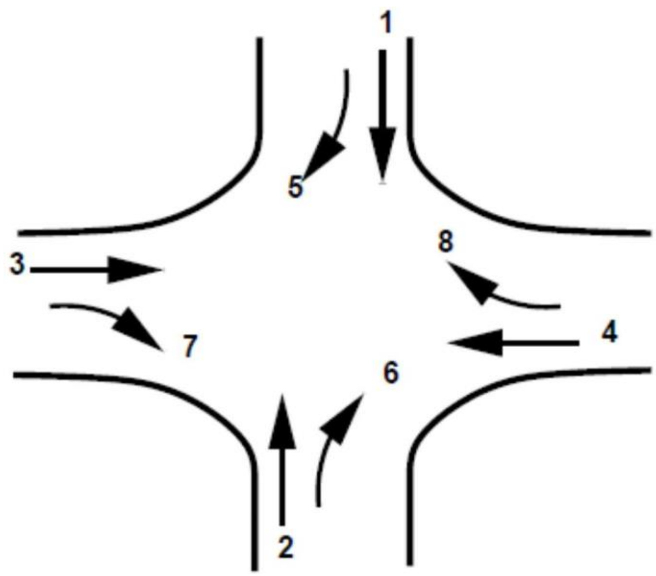

Figure 4.1: Four legged intersection

- **Lost time:** It indicates the time during which the intersection is noteffectively utilized for any movement. For example, when the signal for an approach turns from red to green, the driver of the vehicle which is in the front of the queue will take some time to perceive the signal (usually called as reaction time) and some time will be lost here before hemoves.

The signal design procedure involves six major steps. They include the

(1) Phasedesign,
(2) Determination of amber time and clearancetime,
(3) Determination of cyclelength,
(4) Apportioning of greentime,
(5) Pedestrian crossing requirements,and
(6) The performance evaluation of the abovedesign.

(1) Phase Design

The objective of phase design is to separate the conflicting movements in an intersection into various phases, so that movements in a phase should have no conflicts. If all the movements are to be separated with no conflicts, then a large number of phases are required. In such a situation, the objective is to design phases with minimum conflicts or with less severeconflicts.

There is no precise methodology for the design of phases. This is often guided by the geometry of the intersection; flow pattern especially the turning movements, the relative magnitudes of flow. Therefore, a trial and error procedure is often adopted. However, phase design is very important because it affects the further design steps. Further, it is easier to change the cycle time and green time when flow pattern changes, where as a drastic change in the flow pattern may cause considerable confusion to the drivers. To illustrate various phase plan options, consider a four leggedintersectionwiththroughtrafficandrightturns.Leftturnisignored.Seefigure 4.1. The first issue is to decide how many phases are required. It is possible to have two, three, four or even more number ofphases.

- **Two phasesignals**

Two phase system is usually adopted if through traffic is significant compared to the turning movements. For example in figure 4.2, non-conflicting through traffic 3 and 4 are grouped in a single phase and non-conflicting through traffic 1 and 2 are grouped in the second phase. However, in the first phase flow 7 and 8 offer some conflicts and are called permitted right turns. Needless to say that such phasing is possible only if the turning

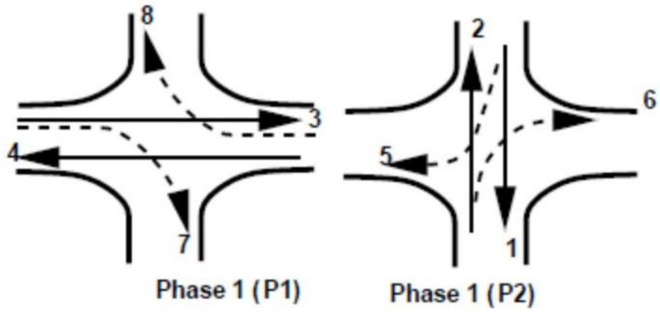

Fig.4.2: Two phase signal

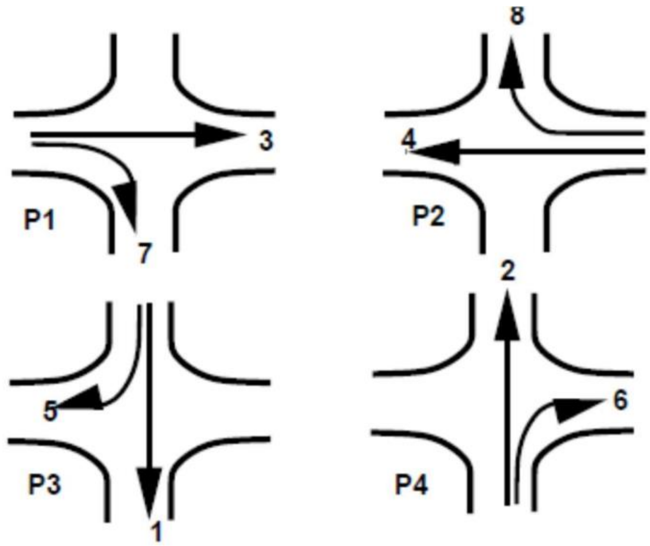

Fig.4.3: One way of providing four phase signals

Movements are relatively low. On the other hand, if the turning movements are significant, then a four phase system is usually adopted.

- **Four phase signals**

There are at least three possible phasing options. For example, figure 41:3 shows the most simple and trivial phase plan. Where, flow from each approach is put into a single phase avoiding all conflicts. This type of phase plan is ideally suited in urban areas where the turning movements are comparable with through movements and when through traffic and turning traffic need to share same lane. This phase plan could be very inefficient when turning movements are relativelylow.

Figure 4.4 shows a second possible phase plan option where opposing through traffic are put into same phase. The non-conflicting right turn flows 7 and 8 are grouped into a third phase. Similarly flows 5 and 6 are grouped into fourth phase. This type of phasing is very efficient when the intersection geometry permits to have at least one lane for each movement, and the through traffic volume is significantly high. Figure4.5showsyetanotherphaseplan.However,thisisrarelyusedinpractice.

There are five phase signals, six phase signals etc. They are normally provided if the intersection control is adaptive, that is, the signal phases and timing adapt to the real time traffic conditions.

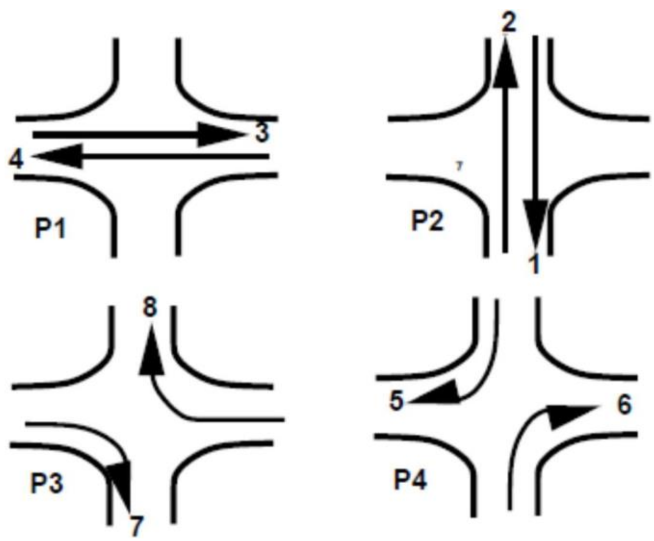

Fig.4.4: Second possible way of providing a four phase signal

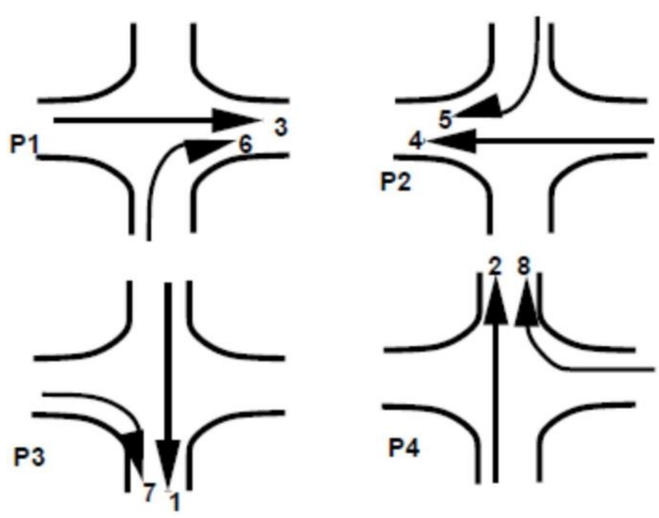

Fig.4.5: Third possible way of providing a four-phase signal

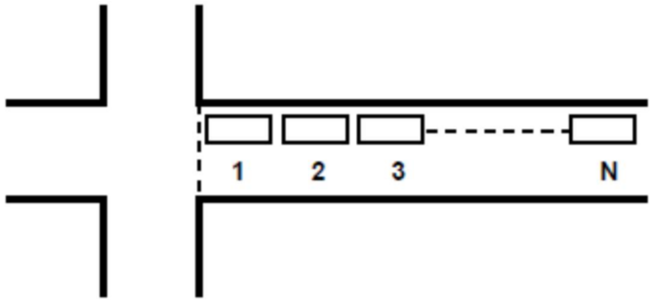

Fig.4.6: Group of vehicles at a signalized intersection waiting for green signal

4.4 Intervaldesign

There are two intervals, namely the change interval and clearance interval, normally provided in a traffic signal.

The change interval or yellow time is provided after green time for movement. The purpose is to warn a driver approaching the intersection during the end of a green time about the coming of a red signal. They normally have a value of 3 to 6 seconds.

The design consideration is that a driver approaching the intersection with design speed should be able to stop at the stop line of the intersection before the start of red time. Institute of transportation engineers (ITE) has recommended a methodology for computing the appropriate length of change interval which is asfollows:

$$\square = \square + \frac{\square 85}{2\square + 19{:}6\square} \qquad 4.1$$

Where, y is the length of yellow interval in seconds,

t is the reaction time of thedriver,

v85 is the 85th percentile speed of approaching vehicles in m/s,

a is the deceleration rate of vehicles inm=s^2,

g is the grade of approach expressed as a decimal.

Change interval can also be approximately computed as

$$\square = \frac{SSD}{v}$$

Where, SSD is the stopping sight distance and

v is the speed of the vehicle.

The clearance interval is provided after yellow interval and as mentioned earlier, it is used to clear of the vehicles in the intersection. Clearance interval is optional in a signal design. It depends on the geometry of the intersection. If the intersection is small, then there is no need of clearance interval whereas for very large intersections, it may beprovided.

4.5 Cycletime

Cycle time is the time taken by a signal to complete one full cycle of iterations. i.e. one complete rotation through all signal indications. It is denoted by C. The way in which the vehicles depart from an intersection when the green signal is initiated will be discussed now. Figure 41:6 illustrates a group of N vehicles at a signalized intersection, waiting for the green signal. As the signal is initiated, the time interval between two vehicles, referred as headway, crossing the curb line is noted. The first headway is the time interval between the initiation of the green signal and the instant vehicle crossing the curb line. The second headway is the time interval between the first and the second vehicle crossing the curb line. Successive headways are then plotted as in figure 4.7. The first headway will be relatively longer since it includes the reaction time of the driver and the time necessary to accelerate. The second headway will be comparatively lower because the second driver can overlap his/her reaction time with that of the first driver's. After few vehicles, the headway will become constant. This constant headway which characterizes all headways beginning with the fourth or fifth vehicle, is defined as the saturation headway, and is denoted as h. This is the headway that can be achieved by astable

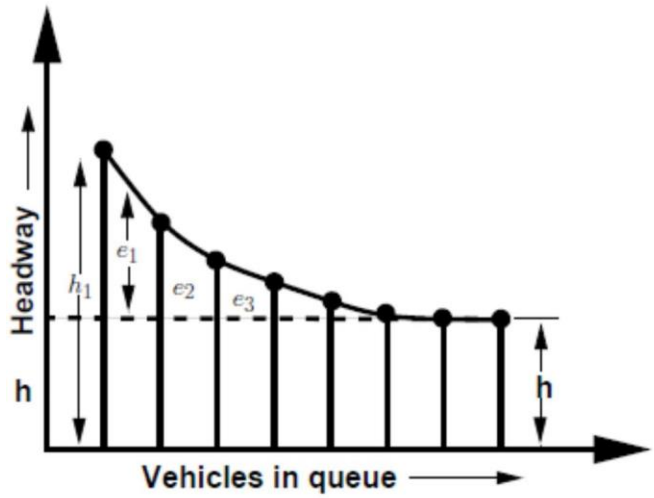

Fig.4.7: Headways departing signal

Moving platoon of vehicles passing through a green indication. If every vehicles require h seconds of green time, and if the signal were always green, then s vehicles/per hour would pass the intersection.Therefore,

$$s = \frac{3600}{h} \qquad 4.2$$

Where s is the saturation flow rate in vehicles per hour of green time per lane, h is the saturation headway inseconds.

Vehicles per hour of green time per lane. As noted earlier, the headway will be more than h particularly for the first few vehicles. The difference between the actual headway and h for the i^{th} vehicle and is denoted as e_i shown in fig.4.7. These differences for the first few vehicles can be added to get start up lost time, l1 which is givenby,

$$l_1=\sum_{i=1}^{n} e_i \qquad 4.3$$

The green time required to clear N vehicles can be found out as,

$$T = l_1+h.N \qquad (4.4)$$

where T is the time required to clear

N vehicles through signal,

l_1 is the start-up lost time, and

h is the saturation headway in seconds.

4.5.1 Effective greentime

Effective green time is the actual time available for the vehicles to cross the intersection. It is the sum of actual green time (Gi) plus the yellow minus the applicable lost times. This lost time is the sum of start-up lost time (l1) and clearance lost time (l2) denoted as t_L. Thus effective green time can be writtenas,

$$g_i = G_i + Y_i - t_L \qquad (4.5)$$

4.5.2 Lanecapacity

The ratio of effective green time to the cycle length (gi/C) is defined as green ratio. We know that saturation flow rate is the number of vehicles that can be moved in one lane in one hour assuming the signal to be greenalways.

Then the capacity of a lane can be computed as,

$$c_i = s_i \frac{g_i}{C} \qquad \textbf{4.6}$$

Where, ci is the capacity of lane in vehicle per hour, si is the saturation flow rate in vehicle per hour per lane, C is the cycle time in seconds.

4.5.3 Critical lane

During any green signal phase, several lanes on one or more approaches are permitted to move. One of these will have the most intense traffic. Thus it requires more time than any other lane moving at the same time. If sufficient time is allocated for this lane, then all other lanes will also be well accommodated. There will be one and only one critical lane in each signal phase. The volume of this critical lane is called critical lane volume.

41.6 Determination of cycle length

The cycle length or cycle time is the time taken for complete indication of signals in a cycle. Fixing the cycle length is one of the crucial steps involved in signal design.

If t_{Li} is the start-up lost time for a phase i, then the total start-up lost time per cycle,

$$L = \sum_{i=1}^{N} t_{Li} \qquad 4.3$$

Where, N is the number of phases. If start-up lost time is same for all phases, then the total start-up lost time is $L = Nt_L$.

If C is the cycle length in seconds, then the number of cycles per hour = 3600C

The total lost time per hour is the number of cycles per hour times the lost time per cycle and is = 3600 C:L Substituting as $L = Nt_L$, total lost time per hour can be written as = 3600:N:tl C The total effective green time Tg available for the movement in a hour will be one hour minus the total lost time in an hour.Therefore,

$$T_g = 3600 - \frac{3600.N.t_L}{C} \qquad 4.7$$

$$=3600[1 - \frac{N.t_L}{C}] \qquad 4.8$$

Let the total number of critical lane volume that can be accommodated per hour is given by Vc, then Vc = Tg/h Substituting for Tg, from equation 4.9 and si from the maximum sum of critical lane volumes that can be accommodated within the hour is givenby,

$$=Tg/h \qquad (4.10)$$

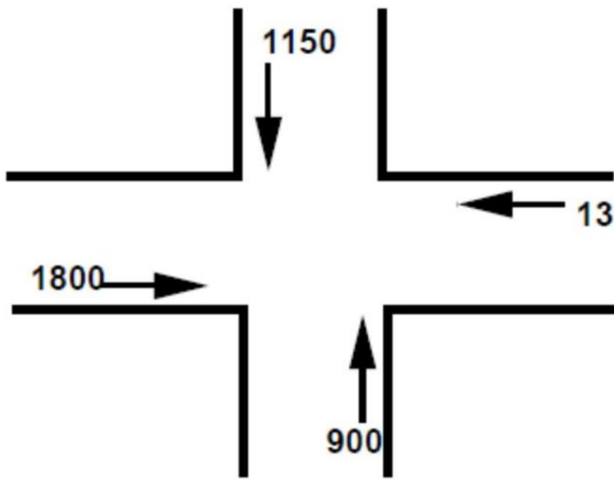

Fig.4.8: Traffic flow in the intersection

$$\square\square = \frac{3600}{h}[1- \frac{\square.\square\square}{\square}] \qquad 4.11$$

$$=\square\square[1-\frac{\square.\square\square}{\square}] \qquad 4.12$$

Therefore

$$\square = \frac{\square.\square\square}{1-\square\square/\square} \qquad 4.13$$

The expression for C can be obtained by rewriting the above equation. The above equation is based on the assumption that there will be uniform flow of traffic in an hour. To account for the variation of volume in an hour, a factor called peak hour factor, (PHF) which is the ratio of hourly volume to the maximum flow rate, is introduced. Another ratio called v/c ratio indicating the quality of service is also included in the equation. Incorporating these two factors in the equation for cycle length, the final expression willbe,

$$\square = \frac{\square.\square\square}{1-\frac{\square\square}{\square\square x PHF x v/c}} \qquad 4.15$$

Highway capacity manual (HCM) has given an equation for determining the cycle length which is a slight modification of the above equation. Accordingly, cycle time C is givenby,

$$\square = \frac{\square.\square.\square\square}{\square\square-(\square/\square)\square} \qquad 4.16$$

Where, N is the number of phases,

L is the lost time perphase,

(Vs)i is the ratio of volume to saturation flow for phase i, XC is the quality factor called critical V C ratio where, V is the volume andC is the capacity.

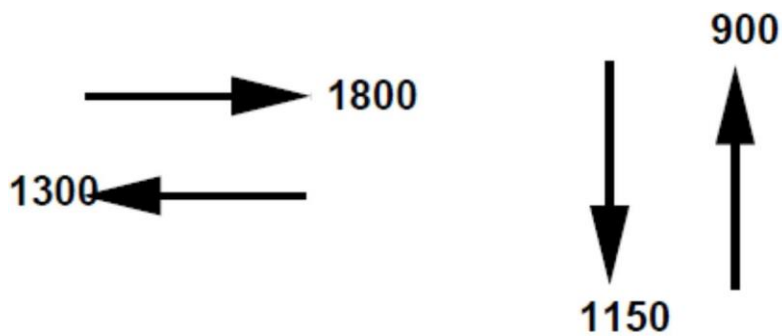

Fig.4.9: One way of providing phases

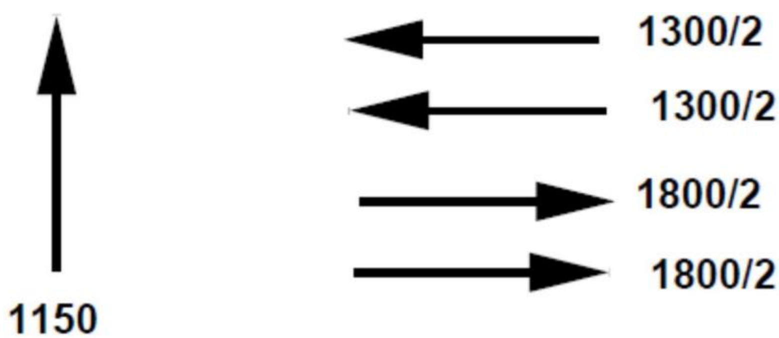

Fig4.10: second way of providing phases

- If we assign two phases as shown below figure 4.9, then the critical volume for the first phase which is the maximum of the flows in that phase = 1150vph. Similarly critical volume for the second phase = 1800 vph. Therefore, total critical volume for the two signal phases = 1150+1800 = 2950 vph.
- Saturationflowratefortheintersectioncanbefoundoutfromtheequationas si = 3600/2:3 = 1565.2 vph. This means, that the intersection can handle only 1565.2 vph. However, the critical volume is 2950 vph . Hence the critical lane volume should be reduced and one simple option is to split the major traffic into two lanes. So the resulting phase plan is as shown in figure(4.10).

Here we are dividing the lanes in East-West direction into two, thecritical

volume in the first phase is 1150 vph and in the second phase it is 900 vph. The total critical volume for the signal phases is 2050 vph which is again greater than the saturation flow rate and hence we have to again reduce the critical lane volumes.

- Assigning three lanes in East-West direction, as shown in figure 4.11, the criticalvolumeinthefirstphaseis575vphandthatofthesecondphaseis600

  vph, so that the total critical lane volume = 575+600 =1175 vph which is lesser than 1565.2 vph.

- Now the cycle time for the signal phases can be computed fromequation,

$$\square = \frac{2 \text{ x } 3}{1 - \frac{1175}{1556.2}} = 24 \square\square\square.$$

Fig.4.11 U-Loop design

CHAPTER

5 ADVANTAGES AND LIMITATIONS

5.1 Advantages

- Provide for orderly movement oftraffic;
- Increase traffic-handling capacity of anintersection;
- Reduce frequency and severity of certain types of crashes, especially right- anglecollisions;
- Provide for continuous movement of traffic at a definite speed along a given route;

Obtained values of each signal phase

1) Red Time = 12Sec
2) Amber Time = 4Sec
3) Green Time = 17Sec

5.2 Limitations

- **Increase in Rear-EndCollisions**

When it comes to accidents, there are strong advantages and disadvantages to traffic signals. Traffic signals can reduce certain types of car accidents, most commonly broadside collisions. One of the primary disadvantages of traffic signals is that they lead to an increase in rear-end vehicle collisions. Rear-end vehicle collisions occur more frequently when a driver abruptly stops at a yellow or red light, causing a distracted driver behind him to ram into the rear of his car. Rear-end collisions aren't typically as severe as broadside collisions, so this trade-off can be seen as worth it. However, in an intersection where broadside accidents are not a concern, installing traffic lights can mean an increase in accidents at the intersection. Traffic engineers do a risk-benefit analysis as part of determining whether to install a traffic light. Engineers must weigh both the advantages and disadvantages of traffic signals. In many instances, it is still worth installing a traffic signal despite a slight increase in rear-end vehiclecollisions.

- **Excessive TrafficDelays**

While they do help manage the flow of vehicular traffic, one of the other disadvantages of traffic signals is that they can cause traffic delay. Waiting for a traffic light to turn green or waiting for a car in a turn lane to safely cross an intersection can result in long wait periods. Excessive delays can translate to wasted fuel, air pollution and costs to motorists. These are often hidden costs that aren't always apparent to drivers.

- **Aggressive, ImpatientDriving**

Partially as a result of excessive delay and partially as a result of unwarranted or improperly functioning traffic signals, drivers can get unnecessarily impatient and aggressive when driving. When that happens, more red lights may be run, more traffic laws are broken and drivers may veer off onto neighborhood streets. Aggressive driving can mean increased accidents, congestion, and air and noise pollution. These are just some of the many disadvantages of not following traffic rules or getting frustrated by trafficsignals.

- **Cost of TrafficSignals**

Cost is too high to implement and maintenance of traffic signals.

Application

CHAPTER 6 APPLICATION

- We can implement this system in pune/Mumbai or any other cities where traffic congestion is mainproblem/issue.
- Near hospitals/schools etc.

CHAPTER 7

CONCLUSION

After a detailed study of Nashik city it is found that for sustainable development of city, Nashik needs integrated transportation management plan. With the aim of promoting sustainable transport in Nashik, it is necessary for the transportation point of view to regulate the heavy traffic smoothly by the way to facilitate compact, pedestrian friendly development along the city's planned hence we have design U-Loop traffic design to improve transportation and to minimize accidents. Nashik has a good potential to develop as a smartcity.

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