Analysis of Delay Variability at Isolated Signalized Intersections

单点信号控制交叉口的延误可靠性

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Main Goal

- On urban arterials, delays incurred at signalized intersections account for a large part of travel time
- The interpretation of delay evolvement or delay variability at intersections will help give a more comprehensive insight into arterial travel time variability, and provide more possibilities for travel time estimation.

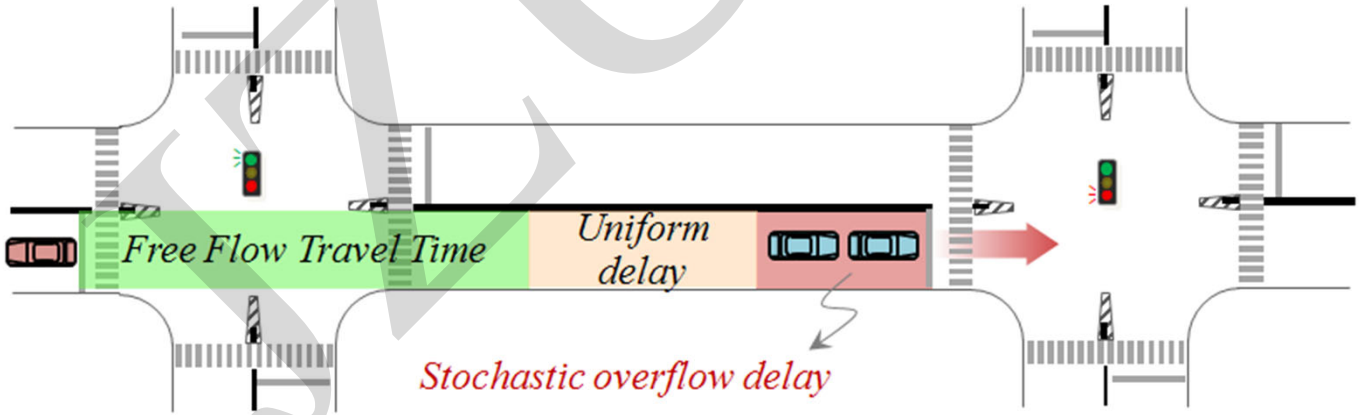

Fig. 1 Phenomenon of stochastic delays at signalized intersections

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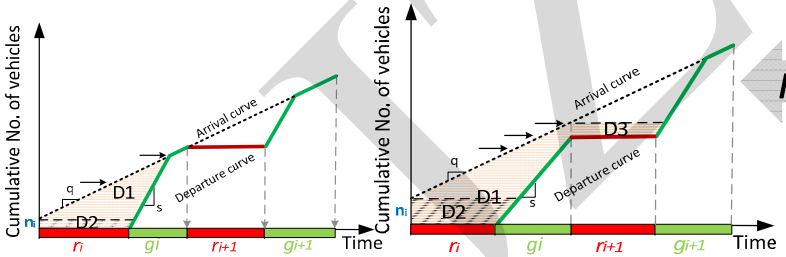
Major methods and algorithm

- An analytical model was developed to investigate delay variability at isolated signalized intersections.
- Classic cumulative curves are utilized to derive average delay per cycle formulas by assuming a deterministic overflow queue. Next, the analogy of a Markov chain process is used to clarify the mechanism of the stochastic overflow queue at a signalized intersection.

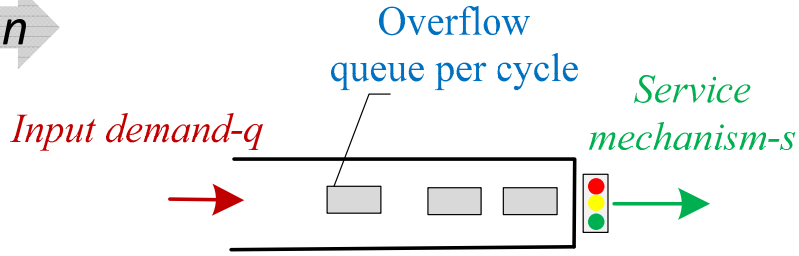
- **Cycle average delay formula**



$$d_i = \frac{D_1 - D_2 + D_3}{qC} = \frac{D_1 - \Phi(n_i) + \Phi(n_{i+1})}{qC}$$

Inter-relation

- **Stochastic initial queue** (Markov Chains)



$$n_{i+1} = \max(n_i + qC - sg, 0)$$

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Results and Contribution

- It has been confirmed that different degrees of saturation lead to different shapes of delay distribution.
- The estimates produced by the proposed model are consistent with these time-dependent delay models.
- Delay variability was averaged over the cycles within the evaluation period to provide variability-related measures of interest.

