

Analysis and Redesign of Existing Road Junction

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ABSTRACT: The increasing of traffic volume at the intersection has been on the rise which has resulted in many problems like road accidents, conflicts, and congestion. The objectives of traffic signals are first, they enable road users to safely navigate through an intersection. Secondly, they give priority to a particular direction or mode of travel at different times. Thirdly, they allow through large volumes of traffic with minimal delay. Traffic volume studies are to be made to determine the number, movement and classification of vehicles at the given location, which is done by the manual method. The vehicles are counted manually without using any device or sensor with respective vehicle categories like a passenger, commercial and agricultural etc. Rapid growth of vehicular population has resulted in traffic congestion at the intersections where there is absence of certain assets like traffic signals, shortage of lane width etc. In present study traffic studies were carried out and measurements were taken at the “Anjilimoodu junction” which is a Y Intersection in order to design traffic signal. This will help in highlighting the problems which are in turn a cause of congestion at the intersection.

KEYWORDS: Carriageway Width, Passenger Car Unit, T-Intersection, Traffic Signal, Traffic Volume.

I. INTRODUCTION

Anjilimoodu junction is one of the traffic congested region near Chengannur town. Also it is one intersection between State highway (M C road) and National Highway (Kollam-Thenny). Also the existence of a bus stop, an auto stand, 2 schools and a college and many other shops near the junction is also a reason for high traffic at this region. The state highway connects the between 2 major towns such as Chengannur and Pandalam, where the national highway which connects Chengannur to Kollam. Thus the junction acts as Y intersection with a bus stop at its centre. There is also a small curved road with connects these two highways. The vehicle from Pandalam side has to take this small road to enter NH road and vice versa. The reason for traffic congestion at the region is improper signaling.

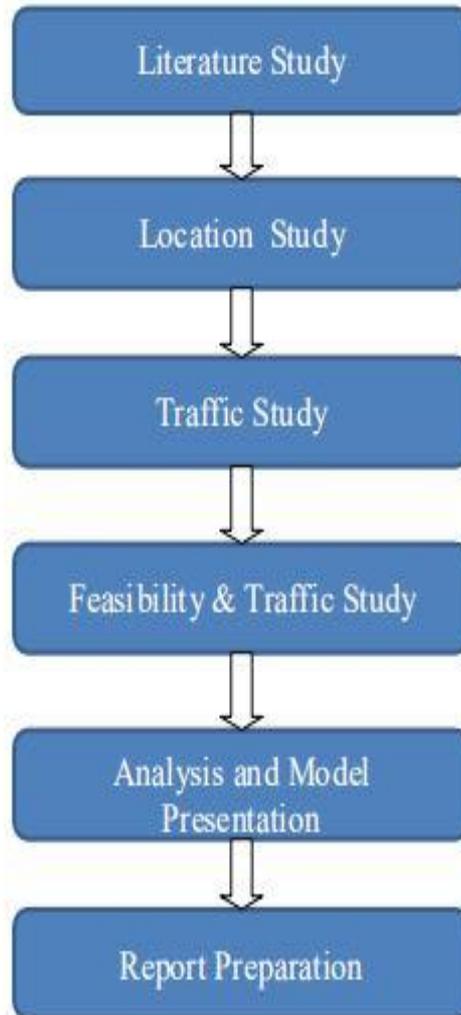
Our aim is redesign the junction by removing the bus stop from the junction and placing a small Island and increasing the width of the curved road and to provide proper channeling and signaling. This would helps in proper movement of the traffic and the junction by reducing congestion.

II. RELATED WORK

Olexandr Stepanchuk. (2018) Analyzing the peculiarity of traffic congestion formation of street network of Kyiv it should be paid special attention to the fact that unpredictable traffic congestions caused by traffic accidents or road works account for only 17.4%, while the permanent traffic congestions occurred every day account for 82.6% of total number of traffic congestions. On the April 2016, there are 12 most problem areas in Kyiv where traffic congestions occur during every working day. Such places require immediate reconstruction and engineering re-equipment. The surveys performed enable to state that traffic congestions can't be eliminated by means of administrative sanctions or traffic management measures only when width of roadway is insufficient for current traffic density. Therefore only required level of transport infrastructure development enables to enhance the transport problem in cities.

R. Lalit & V. Parmar(2017) studied the traffic signal and junction design at Rajkot City, they have conclude that an auxiliary on junction with slope of 10:1 at the intersection of road width two auxiliary lane are provide to reduce traffic congestion problem. A great care should be taken to design junction at inter section for pedestrian and bicycle track .with the study of traffic volume count survey it is given in IRC that if traffic volume less than 5000 so have to give rotary or round about, but in their study traffic volume count is more than 5000, so they conclude suggest Auxiliary lane on both side of the road.

III.METHODOLOGY



The following methodologies are carried for completing the proposed project .first we had study some literature review for the project reference .after that we studied about the nature of the proposed location and we take 50 m of each road for the analysis of the proposed location .after that we had gone for a traffic survey and we found that there is no smooth traffic flow in the current intersection . in the traffic survey we take a saturation flow of 15 min and then we converted it into 1hr saturation flow. after the completion of the location study and traffic survey we concluded that the site had improper traffic signaling due to this there is increase in the traffic congestion at the intersection .after that we gad redesign the intersection at anjlimoodu junction for the smooth flow of traffic .we provide a channneliztion for the junction for the smooth flow of traffic .we converted the mavelikara to chengannur as a one way and we provide speed breakers of 10 cm height which can reduce the speed of vechicle that entering to chenngannur - pandalam road to avoid the chance of accidents. we provide adequate signaling of optimum cycle length of 50 sec. and we provide proper location for the traffic controlling devices. Finally we converted the current plan to our proposed plan for the smooth and efficient flow of traffic.

IV. EXPERIMENTAL RESULTS

Figures shows the current plan and proposed plan of the Anjilimoodu Junction Chengannur, fig.(x) and fig.(y).

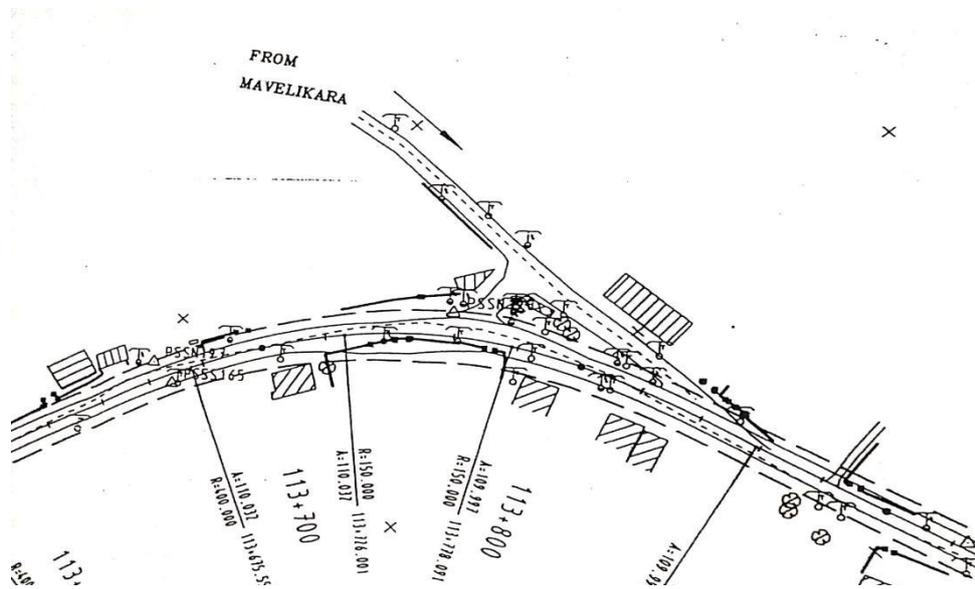


Fig.(x)

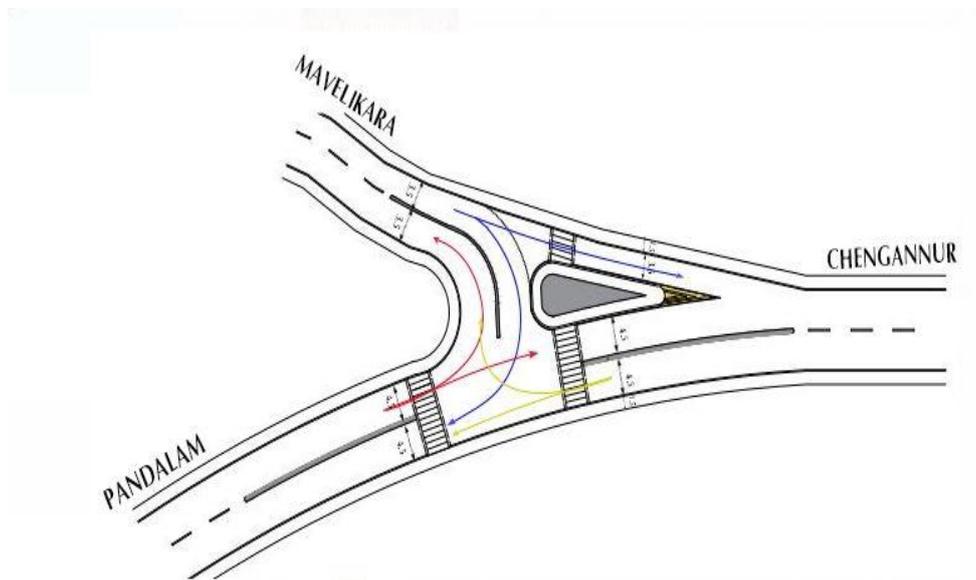


Fig.(y)

DESIGN PRINCIPLES OF CHANNALIZED INTERSECTION

Design of a channelized intersection usually involves the following significant controls. The type of design vehicle, the cross sections on the crossroads, the projected traffic volumes in relation to capacity, the number of pedestrians, the speed of vehicles, and the type and location of traffic control devices. Furthermore, the physical controls such as right-of-way and terrain have an effect on the extent of Channelization that is economically feasible. The degree to which each of these principles applies will depend upon the features mentioned above. While a principle may be modified in its application to a particular site, disregard of these may result in a hazardous design. The principles may be summarized as follows:

1. REDUCTION OF THE AREA OF CONFLICT

The impact area is decreased when Channelization is provided, and hence the probability of conflicts is also reduced. The figure below further clarifies the statement. Fig.(a) shows the conflict area in a Y-intersection without Channelization and Fig.(b) shows the reduced conflict area in the same intersection after providing medians.

2. MERGING TRAFFIC STREAMS AT SMALL ANGLES

Merging at small angles permits the flow of traffic streams with minimum speed differentials .Hence; the gap acceptance time is also small in such cases. The merging of roadways should be done as shown below in Fig.(c)

3. REDUCTION OF THE SPEED OF INCOMING TRAFFIC BY BENDING ITS PATH

The speed of vehicles entering into the intersection can be reduced by bending the path to the intersection approach. However as far as possible the path of the major traffic stream should not be bent .The above technique is shown below in Fig.(d)

4. REDUCTION OF SPEED OF TRAFFIC BY FUNNELING

The funneling technique can also be used for reducing the speeds of the incoming vehicles. Due to the decrease in the width of the lane at the approach, the drivers tend to reduce the speed of their vehicles near the intersection. Fig.(e) shows the funneling technique used for reduction of speed.

5. PROTECTION FOR TURNING VEHICLES/CROSSING CONFLICTING TRAFFIC STREAMS

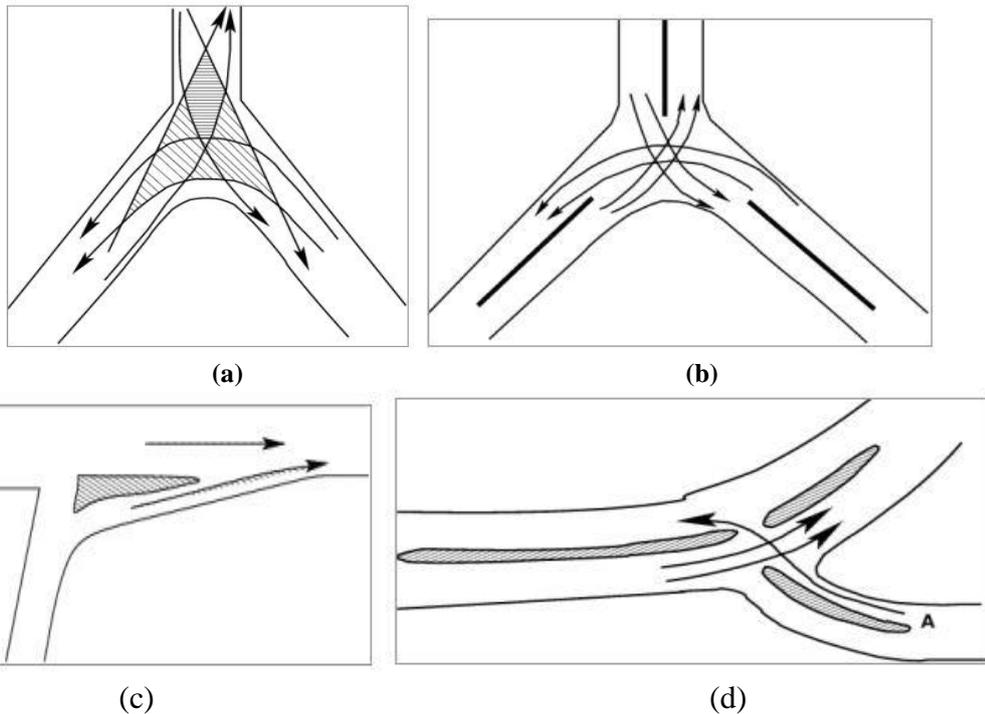
Provision of a refuge area between the two opposing streams allows the driver of a crossing vehicle to select a safe gap in one stream at a time and also provides a safer crossing maneuver. Fig.(f) further clarifies the above statement.

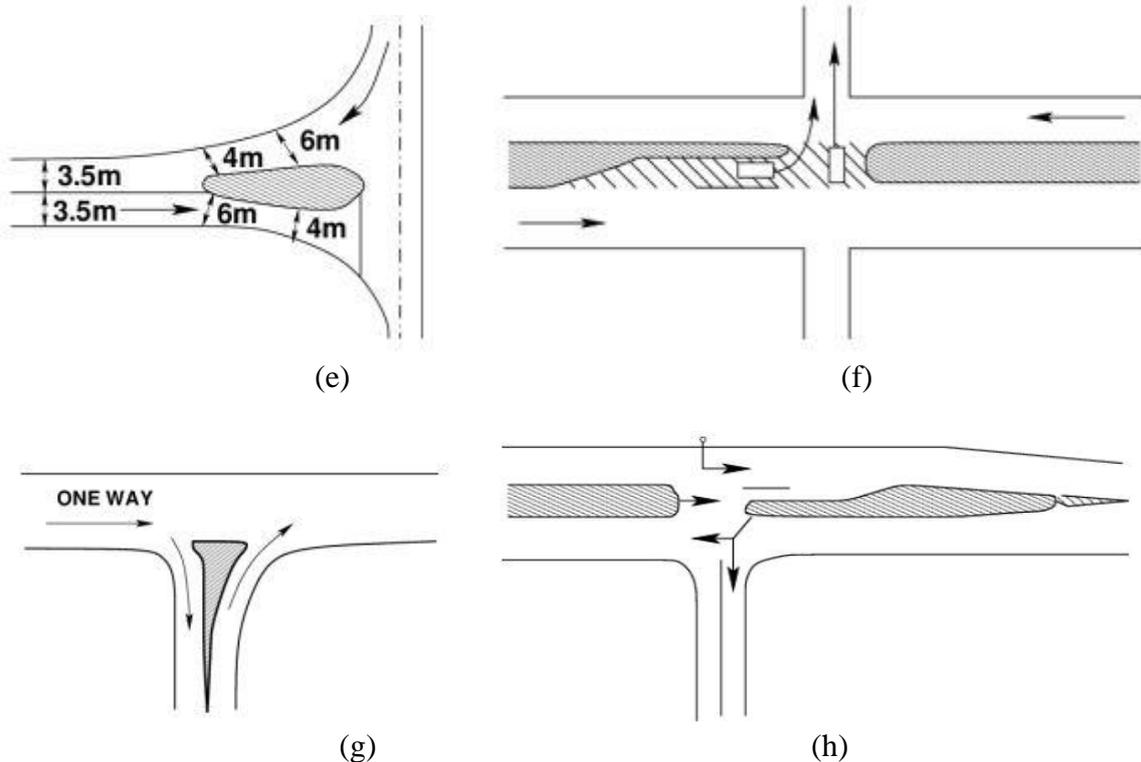
6. DISCOURAGE PROHIBITED TURNS BY ISLAND PLACEMENT AND SHAPE

Undesirable and prohibited turns can be discouraged by the proper selection of shape and location of the islands. Fig.(g) shows how prohibited turns can be discouraged by proper shaping and placement of islands.

7. PROVIDING LOCATIONS OF TRAFFIC CONTROL DEVICES

Channelization may provide locations for the installation of essential traffic control devices, such as stop and directional signs, signals etc. Fig.(h) shows how channelizing devices can also be used for locating traffic control devices.





WEBSTER METHOD

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. In this method, the optimum signal cycle corresponding to the minimum total delay to the traffic at the signalized intersection is obtained after detailed studies of cycle time and delay vis- a-vis the traffic volumes approaching the intersection. This is considered to be a rational approach as it has a mathematical basis.

The steps in the design procedure are:

- The saturation flow of traffic, S1, S2,... on the approach roads are obtained from field studies by noting the number of vehicles in the stream of flow during the green aspects and the corresponding time intervals. In the absence of data, the values are determined using RRL recommendations already given under the definition for „saturation flow“. □
- The normal flows q1, q2, ... on the approach roads, during the design peak hour traffic are also obtained from field observations
- The ratios $y1 = q1/S2$, $y2 = q2/S2$, ... are calculated. In the case of mixed traffic, all the q- and S-values are to be obtained after converting to equivalent PCU values.
- The optimum signal cycle, C0, is given by

$$C0 = 1.5L + 5\sqrt{1 - y}$$

Here L – total time lost per cycle in seconds = nI+R

Where n is the number of phase based on traffic signal installation on the approach road and I is the lost time for the phase and R is the all red time in seconds.

DESIGN OF SIGNALS

The increase in development and, hence traffic hindering create a critical need to operate our transportation systems with maximum capability. Real time traffic signal control is a main part of new part of the new urban traffic control systems aimed at achieving the best utilization of the road network. The use of traffic signal for control of different streams of vehicular and pedestrian traffic is wide in most of the towns and city. This study focused on the junction of the Rajkot city which is located in the saurashtra region of Gujarat state. A classified volume count survey had been carried out to monitor the traffic and the collected data was utilized for the design of traffic signals using Webster’s formula. Based on the analytical part, author suggested an auxiliary lane design as per IRC 41-1994. Figure shows the PCU value of the junction, fig.(z)

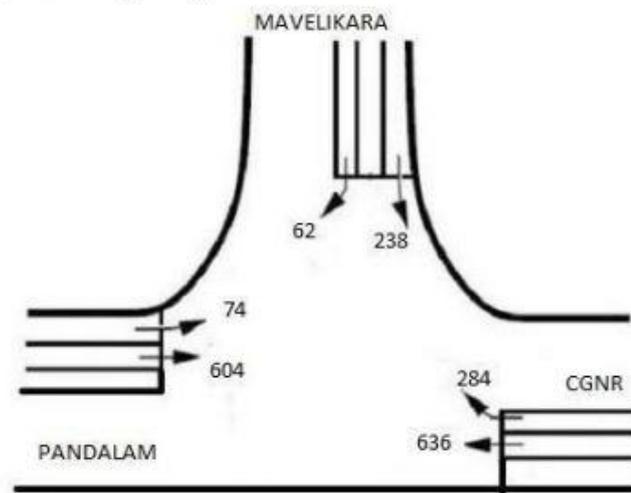


Fig.(z)

For the calculation of cycle length, saturation value, S is required, and it is taken as 2250 as the length of lane is 4.5 meters in road 1 and 2 and 1890 as the length as 3.5 in road 3 Normal flows,

$$q_1 = 634, q_2 = 284, q_3 = 74$$

$$y_1 = 634/2250 = 0.28$$

$$y_2 = 284/2250 = 0.13$$

$$y_3 = 74/1890 = 0.04$$

$$Y = y_1 + y_2 + y_3 = .28 + .13 + .04 = 0.45$$

Cycle length according to Webster method is calculated using the formula

$$C_0 = 1.5L + 5 \sqrt{1 - y}$$

Where $L = 2n + R = (2 \times 3) + 9 = 15$ seconds.

Calculation of Green Time:

Phase 1:

$$1 = Y_1 (C_0 - L) = (0.28/0.45) \times (50 - 15) = 22 \text{ Seconds.}$$

Y

Phase 2:

$$2 = Y_2 (C_0 - L) = (0.13/0.45) \times (50 - 15) = 10 \text{ Seconds.}$$

Phase 3:

$$3 = Y_3 (C_0 - L) = (0.04/0.45) \times (50 - 15) = 3 \text{ Seconds.}$$

Considering all pedestrian time = 9 seconds, Amber time

= 2 seconds for each phase = 6 seconds for three phases.

$$\text{Total Cycle length} = 22 + 10 + 3 + 9 + 6 = 50 \text{ seconds.}$$

Figure shows the signal phase diagram, fig.(p)

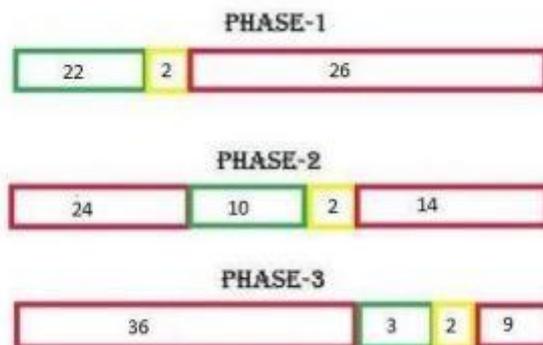


Fig.(p)

V. CONCLUSION

- This project is based on the Redesign of Anjilimoodu junction.
- This is a proposed project at Anjilimoodu junction to reduce traffic congestion.
- The Channelization of road helps in equitable balance of safe and efficient movement of traffic.
- The project work is done as per requirements and standards.
- The adopted design has Channelized road and reduce Area of Conflict.
- Based on the calculations done on the PCU values obtained from the traffic survey, the Signal Cycle Length of 50 sec
- Based on the calculations done on the PCU values obtained from the traffic survey.
- By studying the road traffic of the city we analyzed that the major accident cause is collision of vehicles at the intersections. The collision may be rear shunt on approach to junction, right angled collision, principle right turn collisions and pedestrian collision.
- These collisions can be avoided if proper design of signal is done so that the main objective of the dissertation is to provide better and safe movement of traffic through signal design at the intersection.
- The signal is designed as per IRC guidelines so that the signal can justify the proper

REFERENCES

1. Danish Zaffar Wani, Haiqa Riyaz and Ubaid Illahi (2016) SOLVING CONGESTION BY DESIGNING OF TRAFFIC SIGNAL AT TINTERSECTION(QAMARWARI CHOWK) IN SRINAGAR,J&K
2. Dr. Santosh Ajalihal, Dr. T.S. Reddy, Kayitha Ravinder. Proceedings of eastern Asia society for transportation studies vol 5 (2005): 1009-1024.
3. Frances Agyapong, Thomas Kolawole Ojo (2018) Managing traffic congestion in the Accra Central Market, Ghana.
4. Ibrahim, Johnnie Ben-Edige and Iffazun Mohd. University Technology Malaysia (January 2010): ISSN 1819-6608 vol no.1.
5. Justo, S.K Khanna and. Highway Engineering. New Delhi: Khanna publication, n.d.
6. Kadiyali, L.R. Traffic Engineering and Transport Planning. New Delhi: Khanna publications, n.d.
7. Olexandr Stepanchuk. (2018) Surveying of Traffic Congestions on Arterial Roads of Kyiv City.
8. R. Lalit & V. Parmar (2017) Traffic Signal and Junction Design: A Case Study of Rajkot City
9. S.Sanganaikar, Faisal M, V Leekha, (2017) Design of Traffic Signal at Kundahalli Junction Bengaluru Karnataka