Design of Signals at Srinagar Chowk

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Abstract: From the beginning of history, human sensitivity has revealed an urge for mobility leading to a measure of Society's progress. The history of this mobility or transport is the history of civilization. For any country to develop with right momentum modern and efficient Transport as a basic infrastructure is a must. It has been seen throughout the history of any nation that a proper, extensive and efficient Road Transport has played a major role. ‘Transporters’ perform one of the most important activities, at every stage of advanced civilization. Where roads are considered as veins and arteries of a nation, passenger and goods transported are likened to blood in circulation. Passenger Road Transport Service (PRTS) is an essential connected to the economic development. Transport is the essential convenience with which people not just connect but progress. Throughout history, people's progress has been sustained on the convenience, speed and safety of the modes of transport. Road transport occupies a primary place in to-day’s world as it provides a reach unparallel by any other contemporary mode of transport.

Keywords: SIGNALS, TRIAL CYCLE METHOD, APPROXIMATE METHOD, WEBSTER’S METHOD, IRC METHOD

INTRODUCTION

The Spectacular growth in the number of vehicles on the road has created a major social problem- the loss of lives through road accidents. The growth of road traffic in India is at a very rapid pace due to industrial growth and socio-economic changes in the society. As a result of the steep growth of the motor vehicles, the traffic on the road has been increasing both in terms of volume and intensity. Automobiles have become an essential part of human society for both its day to day functioning and growth. This has resulted in the problem of congestion and casualties on the roads, particularly at road intersections. Urban roads should be designed to be safe and to permit the free flow of traffic at reasonable speed. Their traffic capacity should be balanced against the traffic requirement of the existing and proposed development. This will necessitate the planning of the urban road network as a whole and will involve forecasting future traffic volume and appropriate controls of parking, Land development for increasing the capacities of roadways and road intersections to ensure that the network will continue to function efficiently. The solution to the problem of congestion requires coordination and optimization of traffic regulation measures and in many instances redesigning of the road to make it safe and to permit the free flow of traffic at required speed.

India has experienced a tremendous increase in the total number of registered motor vehicles. The total number of registered motor vehicles increased from about 0.3 million as on 31st March, 1951 to about 142 million as on 31st March, 2016. The total registered vehicles in the country grew at a Compound Annual Growth Rate (CAGR) of 9.9% between 2005 and 2016.

OBJECTIVE OF STUDY

The main objectives of the study are as follows:
1. To quantify the traffic problems on this section and identify the necessary actions to improve those traffic problems.
2. To conduct necessary traffic studies on the selected stretches of the road in order to know existing traffic conditions.
3. To appreciate movement that can be achieved by applying Transportation System Management actions.
4. To suggest some effective measures to prevent traffic problems on Road in future.
5. To be used for the analysis of traffic patterns and trends.
6. Turning movement study is used in the design of intersection.
7. Pedestrian volume study is used for planning pedestrian signal.

The main aim of the study is to bring out major causes or congestion on the road and suggest their remedies.

TRAFFIC VOLUME STUDY

Traffic volume studies are conducted to obtain accurate information about the number and movement of vehicles within a specific area or location of study. Traffic volume of flow is the number of movements or vehicles or pedestrian at a particular point during certain period of time (hour, day, month, and year). The commonly used units for traffic volume studies are vehicles per day or passenger car unit per hour (PCU/hour). A complete traffic volume study may include classified volume study by recording volume of various types of traffic, the distribution by direction and turning movement per unit time.

Purpose of Study
1. If the past traffic volume is known then it is easy to forecast the future traffic, which will be further helpful in deciding priority and importance of the roads.
2. Traffic volume study is used in planning, traffic operation, and control of existing facilities and for planning the designing of new facilities.
3. Traffic volume study is used in analyzing of traffic patterns and trends.
4. Traffic volume study is helpful in computing present demand for service by a street or a highway.
5. The pedestrian traffic volume study is used for planning sidewalks, cross walks and pedestrian signals.
6. The turning movement study is useful in design of intersections, in planning signal timing, channelization and other control devices.

1.8.4 Methods of Traffic Count
A number of methods are used for traffic volume counts. These are listed below:
   1) Manual method
   2) Combination of manual and mechanical method
   3) Automatic Devices
   4) Moving Observer method
   5) Photographic method

   Since classified volumes as well as turning movements of the traffic are needed at the intersections under study manual method has been used for the present study and is explained below:

1.9.9 Design of Signal Timing Scheme
The most important part of the signalized intersection design is the design of the signal timing scheme, which includes the decisions about the number of phases, time allocated to each phase, amber period and any special features such as exclusive turning phase or pedestrian phase.

   Information will be required on traffic volume and pedestrian and tuning movements of traffic for each peak period and on the estimated rate of growth. It is also necessary to find out the speeds of the vehicles on the approaches. Speed should be observed on each approach 50m away from the intersection.

   Since the present study deals with flexed signals design or signal timing scheme which is being given here will be discussed for fixed time signal following aspects:
      1. Phasing.
      2. Amber Period.
      3. Intergreen Period.

1. Phasing
For controlling the traffic at intersection the conflicts between streams of vehicles are time separated. The selection and arrangement of simultaneous flows of movement is known as 'PHASING' A phase is that part of a signal cycle i.e. green for every approach concurrently offering right-of-way. The number of phases will depend on number of roads entering the junction and the amount of tuning traffic.

2. Amber Period
When green period ends, there is a time required for vehicle away from the stop line to stop. The vehicles which have already entered the junction require time so that they can cross the areas of conflicts. This time is provided by display amber colour and is termed as clearance period.

   In calculation of amber period two criteria’s are employed namely:
      1. Stopping Time.
      2. Clearance Time.

   When distance for breaking purposes exceeds the width of intersection, thus stopping time becomes more than the clearance time. In urban areas, yellow period of 3 seconds is taken in most of locations. But in mixed traffic conditions it may be as high as 8 seconds.

3. Intergreen Period
The time from the end of green period of the phase losing right-of-way to the beginning of green period of the phase gaining right-of-way is called Intergreen period. Maximum Intergreen period is normally 4 seconds. It includes amber period plus any other red period between the two green periods.

1.9.10 Determination of Optimum Cycle Length and Green Time
Numerous methods are used for estimating the optimum cycle length and green time for each phase. Some of the approaches to optimizing traffic signal timing are outlined below:
   1. Trial Cycle Method.
   2. Approximate Method.
   3. Webster’s Method.
   4. IRC Method.
2.2 LITERATURE ON TRAFFIC SURVEY

Ankit N Mahidadiya et al (2016) reviewed the Global Scenario on Estimation of Passenger Car Unit. In India, traffic condition is mixed. It cannot be consider all vehicle type as same. As they have different interfere on road traffic. Passenger Car Equivalent (PCE) or Passenger car unit (PCU) is thus a metric used to assess traffic-flow rate on a highway. Passenger Car Unit (PCU) is the metric used to convert heterogenic traffic in to homogenous traffic. In India traffic pattern is heterogeneous, it is necessary to convert heterogeneous traffic to homogenous traffic while designing any signalized intersection. PCU Value is dynamic in Nature. PCU value is depends upon current road traffic condition. These PCU values (devised in developed countries) are not suitable for Indian heterogeneous traffic conditions this paper reviews the estimation carried out to find PCU value worldwide

B.Sudharshan Reddy et al (2016) designed the signal for T-intersection by using Webster’s method in nandyal town, Kurnool district of Andhra Pradesh. Traffic volume studies are to be made to determine the number, movement and classification of vehicles at the given location. These data is used identify normal flow of the road; determine the influence of heavy vehicles or pedestrians on vehicular traffic volume. The length of the sampling period depends on the type of count being taken. According to manual count with 15-minute intervals could be used to obtain the traffic volume data. The collected data is converted into PCU units. Webster’s method is a rational approach for signal design. The design is simple and is totally based on formulae’s laid down by Webster. In this method, the total cycle of the signal is determined which forms a total least delay occurring at signal.

Ishant Sharma (2015) studied on the automatic traffic signal system for Chandigarh. The increasing number of vehicles on our road intersections has given rise to the problems like road accidents, congestions, conflicts and bottlenecks. These problems can now only be solved by providing an efficient traffic control at intersections and that can be achieved by provision of automated volume based traffic signal system at intersections for continuous and efficient movement of vehicles through the intersection Chandigarh – the city beautiful – though a modern and well planned city is also facing the same traffic problems. Here, the present traffic signals are based on the static feed of time without considering the actual available traffic. This leads to a situation where vehicles wait unnecessarily in one of the lanes while the traffic flow is not up to the considerable amount in the other lane. This paper provides the feasibility of replacing existing traffic signals with a system to monitor the traffic flow automatically in traffic signals where sensors are fixed in which the time feed is made dynamic and automatic by processing the live detections. The paper deals with the feasibility of provision of inductive loop detection based traffic signals in place of existing pretimed traffic signals by comparing their performance, suitability and economics. In present study, firstly, Traffic field studies are to be made to determine the number, movement and classification of vehicles from vehicle to vehicle and similarly the time headway of individual vehicles in the queue. In this study, the average value of speed and time headway is taken.

Suhas Vijay Patilet al (2015) studied the development of passenger car units (PCU). In this study an attempt is made to find out Passenger Car Unit (PCU) value for Nal Stop. Passenger Car Unit (PCU) value of each class of vehicle is very important for any mixed traffic flow studies. These may be concerning traffic flow parameters, capacity, signal design, parking lots etc. The work took into account the effect of mixing of traffic, speed and headway. A set of PCU values was then derived. The analysis is based on the field studies conducted at Nal Stop in Pune city considering almost all classes of vehicles commonly found in Pune city, India. The PCU value of each vehicle is not a constant but varies with several factors such as proportion of other classes, level of service, volume to capacity. The speeds of individual vehicles in the queue need not to be precisely equal, but may vary slightly from vehicle to vehicle and similarly the time headway of individual vehicles in the queue. In this study, the average value of speed and time headway is taken.

Veethika Gomasta et al (2015)designed the intersections for Improved Traffic Flow at Bhopal-Case Studies of Jyoti Talkies Square and Vallabh Bhawan Roundabout. In this paper the signal timings at “Jyoti talkies square” have been redesigned for afternoon peak flow. Improvement by widening of road is recommended. At the other intersection called “Vallabh Bhawan roundabout”, capacity of rotary is calculated whether it is within its permissible limits or not. Introduction of Signalized rotary is suggested.

Sachin Jat et al (2015) designed the signal at intersection of vidisha to control the traffic. In this paper the traffic volume of intersections of the Vidisha city and traffic signals were designed at each intersection. The one part of the thesis is survey of traffic volume, which is done by manual method, wherein the vehicles are counted manually without using any device or sensor with respective vehicle categories like passenger, commercial and agricultural etc. and the other part is design of traffic signals, which is done according to the IRC method of signal design by adopting maximum PCU on the intersection in each direction. The design of traffic signals at these intersections in vidisha will help the growing traffic to move with ease and safety and also helps in reducing the accident rate at the intersections due to congestions and confliction between vehicles.

Chris Lee et al. (2015) has estimated PCE value for heavy vehicles at three four-leg roundabouts in Vermont, Ontario, Canada and Wisconsin using vehicle movement data collected from video cameras. The PCEs were determined such that the coefficient of variation in 1- min entry capacities is minimized. The study also applied the PCEs to the prediction of the entry capacity using the
HCM 2010 roundabout capacity model. For the model inputs, the critical headway and the follow-up headway were adjusted based on the difference in driver’s gap acceptance behavior between cars and heavy vehicles.

M. Mardani et al. (2015) has evaluated that PCU value (figure-4) for a vehicle type varies with traffic volume and composition on the road. It is also affected by the type of road as well. Carriageway width also affects the PCU value for all types of vehicles.

J. R. Juremalani et al. (2015) reviewed on the PCU reveals that studies conducted are mostly related to fairly homogeneous traffic conditions, and the few studies conducted under heterogeneous traffic conditions are not comprehensive enough to replicate the field conditions accurately.

A. A. Obiri-Yeboah et al (2014) employed the headway method for estimation of PCU for the traffic mix and flow conditions prevailing at signalized intersections within the Kumasi Metropolis, Ghana. Vehicles considered were placed in three categories; cars, medium vehicles and trucks. The PCEs developed from this study were 1.0, 1.65, and 3.05 for cars, medium vehicles and trucks, respectively, at intersections where roadside friction to flow existed. Where such friction did not exist, the values were 1.0, 1.35, and 2.25 for cars, medium vehicles, and trucks, respectively, which were much lower. The differences in PCE values for corresponding categories of vehicles in the two situations are believed to be a reflection of the impact of roadside friction to vehicular flow at the intersections, which appeared to be more severe on trucks than the other vehicle categories. PCE values which have been adopted from the Overseas Road Note 11 (17) are 1.00, 1.10, and 2.25 for cars, medium vehicles and trucks, respectively, which in comparison to the values obtained in this study, are lower. It is recommended that PCE values from this study be used in intersection analysis within the Kumasi Metropolis as they are believed to reflect better and more accurately the impact of local conditions on discharge at the intersections.

A. Mehar et al. (2014) has demonstrated the effect of congestion level (v/c ratio) on PCU of different type of vehicles on multilane interurban highways. Although the PCU values given are derived for Indian conditions, yet the methodology is quite general and can be used by other researchers to derive PCU values for traffic condition in their countries as well. The major objective of this research was to quantify the effect of traffic volume and composition on PCU values and authors have successfully demonstrated it.

Yahya R. Sarraj (2014) has analyzed the average PCE value for heavy trucks in Gaza. It was found to be 2.23, whereas it was 1.43 for medium trucks and 1.51 for animal-driven carts. In his paper the selection of the signalized intersections was based on the following criteria: High traffic volumes, significant queuing, no parking allowed at or close to the intersection and good mix of different vehicle types. Data was collected at three signalized intersections in Gaza city. Several methods may be used to collect data such as: manual method using a stop-watch, pressure-contact-strip method, sonic detectors and a digital video camera.

R.S. Dhapudkar (2014) analysed the development of Traffic Stream Parameters of Heterogeneous Traffic at Signalized Intersection. This paper reviews the status of heterogeneous mixes worldwide, and what factors need to be considered in such mixes. This paper presents a macroscopic stochastic model of traffic movements at signalized intersection. To study macroscopic traffic parameters (flow, speed and density) and to establish new models for the Indian highway. A heterogeneous traffic stream consists of vehicles that have different speeds, sizes, operating characteristics, and vehicle spacing. It reviews the status of heterogeneous mixes world traffic, and which factors need to be considered in such traffic. The Indian roads are constructed on European equation of homogeneous traffic and different LOS, which are not applicable to heterogeneous traffic of India. So, there is a need to model the new equation for Indian highways. In these traffic parameters were identified by using the video recording technique at just after the signalized intersection. And found out the relation between macroscopic parameters of traffic and compared with the fundamental diagrams. SPSS software is used to define the relationship between the traffic parameters. After study it is concluded that existing equation of traffic stream are not suitable for these Heterogeneous traffic. Thus we need to create new equation for this Heterogeneous traffic of Indian scenario.

Vidhya & Banu (2014) designed a project to develop a density based dynamic traffic signal system. The project consisted processing of image captured in the traffic signal and then it was converted to grayscale image and after that to calculate the number of vehicles contours was drawn to have its threshold. Calculation of number of vehicles gave the density which was further used for allocating green time to the traffic on the approach lane by using the Raspberry pi as a microcontroller.

Charles Anum Adams et al (2014) studied the Passenger Car Unit Values for Urban Mixed Traffic Flow at Signalized Intersections on Two Lane Dual Carriageways in the Tamale Metropolis, Ghana. This study aimed to evaluate the local passenger car equivalent unit values which may be used in the design of traffic intersections in order to improve the performance of signalized intersections in Tamale. Two signalized intersections with fixed time control along one of the busiest corridors were studied. Manual counts were used to collect data from three hour video recordings of each intersection under saturation flow conditions played on a laptop computer. The passenger car unit values (PCU) were estimated using multiple regression analysis between the saturation times and vehicle types. PCU values for Motorcycles, Tricycles, Cars and Buses/trucks have been evaluated. It was recommended that a special area should be prepared in front of the signalized intersection stop lines in the metropolis to accommodate the high volumes of motorcycles in the traffic.
Parvathy R et al (2013) studied the development of new PCU values and effect of length of passenger cars on PCU. In this study, an attempt has been made to learn the characteristics of mixed traffic flow at signalized intersections. This work provides the details of an empirical study carried out to determine the PCU values for various types of vehicles, so that a comparison of results with PCU factors recommended by IRC code is possible. Moreover an attempt has been made to find the effect of length of passenger cars on PCU. Data were collected from two signalized intersections and the headway ratio method and regression method were used to estimate the PCU of different types of vehicle. The PCU values obtained in this study are compared with the values established earlier. It is found that the estimated PCU values are different from those being used in India, and they are inversely related to the length of passenger car. Studies reveal that PCU values have a great impact on signal design, emphasizing the need for further studies in this direction.

Rekha & Karthika (2013) presented a combination of inductive loop sensors and fuzzy logic technology in which inductive loop sensors were responsible for real-time traffic data and fuzzy logic technology was responsible for the allotment of green time to the traffic to clear off the intersection efficiently. This method was proved to be very effective in handling the traffic.

Rashid Hussain et al (2013) proposed the concept of Wireless sensor network technology have the real time traffic data at an intersection and then to allocate the timings to the traffic to clear off the intersection. This method was proceeded to be efficient as it didn’t required any built in system in vehicles for its working.

Karthick et al (2012) proposed a system to analyse the live video camera recordings to handle the traffic automatically by allotting green time to the traffic by calculating the number of vehicles which gives the traffic density which acted as a input for the algorithm which was in place for allocating optimal time for the vehicles to pass the intersection.

Shilpa et al (2009) worked on a new technique “Intelligent traffic light controller” which was made by making use of GSM services as it included providing the information regarding traffic flow to users by sending SMSs in addition to the sensors provided on the intersection to allocate the timings to clear off the intersection. This system was compared with fixed traffic signals and found to be more efficient.

Quazi Sazzad Hossain et al. (2009) have reported estimation of PCE factors for heterogeneous traffic environment prevailing in urban arterials of Karachi city, Pakistan. Four methods were utilized that have their basis on different notions, and required different data items relevant to traffic stream and vehicles. The study suggests that further investigations are necessary to examine behavior of different type of vehicles, which may lead to appropriate values of PCE factors.

Subhash Chand et al. (2009) dealt with the determination of PCU factor. The study clearly emphasizes the need for estimation of PCU values based on actual field studies at the signalized intersections for their analysis and performance as these are found to vary considerably as compared to IRC PCU values. Estimated PCU values are observed to give higher but consistent value of saturation flow for different approach widths as compared to IRC-PCU values. Estimated PCU values give consistent value of saturation flow per meter width of approach for all the approaches. But estimated values of PCU fail to explain the variation of saturated flow during different saturated green phases of same approach which may be attributed its sensitivity to composition and the varying composition of traffic during different green phases of signal. It affirms that PCU values at signalized intersections are highly dynamic and further emphasizes the need of estimation of PCU values based on different comprehensive approach.

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SCOPE OF STUDY
The scope of the study encompasses appreciation of identifying the road sections for conducting necessary traffic studies and to quantify problems with view to suggest improvement measures. The traffic studies include
- Traffic Volume Count Study.
- Spot Speed Study
These traffic studies would enable quantification of traffic flows, identification of causes for delay and inefficiency besides traffic accidents.

Keeping in view the scene of the city with the existing traffic problems and as a part of continuing programme of reviewing and redesigning Intersections, the main object of this investigation is to critically study road intersections with reference to their traffic control measures traffic performance and other relevant features and thereafter redesign them according to the requirement of the present and future traffic and suggest improvements in their present layout. The conclusions and recommendations from these studies will be helpful in better understanding of the problems and finding of the effective measures to overcome all those problems.
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