Study of Design Traffic Signal

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Abstract - *The increasing of traffic volume at our intersection has been arise a problems like road accidents, conflicts and congestions. These problems can now only be solved by providing an efficient traffic control at intersections and that can be achieved by provision of traffic signal system at intersections for continuous and efficient movement of vehicles through the intersections. According to traffic signal, signal timing is most important which is used to decide green time of the traffic light shall be provided at an intersection and how long the pedestrian walk signal should be provided. 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. 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. In India PCU value is based on value given in IRC SP 41. Developed countries devised several methods for calculating PCUs. 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 research work the traffic signal for Agrasen chowk is designed by the various traffic surveys.*

1. INTRODUCTION

Transport is an all operable industry. It penetrate into all phase of production and distribution of goods. In the production stage, transportation is required for carrying raw material and in the distribution stages; transportation is required from farm and factories to the marketing centers for distribution to the retailers and consumers. Transportation improvement has increased personal mobility, reduce travel time, permit greater freedom to select the people their work and in the carrying of goods.

However the unprecedented growth of vehicles ownership especially the small cars and scooters in recent years, our cities are beset with serious traffic problems like congestion and causalities particularly at road intersection due to land constraints. A multidisciplinary approach is needed in understanding the situation and providing the solutions.

          To solve the problem of congestion at intersections, coordination of traffic regulation is required and

intersectional area may be expanded or grade separations may be adopted. In order to study and evaluate the congestion at urban intersections, it is important to acquire factual knowledge of traffic characteristics and to carryout studies and analyse the situation for relieving congestion thereby increasing the capacity of intersection.

1.1 General

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 traffic on roads in India is increasing 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 continuously. 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 rotaries 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 intersection 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, 2011. The total registered vehicles in the country grew at a Compound Annual Growth Rate (CAGR) of 9.9% between 2001 and 2011.

2. 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 is the number of 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.

3. PURPOSE OF STUDY

1. Present traffic helps in accurate future forecasting of traffic, it is 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 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.

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4. TRAFFIC VOLUME VARIATIONS

Traffic flow varies from time to time, as it does not remain constant at different times of day, different days of week and different months of year. To obtain a true picture of traffic volume it is essential to specify the time and date when volume is counted. Some of major findings of above counts from Indian experience are:

1. Monsoon and winter season has less traffic.

2. The composition of the traffic varies from site to site. The percentage of fast traffic is generally higher (roughly 2/3 of total traffic) than that of slow traffic.

4.1 METHODS OF TRAFFIC COUNT

A number of methods are available for traffic volume counts. These are listed below:

1) Manual count 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.

4.1.1 PRESENTATION OF TRAFFIC VOLUME DATA

For collecting the traffic volume on road, vehicles can be classified into following classes Cars/Jeeps, Auto rickshaw's, Scooter/Motorcycle, Cycles, Light Commercial Vehicles (L.C.V.), Heavy Commercial Vehicles (H.C.V.), Trucks, Buses and Cycle Rickshaw.

1. PREDICTED TRAFFIC VOLUME

Forecasting of traffic is necessary for future planning. The accurate estimate of future traffic will influence engineering design of facilities or improvement of existing facilities. Forecasting of traffic depend upon population, gross domestic product, vehicles ownership, agricultural output, fuel consumption etc. to deal with this simple problem following formula can be used to predict traffic volume.

$$A = P (l + r)^{n+10}$$

Where
n = Constant period of intersection.
r = Rate of Volume increased per year.
P = Present volume.
A = Projected volume.

1) Annual Average Daily Traffic (AADT)

If traffic data is collected continuously for 365 days of the year, the average daily traffic would be the total divided by 365 which is known as average annual daily traffic (AADT). AADT is common measure or flow utilized in geometric standards for highways, improvement of existing facilities.

2) Average Daily Traffic (ADT)

If the flow is not measured for all 365 days but only for few days the average flow is then known as average daily traffic.

3) 30th Highest Hourly Volume

The 30th highest hourly volume is the hourly volume that will be exceeded only 29 times in a year and all other hourly volumes of the year will be less than this value. Normally highway facilities are designed for 30th highest hourly traffic volume, as it provide satisfactory level of service and also suitable for economic consideration.

5. TRAFFIC SIGNAL DESIGN

Traffic signals are manually, mechanically or electrically operated devices which by means of its indications, direct traffic to stop or to proceed at intersection. The indication shown by a signal face is an aspect which follows a sequence or red, red and amber together, green and amber. Thus signals are widely used in the assignment of right of way on intersections.

6. ADVANTAGES OF SIGNALS

Traffic signal has the following advantages:

1. Signal reduces the number of conflicts and improves safety at intersections when properly designed and operated.

2. They provide orderly movements of traffic and increase the traffic handling capacity of most of the intersections.

3. They can be used to interrupt continuous flow by allowing the right of way in some set sequence to the other conflicting streams e.g. pedestrians.

4. Under favorable conditions they can be co-ordinated to provide for continuous or nearly continuous movement of traffic at a definite speed along a given route.

As signals have meaningful indications, drivers can easily follow, and at night or in bad weather they compel more attention than hand signals.

7. DISADVANTAGES OF SIGNALS

Traffic signals have the following disadvantages:

1. They can increase total vehicle delay at intersections.

2. When improperly located they may cause unnecessary delay, thereby decreasing motorist respect of them and other management tools.

3. Failure of the installation, although infrequent, may lead to serious and widespread traffic difficulties, especially during peak traffic periods.

4. They usually cause an increase in frequency of rear end collision.

5. They are not normally capable of granting right-of-way to emergency vehicles such as ambulance and fire brigades.

6. Failure of the signals due to electric power failure or any other defect may cause confusion to the road users.

8. TERMS ASSOCIATED WITH TRAFFIC SIGNALS

The modern traffic signals allocate time in variety of ways from simplest to phase pre-timed mode to most complex multiphase actuated mode. The basic terminology of traffic signals is described as follows:

The following terms are commonly used to describe traffic signal operation:

Cycle   : Complete sequence of signal indications.
Cycle Length   : Total time for the signal to complete one cycle given by symbol C (second).
Phase   : Part of the cycle allocated to any combination of traffic movements receiving the right of way simultaneously during one or more intervals.
Interval   : Period of time during which all signals indications remain constant.
Green Time   : The time within a given phase during which the green indications is shown is known as green time.
Lost Time   : The time during which, the intersection is not effectively used by any movement. These times occur during the portion of change in interval and at the beginning of each phase as the first few cars in standing queue experience startup delays.
Effective Green Time: The time during which a given phase is effectively available for stable moving platoons of vehicles in the permitted movements. This is generally taken to be the green time plus the change interval minus the lost time for designated phase given by symbol g.
Green Ratio   : The ratio of the effective green time to the cycle length given by symbol g/C for phase I.
Effective Red : The time during which a given movements or set of movements is effectively not permitted. It is taken as cycle length minus the effective green time. It is given by symbol r_1 (second).

9. 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 at Agrasen Chowk Intersection, Yamunanagar
• Spot Speed Study on road approaching to the intersection
• Design of signal at Agrasen Chowk Intersection

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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