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An Assessment of Cross Intersection: A Case Study of Kamshet-Pawna nagar road

Configuration to prevent accident and traffic jam on kamshet NH4

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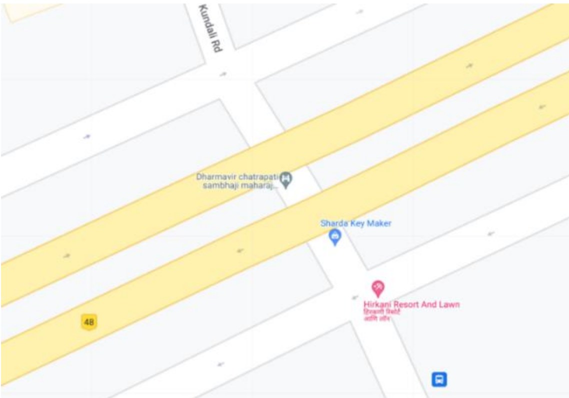
Abstract: Traffic jam is a major problem at the intersections of urban areas. because of the day-to-day growth of vehicular traffic is increasing the load on existing intersections and creating jam conditions vehicular movement. The traffic in Kamshet city is increasing day by day and the situation is now to be upgraded. Crossroad. In this paper an attempt has been made to address the problem of traffic congestion and abnormal delay in traffic. Movement by suggesting the design of fixed time signal in place of Cross Intersection in Kamshet - Pawana Nagar Crossing.

***Keyword* –** Traffic, Signal, Crossing

I. INTRODUCTION

An intersection is where two or more roads meet or cross at grade. The intersection includes areas required for all modes of travel: pedestrians, cyclists, motor vehicles and transit. Thus, the intersection includes not only the sidewalk area, but generally adjacent sidewalks and pedestrian ramps. There is through, turning and crossing traffic at an intersection, and these traffic movements can be controlled in different ways depending on the type of intersection, its design, and the control of traffic. Generally, intersection problems are unavoidable in the case of expressways or freeway systems, where such problems are avoided by providing grade-separated intersections and controlled access. Signal control is a frequently used measure of capacity constraints in urban areas. A sufficiently accurate way of estimating the potential of indicated intersections is critical to correct roadway design and effective traffic management. Signal control is generally considered to be the highest type of control possible at a grade intersection. If the signal control scheme is not designed properly, the signal control may be counterproductive. The ill-effects of improper signal planning can be congestion, undue delay, fuel wastage, air pollution, low intersection efficiency and tremendous inconvenience to the road user. To avoid such situation, it is imperative on the part of the traffic engineer to thoroughly study the traffic conditions, understand it properly and develop optimum cycle times and proper phases to suit the traffic requirements taking into account the geometry of the location.



II. OBJECTIVES

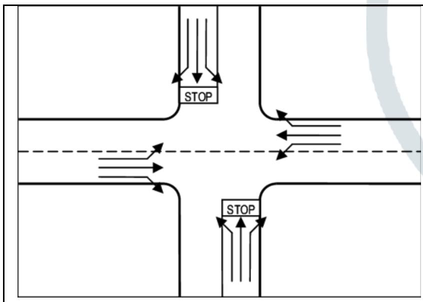
- To provide suggestion for modification of rotary intersection if required.
- To check whether the road has adequate capacity to accommodate future traffic volume.
- Find out the capacity of Cross Intersection

III. INTERSECTION USERS

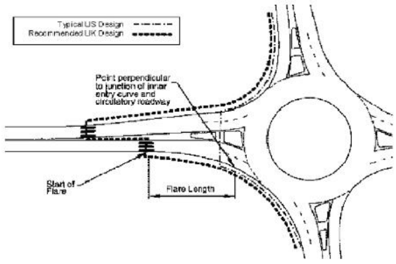
All roadway users are affected by intersection design such as: i. Pedestrians: Key elements affecting intersection performance for pedestrians are:(a) The amount of right-of-way provided for the pedestrian including both sidewalk and crosswalk width;(b) The crossing distance and resulting duration of exposure to motor vehicle and bicycle traffic;(c) The volume of conflicting traffic; and (d) the speed and visibility of approaching traffic. ii. Bicyclists: Key elements affecting intersection performance for bicycles are: (a) the degree to which pavement is shared or used exclusively by bicycles; (b) the relationship between turning and through movements for motor vehicles and bicycles; (c) traffic control for bicycles; and (d) the differential in speed between motor vehicle and bicycle traffic. iii. Motor vehicles: Key elements affecting intersection performance for motor vehicles are: (a) the type of traffic control, (b) the vehicular capacity of the intersection, determined primarily from the number of lanes and traffic control; (c) the ability to make turning movements; (d) the visibility of approaching and crossing pedestrians and bicycles; and (e) the speed and visibility of approaching and crossing motor vehicles. iv. Transit: Transit operations usually involve the operation of motor vehicles (buses), and therefore share the same key characteristics as vehicles as outlined above. In addition, transit operations may sometimes involve a transit stop in an intersection area, thereby influencing pedestrian, bicycle, and motor vehicle flow and safety. Additionally, in some cases, the unique characteristics of light-rail transit must be taken into account. In addition to the users of the street and intersections, owners and users of adjacent land often have a direct interest in intersection design. This interest can be particularly sensitive where the intersection is surrounded by retail, commercial, historic or institutional land uses. The primary concerns include: maintenance of vehicular access to private property; turn restrictions; consumption of private property for right-of-way; and provision of safe, convenient pedestrian access.

IV. INTERSECTION TYPES AND CONFIGURATIONS

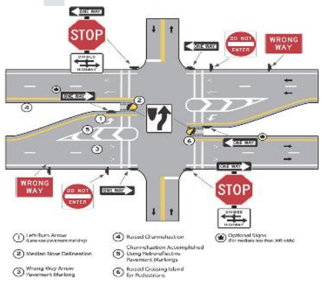
Squares can be classified into four major types based on their basic configuration: i. Ordinary intersections - Simple intersections maintain the specific cross section of the road and the number of lanes throughout the intersection on both major and minor roads. Simple intersections are best suited for locations where auxiliary (turning) lanes are not necessary to obtain the desired level of service, or are not possible due to nearby obstacles. ii. Flared intersections - The characteristic feature of flared intersections is the extension of a specific cross section (main, cross or both) of the road. Flaring is often done to accommodate a left-turn lane, to remove left-turning bicycles and motor vehicles from the through-traffic stream due to capacity in high-volume locations, and for safety on high-speed roads. be given. Right-turn lanes are used less frequently than left-turn lanes, usually in response to a large amount of right turn. iii. Channelized intersections - Channelized intersections use raised islands to designate the intended vehicle path. The most frequent use is to turn right, especially when accompanied by an auxiliary right-turn lane. At oblique intersections, channelization islands are often used to make a right turn, even in the absence of an auxiliary right turn lane. At intersections located on a curve, channelization islands can help direct drivers to and through the intersection. At large intersections, small central islands can be effectively used for pedestrian refuge. iv. Roundabout - Roundabout is a channelized intersection in which one-way traffic flows around a central island. All traffic as well as turns enter this one-way flow. Although usually circular in shape, the central island of the globule may be oval or irregularly shaped. Roundabout stops can be a suitable design choice for both controlled and signal-controlled intersections. At intersections of two-lane roads, roundabouts can usually function with a single circulating lane, making them possible to fit in most settings.



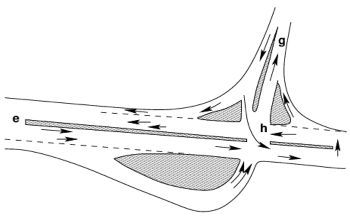
Cross Intersection



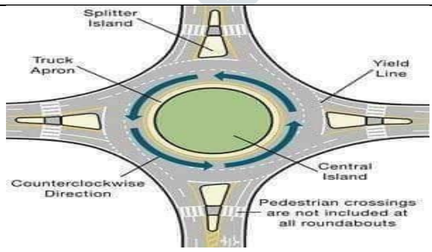
Flared Intersection



Additional throughout lane intersection



Channelized Intersection



Roundabout intersection

V. TRAFFIC SURVEY AND DATA COLLECTION

The traffic data is collected by manual method by counting the number of different types of vehicle approaching to the intersection from all the four directions and then converting the values in to the common factor called Passenger Car Unit (PCU). The traffic data is collected from 7 days of the week in different time intervals in summer days and the traffic data for calculation of the traffic rotary capacity is taken from the morning and evening peak hour.

Table 1: Number of vehicle approaching at intersection from different direction (in PCU)

Approach	Left Turning	Straight	Right Turning	Total
Pune (E)	596	890	156	1642
Lonavala (W)	652	998	326	1976
Pawana Nagar Road (S)	549	659	457	1665
Kamshet (N)	456	664	365	1485
Total	**2253**	**3211**	**1304**	**6768**

VI. CAPACITY OF CROSS INTERSECTION

The actual capacity of the cross intersection is dependent on the minimum capacity of the individual weaving section the capacity is calculated from the formula:

$$Qp = \frac{280W\left(1+\frac{e}{W}\right)\left(1-\frac{P}{3}\right)}{\left(1+\frac{W}{L}\right)}$$

Where,

Qp = practical capacity of the weaving section in pcu per hour.

W = width of weaving section (6 to 18m)

W = $e1+e2$ 2 + 3.5m e = average width of entry e1 and width non weaving section e2

L = length of weaving section between the ends of channelizing island in m

p = proportion of weaving traffic given by

$$p = \frac{b+c}{a+b+c+d}$$

a = left turning traffic moving along left extreme lane

d = right turning traffic moving along right extreme lane

b = crossing/weaving traffic turning toward right while entering the rotary

c = crossing/weaving traffic turning toward left while leaving the rotary

a. Kamshet to Pune (N-E)

$e= \frac{8.5+9.5}{2} = 9\ m$

$w= \frac{8.5+9.5}{2} + 3.5 = 12.5\ m$

$L= 4w = 4 \times 12.5m = 50\ m$

b. Pune to Pawana Nagar (E-S)

$e= \frac{9.5+8}{2} = 8.75\ m$

$w= \frac{9.5+8}{2} + 3.5 = 12.25\ m$

$L= 4w = 4 \times 12.25m = \ m$

c. Pawana Nagar to Loanavla (S-W)

$e= \frac{8.2+9.5}{2} = 8.85\ m$

$w= \frac{8.2+9.5}{2} + 3.5 = 12.35\ m$

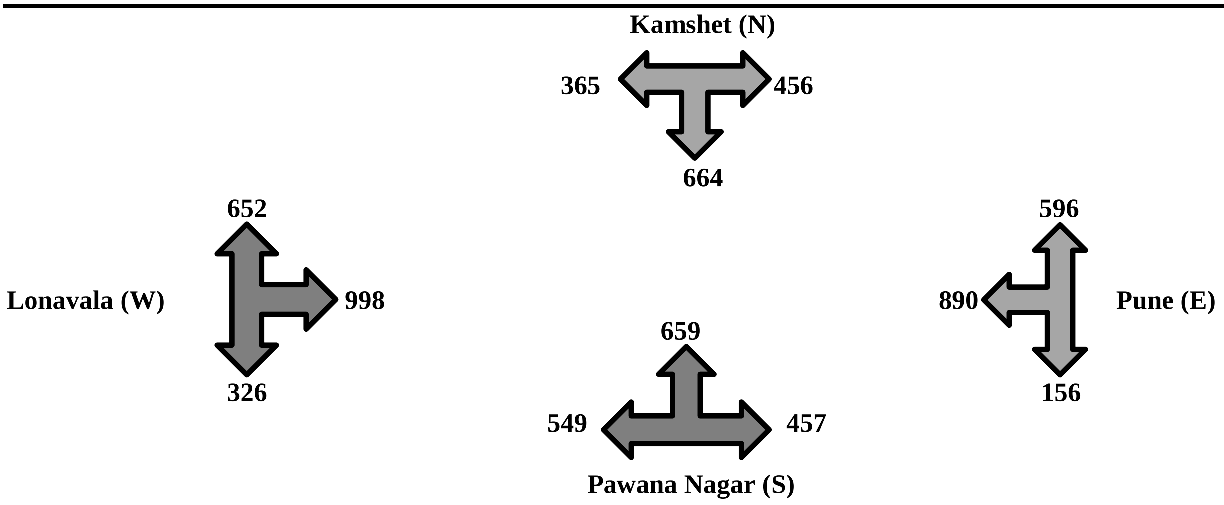
$L= 4w = 4 \times 12.35m = 49.4\ m$

d. Lonavala to Kamshet (S-W)

$e= \frac{9.5+8.5}{2} = 9\ m$

$w= \frac{9.5+8.5}{2} + 3.5 = 12.5\ m$

$L= 4w = 4 \times 12.5m = 50m$



$$P_{NE} = \frac{156+890+457+664}{156+890+664+457+596+365} = 0.69$$

$$P_{ES} = \frac{998+326+890+365}{998+326+890+365+652+156} = 0.761$$

$$P_{SW} = \frac{659+457+998+156}{659+457+998+156+549+326} = 0.721$$

$$P_{WN} = \frac{326+659+664+365}{326+659+664+365+456+457} = 0.688$$

Now find out capacity of cross intersection

$$Qp = \frac{280\,W\left(1+\frac{e}{W}\right)\left(1-\frac{P}{3}\right)}{\left(1+\frac{W}{L}\right)}$$

Capacity of intersection for Kamshet to Pune

$$Qp_{\,NE} = \frac{280\times12.5\left(1+\frac{9}{12.5}\right)\left(1-\frac{0.6927}{3}\right)}{\left(1+\frac{12.5}{50}\right)} = 3704$$

Capacity of rotary intersection Pune to Pawana nagar

$$Qp_{\,ES} = \frac{280\times12.25\left(1+\frac{8.75}{12.25}\right)\left(1-\frac{0.761}{3}\right)}{\left(1+\frac{12.25}{49}\right)} = 3585$$

Capacity of rotary intersection Pawana Nagar to lonavala

$$Qp_{\,SW} = \frac{280\times12.35\left(1+\frac{8.85}{12.35}\right)\left(1-\frac{0.721}{3}\right)}{\left(1+\frac{12.35}{49.4}\right)} = 3607$$

Capacity of rotary intersection lonavala to kamshet

$$Qp_{\,WN} = \frac{280\times12.5\left(1+\frac{9}{12.5}\right)\left(1-\frac{0.688}{3}\right)}{\left(1+\frac{12.5}{50}\right)} = 3711$$

The capacity of the cross intersection is the minimum of the capacity of all weaving sections. Now the above result shows that the maximum capacity of cross intersection is 3711 PCU/hr. And the total traffic entering the intersection is 6768 PCU/hr. so in this the case. **Signalized cross** intersection can be provided to avoid traffic jam.

VII. RESULT AND CONCLUSIONS

From the analysis of the collected data, we concluded that the oncoming traffic at the intersection is very high. 6768 PCU/hr and we know that a cross intersection can handle a maximum traffic volume of 3711 PCU/hr. So by analysis we can It is concluded that the existing crossroad is not capable of handling such a high volume of traffic. And if you can split the traffic by starting Traffic signs with cross intersection, it will split the traffic into about half the traffic which is currently coming Crossroad. So a two stage traffic sign with a total cycle time of 60 seconds shall be installed with the cross intersection so that the crossroad can handle high volume of traffic.

LITERATURE REVIEW

S. Darmaul and his colleagues said that there is disturbance in urban transport, which leads to long queues and increased waiting time at signaled intersections. They rely on concepts and mechanisms inspired by biological immunity to design a distributed, intelligent and adaptive traffic signal control system. They suggest a heterocyclic multi-agent architecture, where each agent represents a traffic signal controller assigned to the signaled intersection. Each agent communicates and coordinates with neighboring agents. and achieves learning and adaptation to disturbances based on an artificial immune network. The suggested Immune Network Algorithm Based Multi Agent System (INAMS) provides intelligent mechanisms that explicitly capture disturbance-related knowledge and take advantage of past successes and failures in disturbance handling through optimization of reinforcement theory. The network is simulated with VISSIM, a state-of-the-art traffic simulation software. [1]

Y. Zakaria and S.I. Rabia, Estimating Minimum Delay Optimal Cycle Length Based on Time-dependent Delay Formula For fixed time traffic signal control, the well-known Webster's formula is widely used to estimate minimum delay optimum cycle length goes. However, this formula underestimates the cycle length for high levels of saturation. He proposed two regression formulas to estimate the minimum delay optimum cycle length based on the time-dependent delay formula used in the Canadian Capacity Guide and the Highway Capacity Manual (HCM). For this purpose, a search algorithm was developed to determine the minimum delay optimal cycle length required for regression analysis. Numerical results show that the proposed formulas give better estimates for optimal cycle lengths at high intersection flow ratio s than Webster's formula. [2]

M. Ghanbarikarni and colleagues provide a timing optimization algorithm for traffic signals using an internal timing policy based on balancing the queue time ratio of vehicles across network links. In the proposed algorithm, the difference between the actual queue time ratio and the optimal one for each link of the intersection was minimized. To evaluate the efficiency of the proposed algorithm on traffic performance, the proposed algorithm was implemented in a hypothetical network. By comparing the simulating software (Amsun) outputs before and after implementing the algorithm, they concluded that the queue time ratio algorithm improved traffic parameters by increasing the throughput as well as reducing the latency time and density of the network. [3]

X. Chen and M.S. Lee worked on comparing the results of different software on multi-lane roundabouts, his study showing that discontinuous entry flow patterns (i.e., one entrance has significantly higher flow than others) lead to overall roundabouts of queues and can accelerate the delay. Various software packages including RODEL, SIDRA and VISSIM were then used to estimate multiple performance measurements, such as capacity, queue length, and delay, compared to the collected field data. With comparison, it is found that all three software packages estimate multi-lane roundabout capability prior to calibration. With default parameters, SIDRA and VISSIM underestimate delays and queue lengths for multi-lane roundabouts under congestion, while RODEL results in higher delays and queue length estimates on most entry approaches. [4]

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