Research Notes

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OPERATIONAL GUIDANCE FOR BICYCLE-SPECIFIC TRAFFIC SIGNALS IN AN URBAN SETTING

Most bicycle-vehicle crashes in urban areas occur at intersections. Safety improvement may come from separating bicycle movements from other conflicting traffic. This is most often done with bicycle-specific traffic signals. Because there may be performance differences among cycling demographics, it is important to have a detailed understanding of the performance characteristics of urban cyclists.

This research collected and analyzed video data of cyclist behavior at signalized intersections in several Oregon cities. A total of 4,673 cyclists were observed and broken into demographic groups. These observations were used to study:

- performance (accelerations, cruising speeds, and reaction time)
- queue discharge (cyclists leaveing a lineup during the green period at traffic signals)
- signal compliance.

The researchers developed a general methodology to estimate bicyclists' acceleration and speed for traffic-signal timing applications. This research analytically derived expressions that can be used to classify an individual bicyclist's performance as a function of the observed acceleration profile.

Performance: an analysis of observed intersection crossing times indicates that nearly all riders are accommodated by the AASHTO default signal timing. The exceptions are some recreational riders at wide intersections. The researchers recommend examination of acceleration and speed distribution if specific bicycle traffic-signal designs result in high delays, fuel consumption and emissions.

Queue Discharge: the discharge characteristics of cyclist queues at a signalized intersection were determined using video from before and after installation of a bike box. The study found that the addition of a bicycle box decreases the discharge time for queues of equal length compared to a bicycle lane. The decrease in discharge time between bike boxes and lanes becomes greater with larger queue sizes. The addition of a bicycle box also decreases the intersection clearance time for queues of five or more cyclists.

Compliance: the researchers observed cyclists arriving on red prior to passing thru the intersection. Moving shortly before a green light (signal jumping) was observed in 4.3% of the sample. Other cyclists selected gaps in the conflicting traffic stream and crossed while the signal was red (5.9%). An important finding is that compliance is comparable at intersections with bicycle-specific signals and those without. A possible conclusion is that design is probably not likely to influence noncomplying cyclists. Enforcement and/or work to change the culture of cyclists may be needed.

The results of this study provide baseline data on cyclist performance and behavior. Any agency planning to install bicycle specific traffic signals will find this valuable. Use of this data greatly aids in correctly time bicycle signals to maximize intersection performance and safety.

Implementation of Report Findings: in late 2013, FHWA issued an interim approval for the optional use of Bicycle Specific Signal Heads. It is expected that this type of signal head will be installed in many intersections in Oregon. This study will be helpful in providing information regarding the operational aspects of bike signals. Specifically, the Traffic Services Unit of Traffic-Roadway Section maintains the 'ODOT Signal Timing Notebook', which is used by ODOT signal timers. This notebook contains a section for bike signal timing that currently uses the AASHTO specified 10 mph cruising speed. The results of this study suggest that this speed is too high. Based on this study, this section of the notebook may be amended.

Additionally, the lower bicycle cruising speeds identified by this study may be used to adjust the stretch time/carryover settings for intersections with bicycle lanes *without* bicycle-specific signals so that bicyclists can navigate through the intersection more safely.

For more information: the full 298 page ODOT Research report is available online. A link to the report is provided below. This research effort has contributed to portions of a paper soon to be published in the Transportation Research Record.

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To read the research report go to:
http://www.oregon.gov/ODOT/TD/TP_RES/docs/Reports/2013/SPR747_Bicycle_Specific.pdf

Related PSU Bike and Pedestrian Data Collection Link:
http://otrec.us/news/entry/otrec_researcher_details_bike_ped_data_collection_methods

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