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ADVANCED TRAFFIC SIGNAL MANAGEMENT OF YAVATMAL CITY(M.H.)

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Abstract - *This paper introduces the study of approach to handle the situation for emergency vehicles like fire brigade, ambulance and to avoid traffic to reach the destination in time in order to save the lives. The durations of traffic light in the conventional methods have been constant which turns out to be a big drawback. A real time problem of the skew intersection at Lohara M.I.D.C. Yavatmal city has some issue regarding traffic management. It is necessary to survey, analyze and design a traffic system pertaining to engineering. A traffic signal is an alternative form of intersection for traffic control. Traffic signals are one of the most beneficial and flexible active control of traffic and is widely used in several cities world-wide. The main objective of providing a traffic signal is to eliminate the congestion problem, accidents and improve the traffic flow. At the proposed site there is no proper effective traffic management, the intersection is unsignalized there is no separate footpath for pedestrian and also the accidental problems are more due to improper geometric design therefore, there is need to study and improve the existing transport system. The urban roads should be designed to be safe and to permit the free flow of traffic at reasonable speed. Along with the Public transport runs the private transport whose number is increasing day by day. The traffic is analyzed through data collected from cameras and depending upon the volume of traffic, the traffic light durations are set. Traffic knowledge should be incurred in people.*

Key Words: Smart traffic signal, Smart cities, Road, Internet-of-things, Right-Turn, Left-Turn and Extension time.

1. INTRODUCTION

In the light of providing safety, smooth operation and effective traffic management system in urban road intersection the present study is initiated. Urban traffic is increasing day by day and creating several issues related to time management traffic since, understanding of traffic rules and operation. The problem of traffic is conflict one requiring design, planning, engineering and institutional inputs for developing proper solution. A real time problem of the skew intersection at Lohara M.I.D.C. Yavatmal city has some issue regarding traffic management. It is necessary to survey, analyze and design a traffic system pertaining to engineering. A traffic signal is an alternative form of intersection for traffic control. Traffic signals are one of the most beneficial and flexible active control of traffic and is widely used in several cities world-wide. The conflicts arising from movements of traffic in similar directions is addressed by time sharing concept.

Advantages of traffic signal includes orderly movement of traffic, increased capacity of the intersection and requires only simple geometric design. The spectacular growth in the number of vehicles on the road creates major social problems 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. The main objective of providing a traffic signal is to eliminate the congestion problem, accidents and improve the traffic flow. At the proposed site there is no proper effective traffic management, the intersection is unsignalized there is no separate footpath for pedestrian and also the accidental problems are more due to improper geometric design therefore, there is need to study and improve the existing transport system. The urban roads should be designed to be safe and to permit the free flow of traffic at reasonable speed. Along with the Public transport runs the private transport whose number is increasing day by day.

Recent rapid urban development in India has resulted in transport problems, such as traffic congestion, parking difficulties, longer commuting and an increase in traffic accidents. Although the national and state governments have made substantial efforts to improve urban transport, problems have been aggravating by the rapidly increasing number of private vehicles. The rapid increase in the volume of traffic in most of the countries containing the heterogeneous traffic demands a more efficient and intelligent system to be deal with. A miscellaneous traffic stream consists of

vehicles that have different speeds, sizes, operating characteristics and vehicle spacing. Existing local government capacity for urban transport planning for Yavatmal city is still insufficient because of day by day increase in traffic volumes. One of the main planning issues is that most of the cities do not have a long-term comprehensive transport and traffic strategy.
Intersection is an area shared by two or more roads or streets meet or across. This area are usually allowed to avoid interference with other traffic to reach their desired destinations. Traffic intersections are complex locations on any highway. This is because vehicles moving in different direction have to occupy same space at the same time. In addition, Intersection generally managed pedestrian as well as vehicle traffic. A small error in judgment by driver can cause severe accidents. It also causes delay which depends on type, geometry, and type of control at the intersection. Overall traffic flow depends on the performance of the intersections which affects the capacity of the road. Therefore, point of view of both accident and the capacity, the study of intersections is very important for the traffic engineers especially in the case of urban places.

1.1 Aim and Objective

To Study & Improvise of Existing Transport System at Lohara M.I.D.C. Intersection, Yavatmal.
Within this context the objectives of this project were:

- To survey and investigate the study area for gathering data for analysis.
- To study about existing transport situation such as transportation infrastructure, traffic safety, traffic signals, etc.
- To analysis and design the traffic engineering system applicable for Safety operation.
- To locate the traffic congestion area and identify problems due to congestion.
- To collect the traffic volume data at the intersection
- To decrease the traffic delays and accidents.
- To evaluate design details of the traffic signal at intersection.

1.2 SCOPE OF STUDY

As we are moving towards the traffic facilities in Yavatmal city our project is little contribution towards the removing of traffic problems and congestion on the Lohara M.I.D.C. square.

This project is useful for PWD and Municipal Council in future if properly implemented. It is also useful in traffic calming. Still the effort initiated in this project we facilitated the vehicular or motorist and government agencies to minimize the traffic problems. The existing road capacity insufficient to sustain that much quantity of traffic. Also is effect on land used pattern and people mobility. Because of that people facing the congestion problem delay to workplace and rate of increasing of accident.

The general design principles of intersection are designed to maintain the speed of vehicles and maximize the capacity of intersection. And to regulate the traffic operation and ensure safety of road users.

1.3 Description of Study Area (Yavatmal City)

1.3.1 Location

Yavatmal is small city situated on small hillock at the altitude of 432.57m from mean sea level. Its geographic location is 20°23'N 78°08'E. The city of Yavatmal is Headquarters of Yavatmal District.

Fig. No 1.3.1 (a) Location of Yavatmal District (in blue color) in Maharashtra State Map.

Fig. No 1.3.1 (b) Study Area (Lohara square Yavatmal) Source: Google Map.

1.3.2 Geography

Yavatmal District is bounded on the North by A District, to the North East by Wardha District, to the East by Chandrapur District, to the South by Telangana State and Nanded District, to the South west by Hingoli District, and to the west by Washim District. The chief rivers flowing through the district are the Wardha and Penganga. The Bembala and Nirguda are the main perennial tributaries of the Wardha which flows through the District. Adan is the other important river in this area.

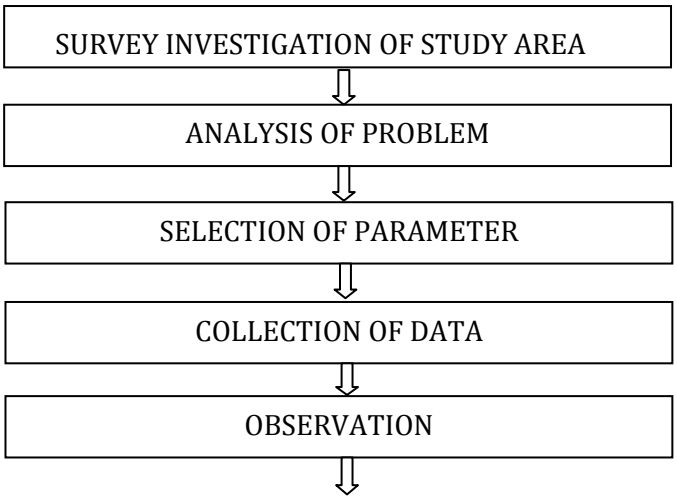
1.3.3 Recent Population Trend

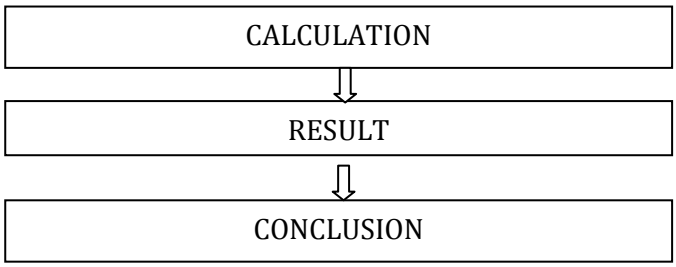
Recent population in the Yavatmal district according to census data 2011 is 2,70, 303. And only city containing the population excluding all inter connected or outer region is 1,31,317. Out of the district population 78.42 % covered in rural area and only 21.58% covered in urban area.

2. METHODOLOGY

The study aims at minimizing the conflicts and congestion of traffic for the given intersection "MIDC LOHARA SKEW INTERSECTION". With this objective in view, the traffic data and the site data of the intersection are collected. By adopting the methodology, we are designing the traffic signal at intersection. We collected the data from Municipal Corporation; Yavatmal, Gramin police station, Yavatmal, RTO office Yavatmal.

METHODOLOGY





2.1 Methodology Phases

2.1.1 Survey Investigation of Study Area

At the mid place of Lohara i.e. Lohara skew intersection having very high density of Traffic due to all four roads like from road A, road B, road C and road D meets at a one point. We investigate the problems from the experience of drivers and the traffic polices etc. and measured the whole area by Measuring Tape. The Lohara intersection is situated at N $20^0$23' 25.1448" E 78^0 5'30.7788".

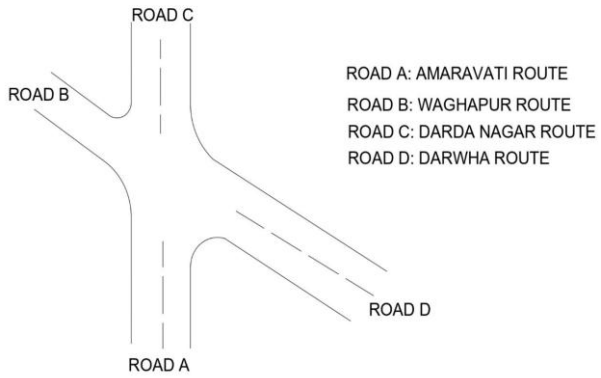


Fig No. 2.1.1(a) Skew Intersection of study area

It is Important to provide traffic signal at Lohara skew intersection because there is no proper Traffic Management system except Island but these Island are not in proper working. The Peoples are not following the Traffic Rules. In Present Situation the design is not properly so that to create problems likes Traffic Jams, Collision of Vehicles and Time Consuming. Because of this problem are created we decided to design Effective Traffic signal System.

The following Obstructions and improper designs are found after the Completion of Survey

- Obstructions are created due to improper arrangement of Dividers.
- Lack of space for Parking Facilities.
- Road Margins are not provided.
- Traffic Operations signs are not provided.
- Improper Designs for Pedestrian Crossing.

Fig No. 2.1.1(b) Study Area Lohara Square, MIDC, Yavatmal

Skew intersection

Intersections are places where two or more highways intersect. Their performance dictates the performance of the rest of the traffic network. When two highways cannot intersect at 90° due to some geometric constraints, can creates complicated scenario of pedestrian. This project describes the result of a study carried out to evaluate the effect of orientation of a signalized intersection on the control delay to vehicular traffic. Using the data collected from site. Two models of skewed intersection based on a normal T–intersection was simulated at minor approach at 45° (i.e. skewed to the left), and 135° (i.e. skewed to the right), respectively. The result of the analysis showed that delay to the automobile operator in the minor approach increases when the minor approach is skewed from left to right.

2.1.2 Accidental Analysis

The problem of accident is very acute in skew Junction due to complex flow pattern of vehicular traffic presence of mixed traffic and pedestrians. Traffic accidents may involve property damages, personal injuries, disfigurement, physical impairment, loss of consortium etc. The statically analysis of accidents carried out periodically at intersection road stretches or zone will help to arrive at suitable measure to effectively decrease the accident rates.

(A) Causes of Accidents: -There are four basic elements in a traffic accident.

- The road users
- The vehicles
- The roads and it's conditions
- Environment factors traffic weather etc.

Various causes of accident may be listed as given below.

- **Drivers: -**Excessive speed and rough driving, carelessness, breaking the rules and regulations, failure to see or understand the traffic situation. Signs or signal, temporary effect due to fatigue sleep or alcohol.
- **Pedestrians: -**Violating regulations, carelessness in using the carriageway meant for vehicular traffic.
- **Passengers: -**Alighting from or getting into moving vehicles.
- **Vehicle defects: -**Failure of brakes, steering system or lighting system type burst and any other defect in the vehicles.
- **Road Co-Ordination: -** Slippery road surface, pot boles, ruts and other damaged conditions.
- **Weather: -**Unfavorable weather condition like fog, snow, dust, smoke or heavy rainfall which resists normal visibility and render driving unsafe.
- **Animal: -**Stray animals on the roads.
- **Other Causes: -**Incorrect sign and signals, gate of level crossing not closed when required, ribbon development, badly located advertisement boards or service station etc.

Fig. No. 2.1.2 (a) accident analysis at study area

(B) Congestion:

Traffic congestion has been one of major issues that most metropolises are facing and thus, many measures have been taken in order to reduce crowding. It is believed that identification of crowding characteristics is the first step for such efforts since it is an essential guidance for selecting appropriate measures. Crowding – both in perception and in reality – impacts the movement of people and transportation and is deeply tied to the history of high levels of accessibility and mobility. Traffic congestion i.e. rush hour wastes time

and energy, causes pollution and stress, decreases productivity and imposes costs on society.

For scientific planning of road system, it is needed to have a proper data base of existing traffic parameters of the roads. The different traffic parameters have been evaluated on selected urban road, we have selected the Lohara intersection MIDC, Yavatmal. Some of the problems are shown in following image.

Fig. No. 2.1.2 (a) Congestion due to free-flowing traffic

2.1.3Data Collection

Identify the data of skew junction at Lohara square with respect to plans which are collected from Municipal Corporation, Yavatmal. The Accidental data are collected from Lohara Police Station and RTO, Yavatmal.

(A) Data Collection: -

Data collection is the major effort for the execution of project. As for example, to analysis the traffic volume, traffic survey needs to be carried out, to analysis the traffic safety parameters, traffic accident data need to be obtained, etc. The traffic data is collected by manual method by counting the number of different types of automobiles approaching to the intersection from all the four directions and then converting the values in to the common factor called Passenger Car Unit (PCU).

Table No. 3.1 PCU Factors used for traffic signal design

Vehicle	PCU Factor
Car	1
2W	0.5
3W	1
Bus/Truck	3
Cycle	0.5
Rickshaw	1.5
LCV	1.5
Horse Drawn	4
Tractors	4.5

(B) Method of Traffic Count

Traffic volume studies are conducted to determine the number, movements, and classification of roadway vehicles at a given location. These data help identify critical flow time period, determine the influence of large vehicle and pedestrians on vehicular traffic flow. The length of sampling period depends on the periods on the type of count and the intended use of the data recorded. For example, an intersection count may be conducted during the rush period. We adopted the Manual method being taken.

(C) Manual Count

Most of applications of manual counts require small sample of data at any given location. Manual counts are sometimes used when the effort and charges of automated equipment are not justified. Manual counts are necessary when automatic equipment is not available. Manual counts are typically used for periods of less than a day. Traffic count during a Working day morning rush hour may show exceptionally high volume. Manual methods are recorded using Tally sheets method or with the help of videos.

(D) Tally Sheets

Recording data onto tally sheets is the simplest means of conducting manual counts. The data can be recorded with a tick mark on a prepared field form.

Table No. 3.2 Road Identification

Sr.no.	Road	Name of Road
1.	ROAD A	AMRAVATI ROAD
2.	ROAD B	WAGHAPUR BY-PASS
3.	ROAD C	CITY ROAD / DARDA NAGAR ROAD
4.	ROAD D	DARWHA ROAD

So, from these different roads, following route networks/legs were analyzed: (A-B, A-C, A-D, B-A, B-C, B-D, C-A, C-B, C-D, D-A, D-B, D-C). For all the above stated leg, traffic survey has been conducted nine days. All nine days include six working days, weekend day (Saturday and Sunday) and festival day.

In the first phases of survey, full day survey conducted to determine peak hour of traffic at intersection. In this survey, every two-hour data of traffic volume from 7.00 am to 9.00 pm of working day is noted down.

3. PROPOSED DESIGN STEPS

3.1 Camera specifications and positioning

The cameras should be positioned at sufficient height so that their field of view contains at least 40metres

stretch of road. One camera is thus positioned at main corners of the crossroad.
There are three methods commonly used for design of traffic signals listed below:
(a) Trial cycle method
(b) Webster's minimum delay method
(c) IRC method

(a) Trial Cycle Method
The following are the steps in this method:

(i) The 15-minute traffic counts n1 and n2 on the two roads 1 and 2 are observed during peak hour of flow.
(ii) A trial cycle of C seconds is assumed. The number of cycles in the 15-minute period, n1 will then be 900/C1. Assuming the time headway as 2.5 seconds, the green periods for roads 1 and 2 clear the during the trial cycle are as –

$$G1=2.5n1C1/900$$
$$G2=2.5n2C1/900$$

(iii) The amber periods A1 and A2 are calculated based on the approach speeds (or assumed to range from 2 to 5s)
(iv) The cycle length C'1, equals to (G1 + G2 + A1 + A2) seconds
(v) If C'1 is very nearly equal to the assumed values C1, it is taken to be the design cycle. Otherwise, a different trial cycle, C2 (if C1 < C1, C2 < C1) is assumed, and steps (i) to (iv) are repeated.
(vi) This iterative procedure is repeated until there is good agreement between the calculated and assumed values of the cycle lengths.
Finally, the timing and phasing diagrams are shown to summaries the design.
This type of method suitable for two phases only. Thus, trial cycle method is not used.

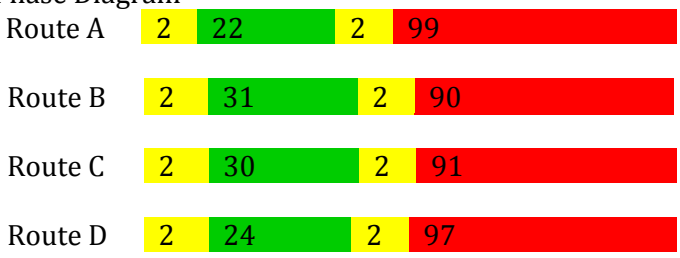
4. RESULTS

While the study of traffic signal we see the lots of parameters were monitored, evaluated and analyzed to understand the traffic improvement necessities to be implemented or adopted. Traffic parameters are the major element for the analysis of the traffic capacity. In this study, we had analyzed the traffic flow from each of the route at Lohara intersection such A to C, A to D, etc. After the study of the traffic capacity and volume features for the design of traffic signal at Lohara intersection, Yavatmal following results were observed:

Table No. 4.1 Final Time Calculated on Respected Routes

Route	Green Time	Amber Time	Red Time
A	22	4	99
B	31	4	90
C	30	4	91
D	24	4	97

Phase Diagram



4.1 Recommendations

On the basics of the result obtained for the study of traffic signal and its improvement, following recommendations have been suggested:

- Remove the encroachment for efficient flow and smooth moment of traffic.
- Road margins should be provided on the intersection.
- Provide effective parking facilities.
- Give the provisions about markings, signs etc.

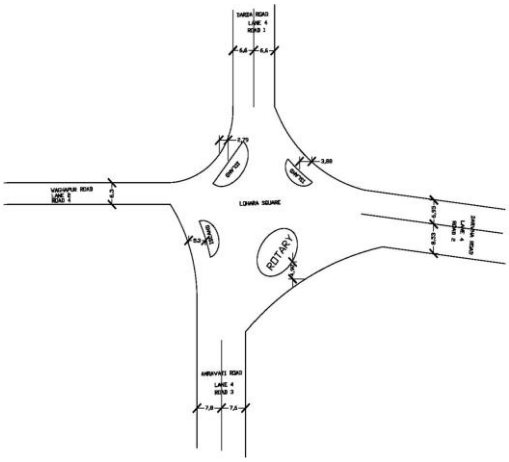
5. CONCLUSION

We had successfully designed signal for an intersection at Lohara square. as per our studies concluded that, effective transportation system is based in all aspects of traffic system for Lohara square. We analyze the problem and collected the data

- The compatible system with administrative procedure for design of traffic signal is developed.
- The problem faced by vehicles are overcome by this system and reduced the conflict point on the intersection.
- Using the IRC guideline, the design of the traffic signal is designed and improvement in existing transport system.
- It improves the urban traffic safety and service quality.
- We surveyed and investigate the study area and collect all data along with dimension.
- It decreases the traffic delays and accident.
- We analyze and design the traffic engineering system applicable for safety operation

- The engineer needs design methods based on fundamental relationship between geometry, capacity and safety that will him/her to get directly from proposed geometry to realistic estimate of operating conditions. It analyzes the need of the improvement for the better movement of vehicle and safety of motorists and pedestrians. Traffic knowledge should be incurred in people. As per the literature reviewed, the signal design is feasible only for heavy traffic flow and low traffic congestion. So, from analysis we can conclude that the existing transport system is able handle the traffic.

6. PROPOSED DESIGN FOR THE AREA OF LOHARA SQUARE YAVATMAL



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