A Study on the Contemporary Insights of Traffic Signal Design under Heterogeneous Conditions: A Literature Review

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Abstract

Traffic signal design is usually carried out based on one or other design guideline. While the developed countries like UK, USA, Canada and Australia have come up with their own guidelines, developing countries are still using these guidelines developed in the western world with very different traffic conditions. While the conventional guidelines are formed based on lane-based homogeneous car dominant traffic regimes, developing countries have their own traffic characteristics like non-lane based traffic, heavy presence of two wheelers, three wheelers and non-motorized vehicles. Driver behavior in the developing countries are significantly different from that of the developed countries. Recently various researchers have addressed this issue by observing the traffic patterns in such situations and proposing various methods to fine tune the signal design guidelines. Deviations from near homogeneous conditions happen basically due to the heterogeneous nature of the traffic. Heavy presence of

motorcycles in the traffic stream has contributed to a distinct behavior in the signalized intersections resulting initial surge and grouping. They also tend to creep between the larger vehicles to occupy the available spaces resulting noncompliance to lanes and making it difficult to model their behavior. This is because most of the contemporary methods for PCU estimation is based on the systematic discharge of vehicles in a queue where a reasonable headway can be observed. Noncompliance to lanes challenges this methodology. When the traffic streams are composed of non-motorized traffic and three wheelers, their impact cannot be compensated through a constant PCU assigned to them. It is observed that PCU values in an intersection under heterogeneous traffic is not a constant but become dynamic based on various factors such as level of saturation, vehicle composition and type of facility. Proof for this phenomenon is strong in heterogeneous traffic conditions. The effects of bicyclists and red violating pedestrians are also having a detrimental effect on the assumptions used in classical design manuals developed in the developed world. Geometrical considerations like shared left lanes, shared right lanes, upstream short lanes and downstream lanes drops also have a significant impact on the performance of intersections under heterogeneous traffic. Therefore, this literature review concludes the necessity of a tailor made method of traffic signal calculations under heterogeneous traffic, especially when reaching saturation levels as witnessed in the developing countries.

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