Joint Transportation Research Program

Principal Investigator: Darcy M. Bullock, Purdue University, darcy@purdue.edu, 765.494.2226
Program Office: jtrp@purdue.edu, 765.494.6508, www.purdue.edu/jtrp
Sponsor: Indiana Department of Transportation, 765.463.1521

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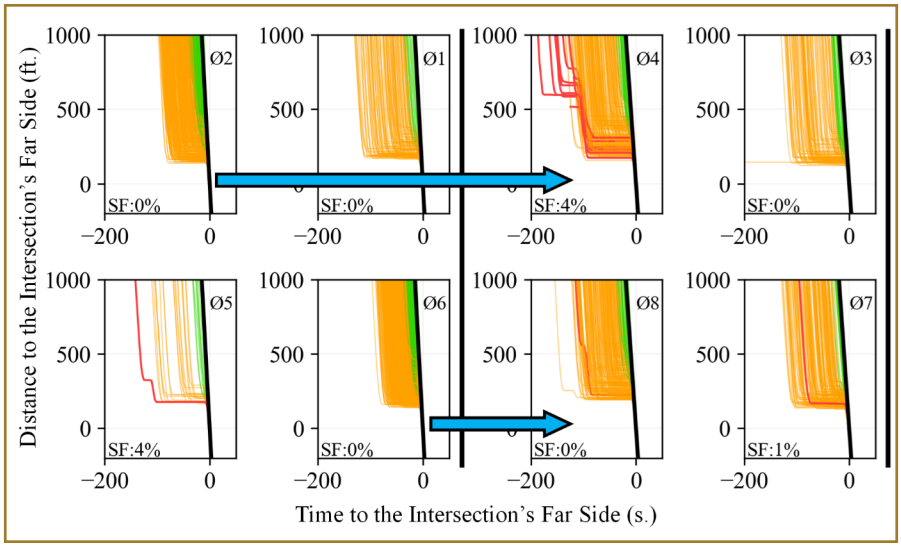
Business Processes to Prioritize Traffic Signal Retiming and Assess the Impact of Retiming Activities

Motivation

Traffic signal operations have a significant impact on road network operations. The Indiana Department of Transportation (INDOT) manages over 2,000 traffic signals in the State. It is therefore important for INDOT to identify locations that require additional operations improvements through signal retiming.

The traditional process of assigning limited resources to signal retiming practices was a 3- to 5-year cyclic schedule. However, this approach allows signals to operate inefficiently over long periods of time. Recently, Automated Traffic Signal Performance Measures (ATSPMs), which rely on intersection detection and communication equipment, have been used to systematically monitor intersection performance and locate retiming opportunities. Nevertheless, ATSPMs require significant capital investments in infrastructure and maintenance activities to accomplish statewide coverage.

In the last few years, commercial high-fidelity connected vehicle (CV) trajectory data has appeared as a scalable dataset that can be used to estimate actionable traffic signal performance measures. This approach provides important benefits, since agencies can proactively monitor operations without deploying a large amount of detection and communication equipment. However, no CV-derived methods have been developed



Purdue Probe Diagram showing performance of intersection movements and opportunities to reallocate green time.

to assess green redistribution potential at scale based on individual conflicting movements within and across ring diagram barriers at the intersection.

Study

This study presents a scalable methodology by which CV-based performance measures can identify critical split failing movements where additional green time could be provided from either within or across ring diagram barriers at the intersection. In addition, downstream blockage from adjacent intersections was considered to determine if the rebalancing would be effective.

To demonstrate the efficiency of the proposed technique, eleven timing changes over different time-of-day (TOD) periods at nine signalized intersections across the state were implemented. Reductions of up to 53 sec/veh and a 30% on average control delay and split failures, respectively, were achieved. A detailed before-and-after analysis is provided within this report for each modified intersection that presented overall positive changes, and the business processes used to achieve these results are discussed.

Using the proposed methodology, agencies can promptly identify systemwide capacity challenges and places where tactical deployment of retiming resources is likely to result in an improvement. The presented analysis also resulted in the development of a companion study, SPR-4857, which provides a method to screen for intersections that have capital investment opportunities where signal retiming is unfeasible.

Recommendations

It is recommended that the proposed screening technique be performed monthly, statewide, and by district. INDOT resources can then be allocated to verify the feasibility and accuracy of retiming suggestions and then implement the most promising revisions. Furthermore, this approach can help assess the efficiency of timing changes, since previously modified intersections should be placed lower in the rankings for subsequent iterations.

Recommended Citation for Report

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