

Development of a Guideline for Traffic Signals at Individual Intersections

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Abstract

With the ever increasing traffic congestion, number of methodologies are developed to initiate sustainable traffic management solutions for the current traffic demand. Rather than going for mega scale infrastructure improvements which would be costly as well as time consuming in short term, it is needed to introduce short term traffic management initiatives to reduce traffic congestion. This has been identified as the research gap, where the main bottleneck of the system has been the delays at signalized intersections. This research identifies the issues with the current traffic signal system, and aims at developing a guideline for traffic signals at individual intersections.

It has been identified that the behaviour pattern of the drivers can be categorised as aggressive and peaceful behaviours (Trabia, 1999). Gradinescu (2007) also refers to the parameters needed in identifying the aggressive driving behaviours, which were quite useful in directing the research in producing the methodology.

With the aggressive driver behaviour patterns expected in Sri Lanka, the guideline to be developed has been categorised into four; guidelines for geometrical details, phasing arrangements, signal timing, and pedestrians. The data was collected for twelve intersections in Colombo area. Further, the collected data was analysed using VISSIM traffic simulation software, which is already calibrated for the Sri Lankan condition. Further, proper logical arguments are also developed in proving and verifying the guidelines.

As for the geometrical details, when no separate right turn is available, it is recommended to use leading green for the right turns in signal design. If the intersection is supposed to have separate right turn lanes, it is recommended to use either lagging green or leading green for the right turns depending on the size of the right turn bay and vehicle volume. Further, with respect to left turns, it is recommended to provide a separate left turn, if the amount of left turns expected are more than the equivalent per lane amount of through movement.

With respect to the selection of phasing arrangement, it is suggested to start off every intersection with two phases and use 1300 as the maximum number of right turns plus through volumes that can pass through an intersection during one hour green period. When any phase is violated, it is proposed to split the phase. If separate right turn lane is available, go for leading green for right turns only phase, even when both approaches have right turn lanes. If right turn percentage is significantly smaller, it can be accommodated at the end of Amber. Further, if no separate right turn is available, go for either complete through plus right turn phase for each direction or go for leading green for right turns only phase.

As for the guidelines for traffic signal timings, the saturation flow for the Sri Lankan condition should be kept as 2000 vehicles per hour, which is verified through simulations. Further, maximum cycle time should be kept as 150 seconds for 4 phase intersections and 120 seconds for three phase intersections in order to reduce the overall delay for all the phases, except under very special circumstances.

With respect to the guidelines for pedestrians, when heavy pedestrian movements are expected, it is proposed to delay the left turns by few seconds. It is also suggested not to provide the pedestrian phase with left turns if the speed of the turning vehicles is more than 15kmph.

In conclusion, based on the number of surveys, arguments and simulations conducted the above guidelines are developed in order to reduce the ever increasing traffic congestion that is currently experiencing in Sri Lanka and further research need to be conducted in traffic signal coordination for intersection clusters.

Key words: Prioritization, AHP, Pavement maintenance Traffic congestion, Delay at signalized intersections, Guidelines for traffic signals

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