

Investigation of a Cloverleaf Intersection on the Regional Traffic

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ABSTRACT

Increase in the number of the vehicles causes the existing road network insufficient. Because of this, the drivers and passengers who spent several hours in the traffic are affected adversely and economical and spiritual losses. This situation pushes investor organizations to find new solutions. The alternative solutions are more often to improve the existing road geometries instead of constructing new road routes. Parameters such as delays and travel time are used for the evaluation criteria of the new solutions. In this study, cloverleaf styled junction is analyzed according to the parameters of delay and travel time. The existing transportation system is provided by the long routes and travel durations are also long. Consequently, positive results of the cloverleaf styled junction are assessed.

I. INTRODUCTION

Cloverleaves are four-leg interchanges that employ loop ramps to accommodate left-turning movements. Interchanges with loops in all four quadrants are referred to as “full cloverleafs” and all others are referred to as “partial cloverleafs”. A full cloverleaf may not be warranted at major-minor crossings where, with the provision of only two loops, freedom of movement for traffic on the major roadway can be maintained by confining the direct at-grade left turns to the minor roadway. Comfort and safety are two primary goals of transportation engineering. The number of vehicles is increasing day by day in INDIA.

However, no new road is, almost, constructed for the existing traffic. Therefore, current networks become insufficient. Constructing new road is not economical, so the investor organizations try to improve the road geometries. For this improvement, the parameters of delay and travel time are used for evaluation criteria.

Based on current trends, highway congestion is becoming a major problem for existing traffic infrastructure in medium-sized cities within the next 10 years. Many heavily congested highways are frequently prone to and cause severe traffic flow problems. Of course the congestion is not confined to the highway itself. Spillback often occurs on the off-ramps and on to the connecting arterial. In this research we study the performance of a cloverleaf including ramp metering, and analyze different traffic operations. A literature review on comparable studies and projects regarding congestion problems and interchanges is presented first. Later the simulation methodologies are discussed and the case study is presented.

II. LITERATURE REVIEW

Urban interchanges contain both saturated traffic flow and unsaturated traffic flow. Their traffic characteristics are significantly different from signalized intersections and unsignalized intersections. On the foundation of iterative observation and research of traffic flow characteristics of an Indian cloverleaf intersection, this paper puts forward a study on investigation of a cloverleaf intersection on the regional traffic. Traffic flow at urban interchanges is unique; combining actual data and calibration, researchers used the VISSIM simulation model to calculate the capacity of the cloverleaf intersection that has to be made over NH-8. The capacity of the whole interchange is analyzed by simulation experiments, and the relationship between the whole interchange capacity and the turning vehicle proportions is put forward; with the increase of turning vehicle proportions, the whole traffic capacity of the interchange decreases constantly. The conclusion can be used for decision-making on planning, design, and management.

III. BASIC PROBLEMS FACED WHILE USING CLOVERLEAF INTERSECTION

- i. Communication with road users is still a serious unresolved issue on the cloverleaf intersection.

- ii. Road design, especially at merging or existing lanes still creates trouble for the commuters.
- iii. Lack of implementation of uniform road engineering standards or road oriented safety inspection/audit techniques.
- iv. Improper painting of lane markings that guide road users through the interchange without obstructing the flow of traffic.

IV. MODEL DEVELOPMENT USING MICRO SIMULATION

Traffic studies are usually conducted using micro-simulation software. Several micro simulation software's are available for this purpose (e.g. PARAMICS, AIMSUN, VISSIM, etc.). VISSIM is chosen as the simulation tool for this particular study. VISSIM is a microscopic traffic simulation model that analyzes traffic and transit operations under constraints such as lane configuration, traffic composition, traffic signals, transit stops, etc., thus making it a useful tool for the evaluation of various alternatives based on transportation engineering and planning measures of effectiveness. The movement of vehicles is based on car following theory and random effects caused by differences in driver behavior and vehicle performance.

V. ROAD SAFETY GUIDELINES

- i. Providing clear illustrations and diagrams in the media to educate much of the public before new interchanges open.
- ii. Installing clear road signs and direction indicators to aid motorists in deciding their path of travel well in advance.
- iii. Painting lane markings that guide road users through the interchange without obstructing the flow of traffic.
- iv. Performing safety inspections and audits to determine effectiveness of road design and clarity of signage.
- v. Proper visibility of Line Of Sight, especially at the junction so that the rider can control his speed over vehicle.

VI. STUDY AREA AND ESTABLISHED MODEL

Huda is planning to build a cloverleaf intersection, around (1.5-2)km before Kherki Daula Toll Plaza from the City Centre on NH-8, to ensure smooth traffic flow between Southern Peripheral Road (SPR), Central Peripheral Road (CPR) and NH-8, and reduce traffic on NH-8.

The SPR originates from Gurgaon-Faridabad Road near Ghata and meets NH-8 near Kherki Daula, and is proposed to be connected to NPR through CPR. The CPR starts from a place close to Kherki Daula village and meets NPR near Harbaru village. Construction of the SPR is nearing completion. It is already connected with NH-8. Land acquisition for CPR is in an advance stage. This has necessitated the construction of an intersection to avoid traffic jams on NH-8, once SPR and CPR get operational. The NPR, which is also expected to be completed by this year, will also contribute to traffic on CPR.

"For smooth traffic flow, a cloverleaf intersection has become essential at the junction of SPR, CPR and NH-8. We had a meeting with NHAI in this regard, which has given its consent for the project," said Huda chief engineer T D Chopra, adding the junction will be on NH-8, and thus built by NHAI. This has necessitated the construction of an intersection to avoid traffic jams on NH-8, once SPR and CPR get operational.

CONCLUSION

Micro-simulation traffic models are developed to study the impact of configuration changes to a clover leaf near metropolitan city limits in the INDIA. Different designs that incorporate variables that affect the traffic volumes are investigated in this study. The evaluation of alternatives is limited to few configurations, while several others those are equally viable and optimum are possible. Research suggests that low traffic volumes improve the traffic conditions of a full cloverleaf configuration and reduce environmental impacts. The alternative configurations tested resulted in minimum changes to the travel time. For medium traffic volumes an improvement is seen with every alternative configuration that is checked. The best ranking alternatives are the alternatives which include an increase in lanes. It is important to note that the improvement in the traffic flow can be achieved by identifying the bottlenecks in the network and provide for enough storage space in turning pockets and to reduce the queue spillback that will occur on the mainlines.

A. Advantages of Cloverleaf Interchanges

- i. A configuration with loop ramps to safely accommodate left-turning movements that is well suited for the intersection of two freeways.
- ii. Well suited for use in rural or suburban locations where space is available.

B. Disadvantages of Cloverleaf Interchanges

- i. The interchanges require more right of way area than that required for a diamond interchange.
- ii. It requires more travel distance for the left-turning traffic than the corresponding movement in a diamond interchange.
- iii. Use of the loop ramps generates a weaving movement within a short distance.

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