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Review Paper On Infrastructure Management For Signal Free Movement

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Abstract—

In the present-day scenario almost all the road traffic consists of mixed traffic, i.e. the combination of both Non-Motorized and Motorized traffic. The mixed traffic affects the characteristics of the traffic stream to a great extent. Non-Motorized Vehicles are the vehicles which will run with the power of human beings or animals. The non-motorized vehicles include bicycles, rickshaws, and hand drawn vehicles, pull carts and so forth. Motorized vehicles are those vehicles which run with the power of the engines. The motorized vehicles are divided into light motorized vehicles and heavy motorized vehicles. Light motorized vehicles consist of auto rickshaws, jeeps, taxis, motorcars, three-wheeler conveyance vans and so forth. Motorcycles do not come under this category. Heavy motorized vehicles consist of vehicles with number of wheels more than six.

I. INTRODUCTION

Heavy motorized vehicles consist of vehicles with number of wheels more than six. This Heavy Motorized Vehicles consists of Buses, Lorries, and Trucks etc. As per the World Bank survey about 50 percent of the non-motorized vehicles are present in the south Asian nations like India, Bangladesh. In Bangladesh, the maximum number of trips generated during peak hours is due to non-motorized vehicles like bicycles, rickshaws. The presence of non-motorized vehicles affects the capacity of the section. With the increase in the Non-Motorized vehicle capacity, the total capacity of the section will be reduced, affects the safety of the total stream and the declining of energy resources (petrol, diesel etc.). In order to minimize the consequences of Non-Motorized vehicles there should be a separate track for Non-Motorized vehicles like in U.S.A. or else proper study should be made on the Non-Motorized vehicles and its effects on the traffic stream. In India practically it is not possible to lay a separate track for Non-Motorized vehicles, so proper study has to be conducted on Non-Motorized Vehicles and its characteristics along the mixed stream. Hence Non-Motorized vehicular movement and its effects on traffic characteristics are taken into account in the project.

A. TRAFFIC FLOW PARAMETERS:

1. Speed:

Speed is defined as the time taken by a vehicle to cross certain distance and is denoted by ‘u’. As per traffic terminology, speed is the distance travelled by a vehicle over a certain period of time. While considering a section, individual speed is not considered, average speed is considered. There are two speeds available. They are time mean speed, space mean speed. Time mean speed: It is the arithmetic mean of the speeds that occur in the section with the flow of vehicles.

Space mean speed: It is the harmonic mean of the speeds of the vehicles that occurred over the space at instant time or it is the ratio of the length of the section to the average time of vehicles crossing that section.

2. Flow:

Flow is defined as the number of vehicles that are traversing a section over a certain period of time. It is denoted by ‘q’.

Units: vehicle/time

3. Density:

The number of vehicles that are occupying a section at a particular time is defined as Density.

B.BACKGROUND

1. Overview

Rotary intersections or round abouts are special form of at-grade intersections laid out for the movement of traffic in one direction around a central traffic island.

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Essentially all the major conflicts at an intersection namely the collision between through and right-turn movements are converted into milder conflicts namely merging and diverging. The vehicles entering the rotary are gently forced to move in a clockwise direction in orderly fashion. They then weave out of the rotary to the desired direction. The benefits, design principles, capacity of rotary etc.

2. Advantages and disadvantages of rotary

The key advantages of a rotary intersection are listed below:

1. Traffic flow is regulated to only one direction of movement, thus eliminating severe conflicts between crossing movements.
2. All the vehicles entering the rotary are gently forced to reduce the speed and continue to move at slower speed. Thus, none of the vehicles need to be stopped, unlike in a signalized intersection.
3. Because of lower speed of negotiation and elimination of severe conflicts, accidents and their severity are much less in rotaries.
4. Rotaries are self-governing and do not need practically any control by police or traffic signals.
5. They are ideally suited for moderate traffic, especially with irregular geometry, or intersections with more than three or four approaches.

Although rotaries offer some distinct advantages, there are few specific limitations for rotaries which are listed below.

1. All the vehicles are forced to slow down and negotiate the intersection.

Therefore, the cumulative delay will be much higher than channelized intersection.

2. Even when there is relatively low traffic, the vehicles are forced to reduce their speed.
3. Rotaries require large area of relatively flat land making them costly at urban areas.
4. The vehicles do not usually stop at a rotary. They accelerate and exit the rotary at relatively high speed. Therefore, they are not suitable when there are high pedestrian movements.

3. Guidelines for the selection of rotaries

Because of the above limitation, rotaries are not suitable for every location. There are few guidelines that help in deciding the suitability of a rotary. They are listed below.

1. Rotaries are suitable when the traffic entering from all the four approaches are relatively equal.
2. A total volume of about 3000 vehicles per hour can be considered as the upper limiting case and a volume of 500 vehicles per hour is the lower limit.
3. A rotary is very beneficial when the proportion of the right-turn traffic is very high; typically, if it is more than 30 percent.
4. Rotaries are suitable when there are more than four approaches or if there is no separate lanes available for right-turn traffic. Rotaries are ideally suited if the intersection geometry is complex.

4. Traffic operations in a rotary

As noted earlier, the traffic operations at a rotary are three; diverging, merging and weaving. All the other conflicts are converted into these three less severe conflicts.

1. Diverging: It is a traffic operation when the vehicles moving in one direction is separated into different streams according to their destinations.
2. Merging: Merging is the opposite of diverging. Merging is referred to as the process of joining the traffic coming from different approaches and going to a common destination into a single stream.
3. Weaving: Weaving is the combined movement of both merging and diverging movements in the same direction. These movements are shown in figure 1. It can be observed that movements from each direction split into three; left, straight, and right turn.

II. STATE OF DEVELOPMENT

Sougata Maji In this paper author study the actual cause behind the congestion through primary survey and observed the situation of the road at peak hour (9.30am-10.30am). Based on the analysis of current situation, the paper presents some logical solutions which are available within Asansol transport system only need proper execution in a right way. The advantage of the paper is the recommended solutions is supportable by financial condition, less harassment to common people, safety from accident, reducing trip delay, and welfare for city environment. But in case of implementation there may come constraints like-lake of regular monitoring

system, lake of operational efficiency, delay in implementation etc. By considering the policy gap the above maintain solutions can mitigate the congestion in Asansol city at greater extent. Keeping in view the essentiality of time and population growth The Asansol Municipal Corporation needs to implement such kind of solutions to maintain proper traffic flow. The advantage of the paper is the recommended solutions is supportable by financial condition, less harassment to common people, safety from accident, reducing trip delay, and welfare for city environment. But in case of implementation there may come constraints like-lake of regular monitoring system, lake of operational efficiency, delay in implementation etc. By considering the policy gap the above maintain solutions can mitigate the congestion in Asansol city at greater extent. Keeping in view the essentiality of time and population growth The Asansol Municipal Corporation needs to implement such kind of solutions to maintain proper traffic flow.

Sharukh Marfani Studied Traffic Improvement for Urban Road Intersection, Surat. This paper presents improvement of intersection at Simada Naka Junction, Surat which is one of the fastest growing cities of India. Surat is a rapid growing city suffering from traffic congestion. The aim of this paper is to investigate problem and to provide necessary solutions. The analysis is based on video graphic method, data has been collected of peak hours at the selected intersection. Volume conversion is carried out by adopting PCU values from IRC recommendations. Various other traffic flow characteristics are calculated from empirical formula proposed by Transportation Road Research Lab (TRL). Various alternatives have been referred for the solution and out of various alternatives rotary design is taken into account which will be helpful in managing traffic flow on intersection. List of various other proposals has been enclosed in this paper.

Chaudhari Dron This paper gives a suggestion to solve the problem which affects the other traffic along the stretch, Traffic congestion occurs due to various modes of vehicle. Lack of Mass Transportation System, road user uses the personal vehicle or other alternatives for transportation. This study deals with the improvement of Mass Transportation planning between origin and destination. There are many road users uses a personal vehicle, which produced adversely affect total transportation cost and environment.

Toan Trinh Dinh Traffic congestion is a pervasive and serious problem confronting many large cities in the world. Much of the effort and resources have been devoted to relieving traffic congestion, but there have been only a few successful cases. The reasons are of many, but generally due to the failure to accommodate or to manage travel demand, that is, to strike the balance between supply and demand for transport. Singapore has been quite successful in managing a sophisticated system of road traffic despite the rapid growth of economy, population and mobilization. Constrained by a limited physical space, Singapore has to give special attention to managing the growth of transport demand. Singapore has been the first country in the world who introduced successfully special schemes for traffic congestion management, notably the Area License Scheme, the Vehicle Quota System, and the Electronic Road Pricing system

Saurabh Gupta They studied Solution for Reduction of Traffic Congestion at Polytechnic Roundabout, Bhopal. For the present study, all the seven road stretches were selected. The first section is at Science Center Road from NITTTR Bhopal to Intersection. The section is of length 10m. This road is 7-Meter wide two-way road. The footpath is provided on both side of 1m to 1.5m. The road has side parking. The traffic on the road consists of the bike, car, three wheelers (Auto rickshaw, loading and tempo), and cycle thella. So this road is taking in the category of collector road.

Roxanne Hawi They has presented a study on Techniques for Smart Traffic Control. A review on the use of technology to control and manage traffic was presented in this paper. It is observed that the implementation of smart technology in transportation systems has a substantial impact on traffic levels. While the static systems provide a simpler method of automatically controlling traffic; they do not have the flexibility needed on most urban junctions which serve non uniform traffic from the various approaches/roads. Advancement in AI has further led to the development of intelligent traffic control systems. The main objective

of these smart systems is to have the traffic lights mimic the human intelligence thus eliminating the need of having traffic officers control traffic on the roads.

Devarshi Chaurasia She has presented a paper which includes Bus Rapid Transit System (BRTS): A Sustainable Way of City Transport (Case Study of Bhopal BRTS).Author had concluded 'System' that represents an integrated approach to develop not only dedicated lanes for buses but to provide safe and comfortable corridors for pedestrians, cyclists, motor vehicles etc. The important elements of BRT system are bus stops, Foot Over Bridges, Pedestrian Subways, platform, curbs, railings, Public Information System, Pedestrian Crossing Signals, Signages and road markings should be passenger / user friendly of all age groups (Old age, Children), gender and people with varied physical conditions (Pregnant Woman, Wheel Chair Bound Person, Vision Impaired) etc. In, other words BRT system provides us an opportunity to develop our cities in a holistically manner, so that anyone can use it with pride.

Ninad Lanke Traffic congestion is a major problem in many cities of India along with other countries. Failure of signals, poor law enforcement and bad traffic management has lead to traffic congestion. One of the major problems with Indian cities is that the existing infrastructure cannot be expanded more, and thus the only option available is better management of the traffic. Traffic congestion has a negative impact on economy, the environment and the overall quality of life. Hence it is high time to effectively manage the traffic congestion problem. There are various methods available for traffic management such as video data analysis, infrared sensors, inductive loop detection, wireless sensor network, etc. All these methods are effective methods of smart traffic management. But the problem with these systems is that the installation time, the cost incurred for the installation and maintenance of the system is very high.

Booz Allen Hamilton Over the last several decades, the gap between the state of the art and the state of the practice in traffic signal operation has grown. Influential studies such as the 1994 General Accounting Office report to Congress have reported improved technological capabilities that go unused in agencies that increasingly find it difficult to meet the expectations of policy makers and the public. Managing the expectations of the agency managers and decision makers to coincide with the purpose and objective of traffic signal operations has become an increasingly more difficult task for experienced practitioners and traffic signal system managers. The lack of clearly stated operational objectives may contribute to an unrealistic expectation that traffic signals can create capacity, when in fact they can only distribute it. Yet signal operations activities such as retiming projects and traffic signal infrastructure projects are most often proposed by those same practitioners to meet the expectation of relieving congestion.

Changxi Ma Ring roads have been widely built in many cities, especially in the central districts with excessively heavy traffic demands and frequently generated congestion. In order to improve the operations and reduce traffic delay on urban ring roads, this paper developed a coordinated signal control system for urban ring roads under vehicle-infrastructure connected environment. The speed guidance would be provided to motorists utilizing four sub-systems including detection, communication, signal control, and expected speed calculation in the system. The signal timing parameters such as cycle length, green split, and offset, would be adjusted based on the artificial bee colony-shuffled frog leaping algorithm. The proposed signal control system had been test using VISSIM simulation model and the simulation results showed that the average delay, number of stops, and queue length were significantly improved compared with the conventional traffic control system.

M. Shahgholian Nowadays the problem of traffic congestion is known as the main cause of air pollution in the cities of the world. Urban traffic engineers and managers have proposed three general approaches to dealing with this phenomenon. The first approach expands the capacity of the urban traffic network (UTN). This approach cannot be implemented in many urban areas due to urban density and traffic volume. Further, implementation of this approach, in addition to its high cost, requires an accurate understanding of the dynamic

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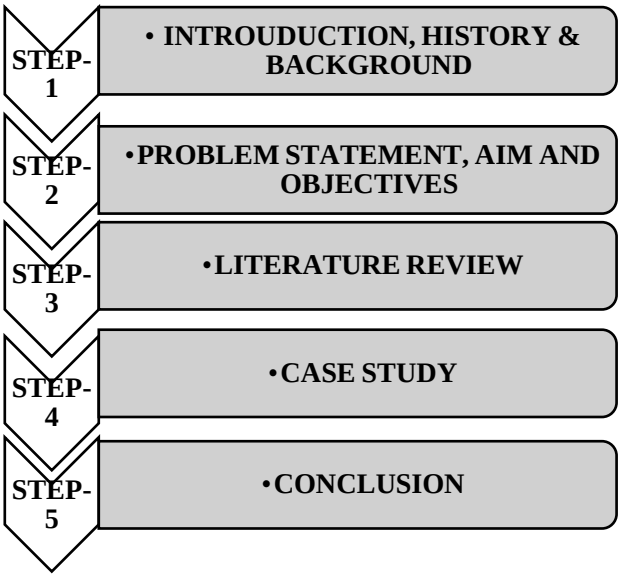
and static properties of UTN for well planning. The second approach can be called the traffic assignment. In this approach, through software applications or information boards, network managers are informed about the users' status in the network and offer the best route to them. Finally, the third approach involves optimizing the capacity of the UTN. This approach tries to control the traffic actuators in order to create the maximum capacity for network users. Maximum capacity means that the total amount of urban trip times is minimized or the total flow of the network links is maximized. Therefore, it can be said that the advanced traffic management systems (ATMS) are based on four main sections. These four sections include traffic information, traffic assignment, traffic optimization, and traffic prediction. This paper initially presents an overview of these four sections, in the end, it proposes a development strategy for the ATMSs.

III. METHODOLOGY

The purpose of this project is to study the Infrastructure management to reduce traffic congestion and signal free movement.

In order to achieve above stated purpose, following approaches are outlined:



A. GRADE SEPARATIONS & INTERCHANGES

There are three types of roadway intersections: intersections at-grade, grade separations without ramps, and interchanges. Each type has specific characteristics and applications. Each is appropriate to use in the proper context. Using an inappropriate solution for a specific context can lead to serious safety and operational issues. This chapter discusses both general considerations and specific design features for interchange and grade separation facilities. Interchanges require major investments and may have significant impact on the natural and built environments. They are the key elements of well-functioning access-controlled facilities. The decision to use an interchange as a transportation solution requires careful and complete study, including traffic analysis, geometric design, and environmental impacts. To work properly, an interchange needs to fit into the context of the roadway system, the surrounding area, and be supported by an adequate network of local facilities

B. Types of Grade Separation

Grade separation is generally achieved by my means of a vertical level. For example, if two roads are intersecting at one point on a ground level, then grade separation is achieved by raising or lowering the profile of one of the roads with respect to ground level. So, the traffic from both roads will never meet and safety aspect stays intact. Grade separation can be achieved by two types of intersections and they are:

- Overpass
- Underpass

1. Overpass

When the vertical profile of one highway is raised with the help of embankments and over-bridge arrangement to eliminate intersection with another highway on ground level, then it is said to be overpass.

Fig 1: Overpass

2. Underpass

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Similarly, when the vertical profile of one highway is lowered with respect to ground level in the form of tunnel to avoid intersection with another highway then it is said to be underpass.

Fig 2: Underpass

3. Interchanges

Grade separation eliminates intersection of traffic flow at junctions but it is incomplete without provision for interchanges. Interchanges facilitates the change of direction of traffic from one highway to another highway at intersections.

Interchange ramps at grade separations can be provided in three different types and they are :

- Direct interchange
- Semi-direct interchange
- Indirect interchange

In the case of direct interchange, the vehicle is diverged into the right side and merged from the right while in case of semi-direct interchange, the vehicle is diverged to its left side and merged from right. In case of indirect interchange, vehicle is diverged to its left and merged from left. All these three are shown in image below.

III. PROBLEM STATEMENT

A rotary intersection or traffic rotary is an enlarged road intersection where all converging vehicles are forced to move round a large central island in one direction before they can weave out of traffic flow into their respective directions radiating from the central island. In India and other countries which follow “keep to the left” regulation clockwise direction of flow around a island is followed.

Grade separated intersections design is the highest form of intersection treatment. This type of intersection causes least delay and hazards to the crossing traffic and in general is much superior to intersections at grade from the point of view of traffic safety, operation and capacity.

A. STUDY AREA 1- DANGE CHOWK

Dange Chowk in Thergaon is located at the junction of the Sangvi-Kiwale bus rapid transit system (BRTS) road and Chinchwad-Hinjawadi Road. The civic body had constructed two parallel flyovers at this chowk around five years ago to enable vehicles coming from Tathawade to go to Kalewadi phata and vice versa without halting at the chowk. The BRTS buses pass through the two lanes on the ground-level in the middle space between the two flyovers.

Fig 3 Dange Chowk

B. STUDY AREA 2- NASHIK PHATA

- To Construct a link between Westerly Bypass (NH-4) and Pune Mumbai Road
- The link will traverse across River Pawana and Central Railway tracks
- This link will further connect NH-50 and will convert the Nashik Phata from 3 legged to 4 legged intersection
- A bridge across River Pawana
- ROB across Central Railway
- Flyover across Pune Mumbai Road connecting NH-50
- Ramps and Underpasses for turning traffic

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Fig 4 Nashik Phata Junction

C.STUDY AREA 3- BHAKTI – SHAKTI JUNCTION

- Low turning Visibility due to existing traffic rotary, which leads to accidents?
- Deficient Junction Geometry
- Due to Shape of rotary, right turning larger trucks from Bhosri directions needs more time in weaving which leads to more traffic delay at the junction.

• Traffic from Mumbai to Pune direction has to stopped twice in the total signal time that also leads to traffic delay

III. CONCLUSION

This paper focuses only on the literature review of previously published studies. The findings of this paper are the recommended solutions is supportable by financial condition, less harassment to common people, safety from accident, reducing trip delay, and welfare for city environment. This study deals with the improvement of Mass Transportation planning between origin and destination. There are many road users uses a personal vehicle, which produced adversely affect total transportation cost and environment. smart systems is to have the traffic lights mimic the human intelligence thus eliminating the need of having traffic officers control traffic on the roads. The results obtained from these surveys and observations led to the investigation of the causes and solutions to the congestion in this area. The grade separator will enable vehicles. Due to this connectivity travel time and fuel consumption will be reduced also minimize Environment Pollution.

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