Improving Intersection Behavior through Delay-Based Left Turn Phase Initiation

Serving protected left turn phases for one or two vehicles can often be an inefficient use of cycle green time when the opposing through movements are over capacity. This paper assesses the performance of an intersection based on the application of controller logic that delays the call for a protected left turn phase based on vehicle wait times. Four weeks of evaluation were carried out where the delay on left turn phase calls was varied in 25 second increments, from 0 to 75 seconds. The results indicate that delaying left turn phase initiation substantially increases the amount of green time for saturated through movements, while minimally increasing the travel delay for left-turning drivers. The paper concludes by recommending agencies consider using a delay in the range of 25 to 50 seconds for calling protected phases at intersections where the opposing through movement is oversaturated and could benefit from additional green time.

Can Eliminating the Protected Left Improve the Saturated Through Movement?

Phase 1 Not Called

Phase 1 Called

Study Location & Intersection Layout

Abstract

This paper assesses the performance of an intersection based on the application of controller logic that delays the call for a protected left turn phase based on vehicle wait times. Four weeks of evaluation were carried out where the delay on left turn phase calls was varied in 25 second increments, from 0 to 75 seconds. The results indicate that delaying left turn phase initiation substantially increases the amount of green time for saturated through movements, while minimally increasing the travel delay for left-turning drivers. The paper concludes by recommending agencies consider using a delay in the range of 25 to 50 seconds for calling protected phases at intersections where the opposing through movement is oversaturated and could benefit from additional green time.
Impact on Cumulative Green Time & Capacity

Impact on Cumulative Green Time & Phasing

Wait Times & Queuing for Left Turning Vehicles

Conclusions

- Detector delay for protected/permissive left turns can be effective where a lightly traveled left turn has a saturated opposing through movement.
- Increasing detector delay does not significantly increase left turn wait times; most drivers were able to complete turns on the permissive phase.
- Increasing detector delay on the Phase 1 approach resulted in capacity increase of 235, 415, and 580 vehicles on the Phase 2 through movement for delay values of 25s, 50s, and 75s, respectively.
- Groundtruthing tools, including time lapse photography and high resolution controller data can be used to verify intersection performance.