Analysis of Peer Intersection Data for Arterial Traffic Signal Coordination Decisions

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1: Purdue University; 2: Indiana Department of Transportation

Paper No. 11-0037

Concept

Decisions on whether to coordinate adjacent intersections are currently made by rules of thumb, coupling indices based on ratios of volume to distance, and modeled traffic flows.

$$\text{CouplingIndex} = \frac{\text{Volume}}{\text{Distance}} = \frac{V}{D}$$

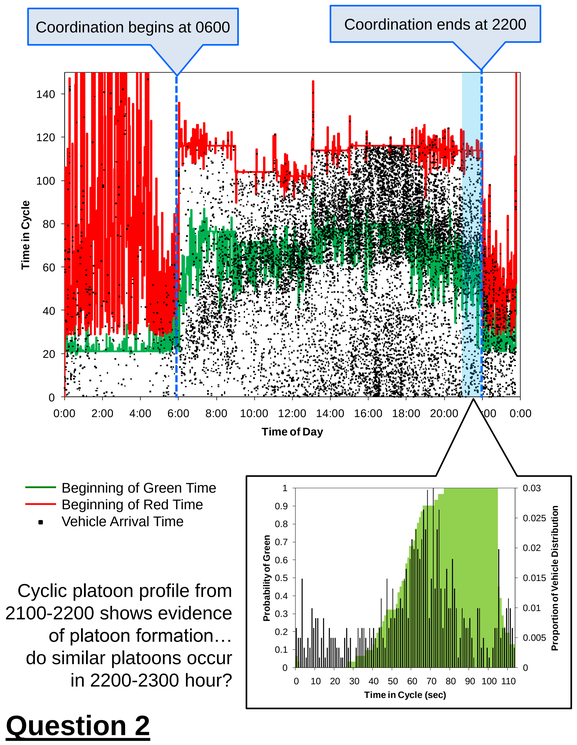
$$\text{CouplingIndex} = \frac{\text{Volume}}{\text{Distance}^2} = \frac{V}{D^2}$$

As high resolution event data from signalized intersections becomes more readily available, it becomes possible to analyze actual link vehicle flows to better characterize whether (and when) signal coordination is desirable. This paper proposes and demonstrates a methodology to assess opportunities to improve arterial progression if a non-coordinated system is coordinated, using peer data obtained from adjacent intersections.

Context of Study

Question 1

- When should free operations begin and end?



Cyclic platoon profile from 2100-2200 shows evidence of platoon formation… do similar platoons occur in 2200-2300 hour?

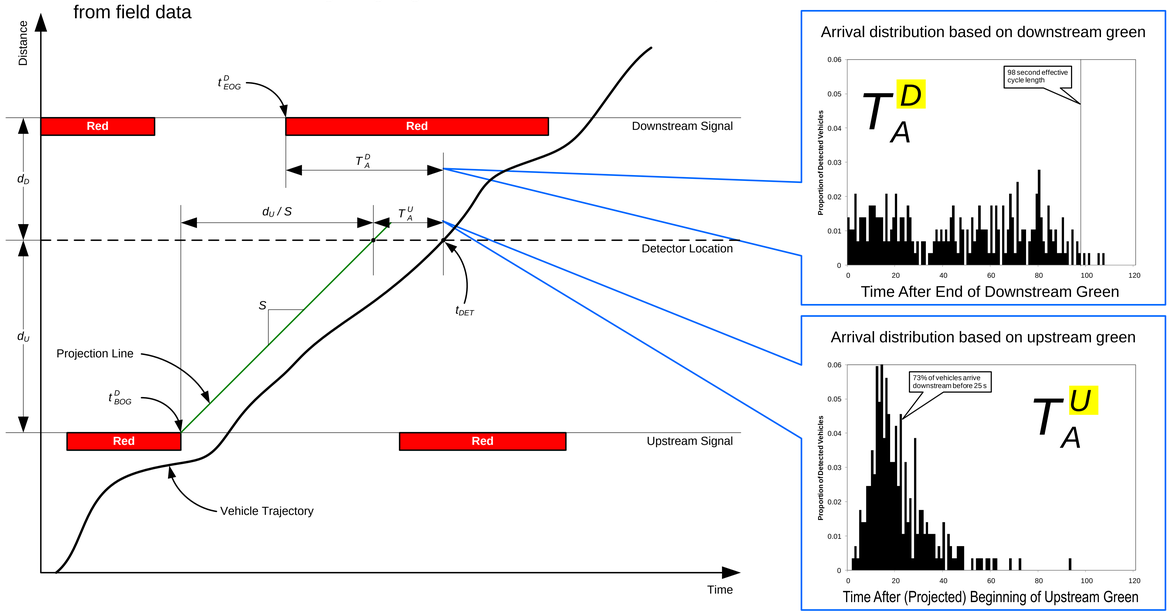
Question 2

- Can we change the frame of reference of arrival data to be based on an adjacent intersection to assess platoon characteristics and progression opportunities?

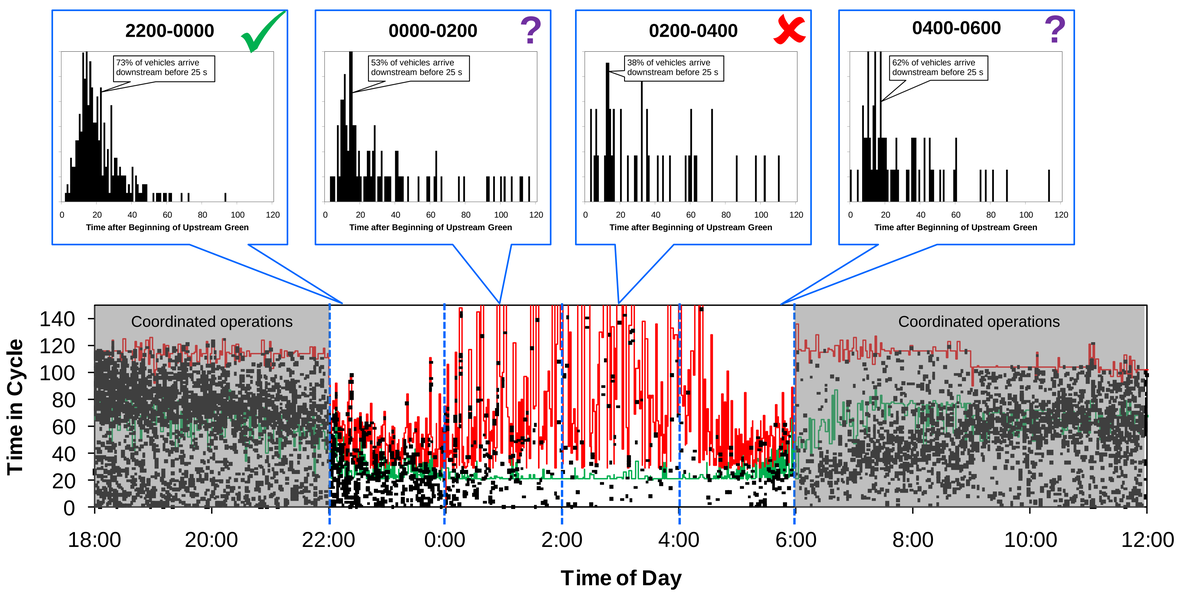
Analysis of Non-Coordinated, Fully Actuated ("Free") Corridor Operations During Overnight Time Periods

Impact of Perspective: Cyclic Flow Profiles From Fully-Actuated Operation Arrival Data

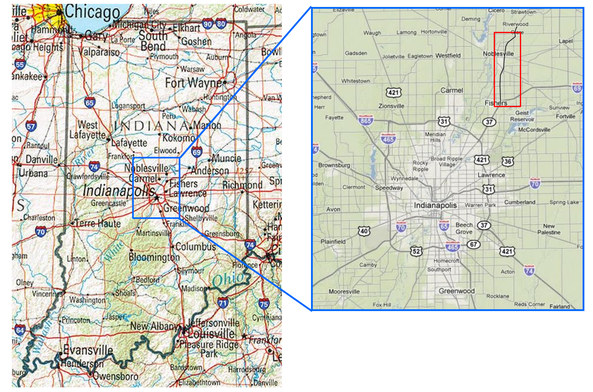
- Traffic engineers think in terms of platoon formation & dispersion down a corridor
- In **non-coordinated, fully-actuated operations**, a local controller is only able to "see" local arrivals and only knows when its own green indications occur, not the upstream ones
- Using adjacent intersection beginning of green time enables trends in vehicle platoons to be visualized from field data

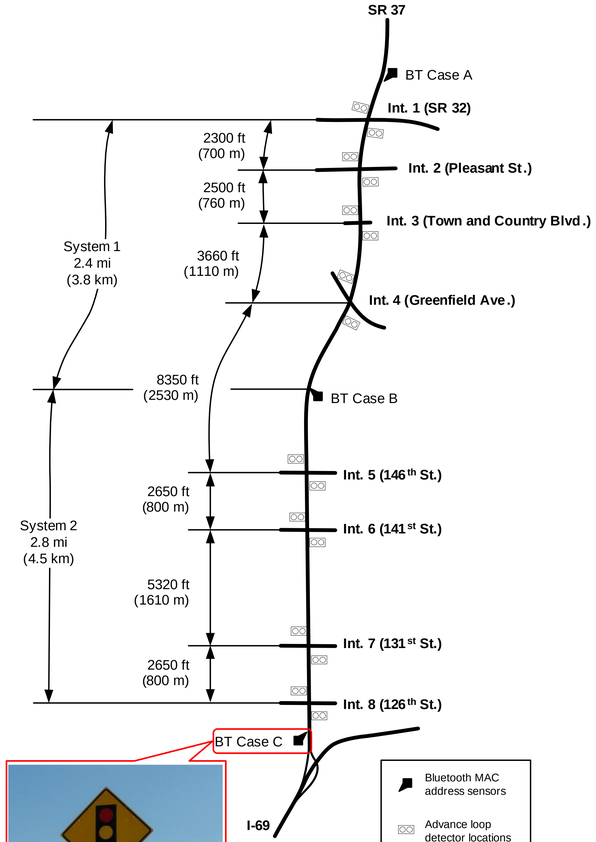


Changes in Platoon Formation Characteristics During the Fully-Actuated Period



Study Corridor





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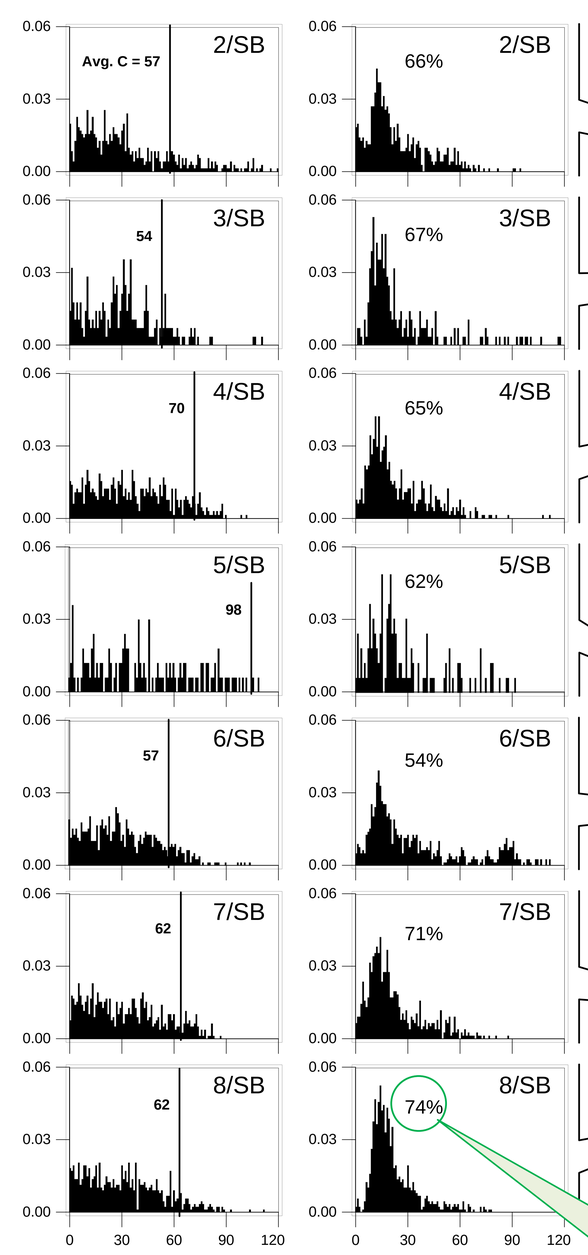
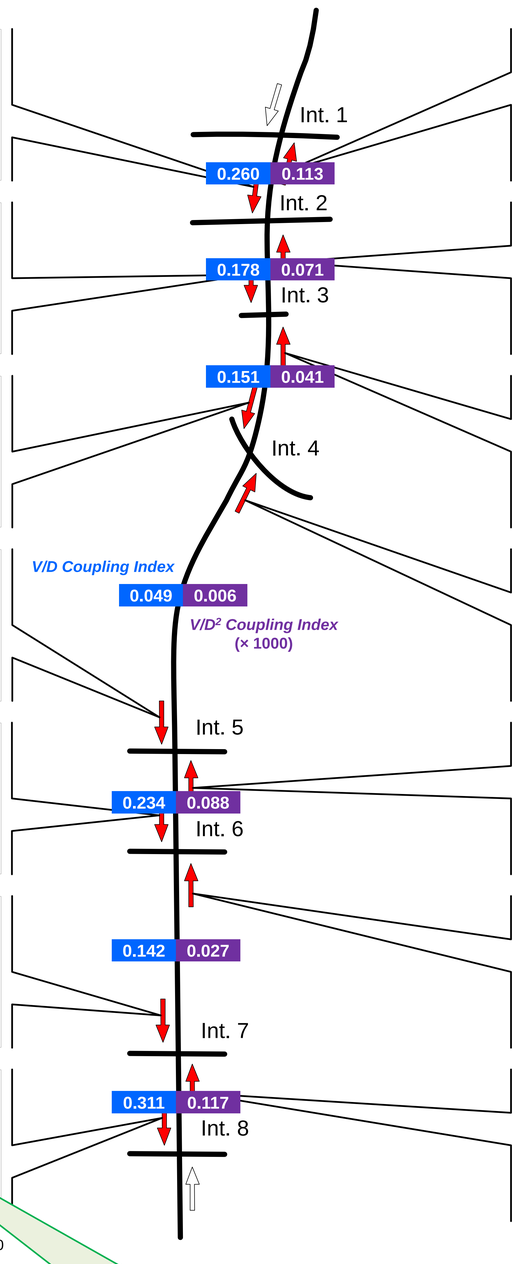
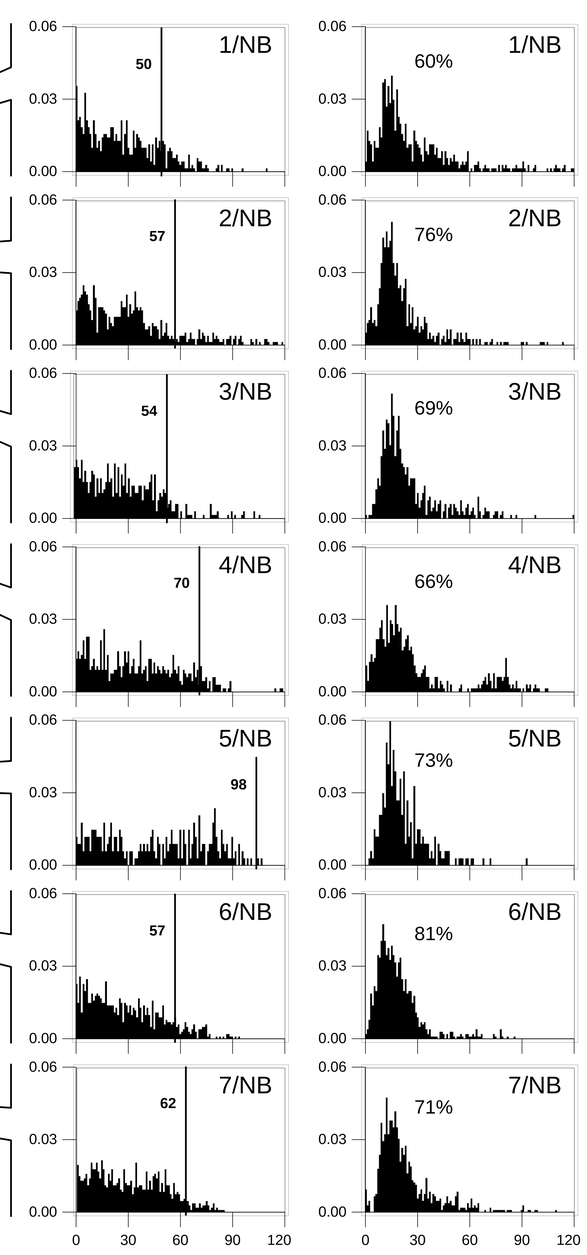
Analysis of Free Operations (2200-2400)

Southbound



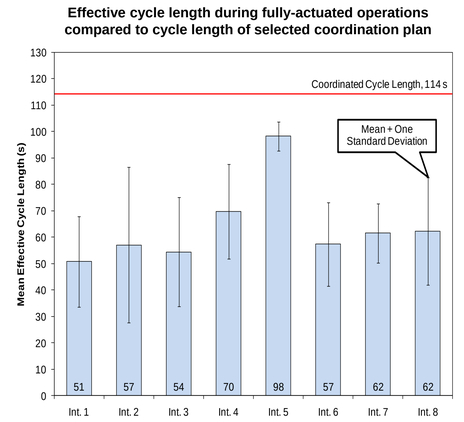


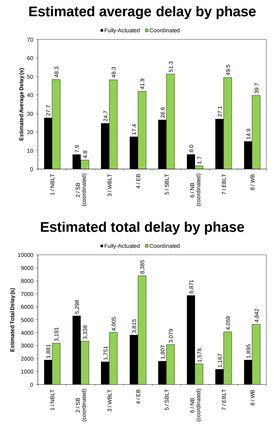
Northbound



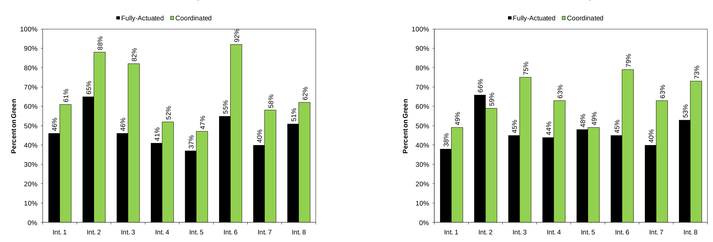
Implementation of Coordination Plan from 2200-2400

Change in Cycle Length and Delay

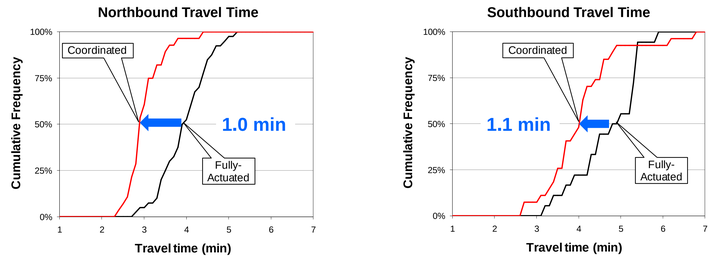




Percent on Green (POG) at Coordinated Approaches



Arterial Travel Time



Conclusions

- Analysis of data showed that platoon profiles can be constructed with peer intersection data during fully-actuated operations with no fixed cycle length. Using only local intersection data, arrivals appeared random on average.
- Extending an existing coordination plan to cover two additional hours formerly operated as fully-actuated resulted in improvement of 1 minute of travel time over 5 miles.
- The shifted time reference technique provides a tool for leveraging field data to make coordination decisions.