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"Synchronization of Traffic Signal at Indore City" (Radisson Square to Lavkush Square)

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ABSTRACT

Synchronization of Traffic signal is quite an important aspect forth effective traffic management issues. Most of the traffic problems are caused by certain deficiencies in management. The traffic congestion, vehicular delays, risk of accident, uneconomic travel, and other psychological strains are the observed. Signal Synchronization Signal synchronization is a standard procedure of signal timing. The objective of this project is Improving Traffic System at Some Intersections of Indore. During the past decade, major cities have undergone haphazard growth of Industrialization, urbanization of the country. Consequently, the urban population has to travel greater distances within minimum possible time. To manage travel demand the intersections should give the least resistance to traffic flow so that the travel time can be minimized. The most requirement of heavy traffic cities is to absorb the growing traffic demand but within the same physical dimensions at the intersection. These days all-around the globe efforts are being put forward to protect the environment to save the earth. In this work, an attempt has been made to study the various intersections, so as to minimize the delays at these intersections and consequently improve the level of service. A traffic signal can be synchronized so that a vehicle starting at one end of the Street and traveling at Reassigned speed can go to another end without stopping for the red light. At each intersection, the existing traffic has been estimated and then the signal is designed. To improve the level of service at intersections and to minimize delay, optimized signal has been synchronized and benefits are estimated.

Keywords : PCU, Saturation Flow, Delay, Traffic Signal, Synchronization, Traffic Survey.

I. INTRODUCTION

There is a sudden explosion of vehicular traffic in modern times and as such, various techniques and methods are to be found out to make the movement of vehicles smoother and easier. For this purpose, a special branch of engineering, known as traffic engineering has now been recognized and it includes the study of regulations for traffic, characteristics of traffic controlling and guiding measures for traffic, flow of traffic at junctions parking areas, traffic survey, engineering elements of road system affecting traffic operations, improvement of traffic facilities in existing towns, etc.

As the traffic on the existing road system in cities grows, congestion becomes a serious problem. Medium and long term solution like widening roads, providing elevated flyover and constructing bypasses and urban expressway are costly. Simple and inexpensive solutions can tide over the crisis for some time. Transportation makes the most productive and cost-effective use of existing transportation facilities, service, and modes.

Many of the urban streets carry traffic volumes for which they were not simply designed. The inevitable result is a delay, congestion, and accidents. The resultant ills can get over to some extent by controlling the traffic, imposing regulatory measures and enforcing management techniques, so as to make the most economic use of the streets. Traffic control measures include traffic signals and these have been already considered. Regulatory measures include restrictions on speed, parking, the size of vehicles and so on, and these also have been discussed separately. A third of the set of measure available to the traffic engineer are collectively known as traffic management measures.

The increasing vehicular traffic on the urban road in network demands an effective measure of traffic control on road –network, especially at the intersection, where turning movement of the vehicle and mixed traffic creates congestion, traffic jam. All the Metropolitan cities in India face this problem in an acute form. The provision of the signal at the intersection is one of the methods to control the traffic, signal permits the leg wise movement of the traffic and synchronization is the coordination between relative signals.

II. METHODS AND MATERIAL

A. Overview of Papers

Arash M. Roshandeh, Herbert S. Levinson (2014)[1] This study introduces a new methodology for signal timing optimization that is carried out by adjusting green splits of a.m. peak, p.m. peak, and rest of the day timing plans for each signalized intersection in the urban street network without changing the existing cycle length and signal coordination to minimize total vehicle and pedestrian delays per cycle. It contains a basic model that handles vehicle delays only and an enhanced model that simultaneously addresses vehicle and pedestrian delays using two different pedestrian delay estimation methods. Both models are incorporated into a high-fidelity simulation-based regional travel demand forecasting model for detailed traffic assignments. A computational study is performed for methodology application using data on Chicago metropolitan area travel demand, traffic counts, geometric designs, and signal timing plans for major intersections in the Chicago central business district (CBD) area. A sensitivity analysis is conducted on the application of the enhanced model to examine the impacts of assigning different weights to the vehicle and pedestrian delays on intersection vehicle travel time and delay reductions after signal timing optimization. The computational experiment reveals that after system wide signal timing optimization, vehicle delays in the CBD area could reduce by 13% when considering only vehicle delays and by 5% when simultaneously considering vehicle and pedestrian delays.

Said M. Easa, M.ASCE; and Jianchuan Cheng (2013)[2] The current method of computing the minimum pedestrian green interval for intersection signal timing assumes that the component variables are deterministic. This paper presents a probabilistic method in which the pedestrian start-up time and walking speed are random variables. To establish pedestrian characteristics, data were collected at 14 intersections in downtown, suburban, and tourist areas. The method is based on a safety margin that is defined as the difference between the supplied and demanded green intervals, where the demanded green interval is a random variable. Relationships for the mean and standard deviation of the safety margin of the demanded green interval are developed on the basis of the first-order second-moment analysis. A closed-form solution for the minimum supplied green interval is then derived as a function of the relevant variables, including the vehicular wintergreen interval and its component variables. A procedure for establishing the walk and the flashing "don't walk" intervals is presented. Graphical aids for determining the minimum pedestrian green interval were developed, and application of the proposed method is illustrated using numerical examples. The sensitivity analysis shows that the minimum pedestrian green interval is much more sensitive to the walking speed than the start-up time or their correlation.

Ilsoo Yun, ; Byungkyu (Brian) Park, (2012)[3] Existing state-of-the-practice traffic signal timing optimization programs rely on macroscopic and deterministic models to represent traffic flow, including coordinated actuated traffic signal systems. One distinct shortcoming of such an approach is its inability to account for the stochastic nature of traffic, such as the variability in traffic demand, driver behavior, vehicular inter-arrival times, vehicle mix, and so forth. In addition, the existing traffic signal timing optimization programs for coordinated actuated traffic signal systems still focus on four basic traffic signal timing parameters (i.e., cycle length, green times or force-off points, offsets, and phase sequences). Studies have shown that actuated signal settings such as minimum green time, vehicle extension, and recall mode are also important parameters in traffic signal operations. This study presents the development of a stochastic optimization method for coordinated actuated traffic signal systems. The proposed method accounts for stochastic variability by using a well-calibrated microscopic simulation model, instead of a macroscopic and deterministic model, and it simultaneously optimizes actuated signal settings and the four traffic signal timing parameters by adopting a genetic algorithm with special decoding schemes. The proposed method was applied to a real-world arterial network in Charlottesville, Virginia. The performance of the proposed method was compared with that of an existing traffic signal timing optimization program, The results indicated that the proposed method outperforms the existing timing plan and the Synchro-optimized traffic signal timing for the tested arterial network.

H.S.Goliya and Nitin Kumar Jain (2012)[4] During the past decade major cities have undergone haphazard growth of Industrialization, urbanization of the country. Consequently, the urban population has to travel greater distances within minimum possible time. To manage travel demand the intersection should be given least resistance to traffic flow so that the travel time can be minimized. The present requirement of metropolitan cities is to absorb the growing traffic demand but within the same physical dimension at the intersection. These days all around the globe efforts are being put forward to protect the environment to save the earth. In this paper, an attempt has been made to study the various intersections, so as to minimize the delays at these intersections and consequently improve the level service. A traffic signal can be synchronized so that a vehicle starting at one end of the Street and traveling at Reassigned speed can go to another end without stopping for the red light. At each intersection, the existing traffic has been estimated and then signal designed. Improve the level of service at intersections and to minimize delay, optimized signal has been synchronizing and estimated the benefits.

Liang-Tay Lin, Li-Wei ChrisTung (2010)[5] For the most part, optimal signal timing is the most effective and economical method for mitigating traffic congestion in urban areas. In this study, a new mixed integer nonlinear programming model is proposed to develop an optimal arterial-based progression algorithm. The proposed algorithm is designed to optimize the bandwidths for contiguous signals along a signalized arterial. The traffic conditions for examining the proposed algorithm are extracted from moderate to high saturated traffic conditions. The main objective of the proposed algorithm is to allow traffic to traverse through the maximum number of downstream intersections without a stop. According to measures of effectiveness, the signal timing generated by the proposed model yields lower stops when compared with the signal timing optimized and generated by Synchronization. In addition, the proposed model yields lower network-wide average delays sec/vet and higher average travel speed km/h under moderate to high saturated traffic conditions. Focuses on the former condition. A test program to investigate whether this condition occurs was carried out for a range of pedestrian densities, complementing data previously published on this subject. The head movement of pedestrians walking both in groups and in a flow was recorded by a video camera, and the examination of the video indicated no synchronization from densification. However, it was observed that the lateral sway of the pedestrian's bodies increased with the increase of density. By using an existing model of an inverted pendulum to estimate lateral forces

Roberto Leal Pimentel1; Moacir Carlos Araújo Jr. (2002)[6]Crowding is a critical condition for footbridges that are prone to vibration problems from pedestrian loads. Synchronization of pedestrian movements has been identified as the cause of the excessive lateral vibration in some footbridges. Two conditions have been named as the cause of synchronization increase in the crowd. Density and pedestrian structure interaction. The former would be related to the onset of the phenomenon the latter takes place after structural vibration reaches a certain level. This paper applied by a pedestrian and using the collected data as input to the model, a steady increase of lateral force from the rise in density was observed, it reached a 104% increase in a density of 1.8 pedestrians/m^2 compared with the force applied for an unrestricted walking condition.

Booz Aleen Hamilton (2009)[7]*:* This report presented the concept of good basic service as a reflection of the agency. Archetypes that most effectively focused their resources, however, plentiful or scarce, on their most important objectives. The interviews revealed that even the best agencies have difficulty articulating and maintaining that focus. This section will outline key strategies for doing so, and an outline of how to embody those strategies in a traffic signal management plan. These objective lead to a few high-level strategies for the agency to promote field infrastructure reliability and signal timing that minimizes and balances congestion.

Per Garder (2004)[8]***:*** The primary objective is to inform the department of transportation and the public of how red light running contributes to crashes at signalized intersection, why they occur and how such crashes can be made less common. The result of the research should ultimately lead to fewer serious crashes at signalized intersection. Safety optimization obviously has to be balanced with other operational concern such as delay and air emission.[3]

Paul P.-Jovanis and John A. Gregor (2000)[9] Coordinated timing plans may be developed for actuated signal systems but all existing optimization methods require that each actuated signal be converted to its nearest equivalent pretimed unit. Using bandwidth maximization as a starting point, a new procedure is developed that specifically accounts for actuated timing flexibility. Yield points and force-offs at non-critical signals are adjusted so they just touch the edges of the through-band while critical signals are unmodified. This method is applied to a data set describing midday traffic conditions on an urban arterial system of six signals in central Illinois. Simulation is used to evaluate these timing plans and compare them with corresponding pre-timed alternatives.

Despite the broad implementation of these arterial actuated systems, existing methods overwhelmingly focus on coordination of pretimed arterial systems. The section briefly reviews the literature concerning arterial traffic signal timing methods, highlighting characteristics that are most important for their application to actuated systems. This review reveals that existing methods for coordinating pretimed systems assume away many of the advantages inherent in the flexibility of actuated systems.

Anuj Sharma; Lelitha Vanajakshi (1997)[10] Signalized intersections are provided in traffic networks to improve the safety and efficiency of vehicular and pedestrian movement. Various measures under education, enforcement, and engineering headings being attempted to improve the safety and efficiency of operations at signalized intersections. Provision of a signal countdown timer, a timer showing the remaining red and green time in a phase, is one such measure and is commonly adopted in India. However, studies on the effects of a countdown timer under Indian traffic conditions are very scarce. Traffic heterogeneity and lack of lane discipline make the transferability of models developed in other countries (with more organized traffic) infeasible. The present study is an attempt to analyze the changes in queue-discharge characteristics and red-light violations (RLVs) under Indian traffic conditions due to the presence of a timer. A before-and-after analysis was carried out using the data collected from a selected intersection in Chennai, India. The analysis was carried out for different vehicle types in the presence and absence of timers separately for the start and end of red/green. Results showed that the information provided at the start of green (end of red) enhances efficiency, the start-up lost time is reduced, and there is an increase in RLVs. Two-wheelers present at the start of the queue is found to be the category that is mostly affected by this information. However, the information provided at the end of green (start of red) was found to reduce the incidence of RLVs. In the presence of information, it was found that the propensity of RLV (proportion of cycles having RLV) decreased from 59 to 31% at the end of green (start of red) and increased from 12 to 75% at the start of green (end of red) with a statistically significant drop in the headways (indicating an increased efficiency). Also, in the presence of information, the intensity of RLVs (mean RLVs per RLV cycle) for both the start of red and end of red decreased from 3.32 to 2.30 vehicles and 8.52 to 5.60 vehicles, respectively. The impacts varied based on vehicle type with major impacts on two-wheelers. The queue-discharge models show a significant change in trend, implying a need to update the signal timings when timers are installed.

B. Need of Study

In today's modern age traffic is growing very rapidly and the numbers of days the car and vehicles are the increasing problems of getting traffic jam causing accidents are on the rise. Pollution, and messy. We must create a system so that traffic can easily flow.

At the time of heavy traffic condition, traffic jam condition is developed on MR-10 road. Due to more traffic jam the delay of vehicles is more. Excessive fuel is loss due to low running speed and delays. Excessive burned fuel creates excessive smoke in nature which creates air Pollution. More traffic jam and delay is also the reason of the noise pollution which is the reason for many health problems. Due to these traffic jams intersection traffic handling capacity and road capacity will reduce. The objectives of the present study are to reduce the delay and time saving due to synchronization of a signal in series, to reduce pollution produced by traffic and fuel loss due to low running speed.

Traffic signals are designed to ensure the safe and orderly flow of traffic, Protect pedestrians, and vehicles at busy intersections and reduce the severity and frequency of accidents between vehicles entering intersections.

Some special requirements in the signal design such as:

a) Pedestrian crossing requirement,
b) Interval design,
c) Effect of tuning vehicles, and
d) Lane utilization

III. CONCLUSION

Expected Outcomes : Synchronization of signal suitable for traffic control, increase level of service, Reduce Travel time, reduce fuel consumption, Accidents will be Reduce Traffic signals are designed to ensure safe and orderly flow of traffic, Protect pedestrians, and vehicles at busy intersections and reduce the severity and frequency of accidents between vehicles entering intersections. Develop the synchronization of signals in series. Determine the time saving & increase in journey speed after synchronization.

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