Notes on the negative impacts of the signal priority system for BRT buses.

Excerpts from the federal Final Environmental Impact Statement (FEIS)

"If transit priority is implemented within the traffic signal timing schemes, there could be additional delays to cross-street traffic. The primary transit priority technique would be to extend the green phase on the BRT route to allow a BRT vehicle to pass through the intersection without stopping." (FEIS 4-31)

"Transit vehicles [BRT and city buses] will be given an advanced green at the Ala Moana Boulevard /Atkinson Drive signal to allow them to reach this lane without competing with traffic in the general-purpose lanes between Atkinson Drive and Holomoana Street." (FEIS 4-38)

"In the Ewa-bound direction, the semi-exclusive lane will begin at the Kalia Road intersection. It will continue to Hobron Lane, where it will transition from a curbside lane to a median lane. An advanced green signal will allow the BRT and other transit vehicles to transition to an exclusive median lane without conflict from other through traffic on Ala Moana Boulevard." (FEIS 4-38)

"To achieve this without having BRT vehicles mix with the through traffic, the BRT will be given an advance green signal before the Ewa-bound through traffic, allowing the BRT to change into the makai lane unimpeded. The BRT will then follow Kalaimoku Street back to Saratoga Road." (FEIS 4-41)

Excerpts from the literature on the subject

Although signal priority has proven to be an effective tool for reducing delays to buses, this technique is not always beneficial to the overall traffic network. Providing priority for transit vehicles along a corridor with a large number of transit vehicles can cause a coordinated network to be out of step resulting in an overall increase in delay. Bus signal priority also has the disadvantage of penalizing the cross-street traffic when high transit volumes exist at the corridor. This can create significant delays at locations where the cross-street carries significant traffic volumes. Some traffic engineers, local elected officials, and others have been reluctant to provide traffic signal priority for transit out of a concern that it would cause non-transit vehicles to encounter significantly increased delay.
Source:
http://transportation.njit.edu/nctip/research/ResRep.asp?status=Ongoing&projectNo=110&grantNumber=992530

Recent progress in technology has facilitated the design, testing, and deployment of traffic signal priority strategies for transit buses. However, a clear consensus has not emerged regarding the evaluation of these strategies. Each agency implementing these strategies can have differing goals, and there are often conflicting issues, needs, and concerns among the various stakeholders. This research attempts to assist in the evaluation of such strategies by presenting an evaluation framework and plan that provides a systematic method to assess potential impacts. The use of this framework and plan is illustrated on the Columbia Pike corridor in Arlington, Virginia using the INTEGRATION simulation package. In building upon prior efforts on this corridor, this work presents a method of simulating conditional priority to late buses to investigate the impacts of priority on service reliability. Using the measures developed in this research, a conditional priority strategy designed to increase bus service reliability without resulting in severe traffic-related impacts was tested. Simulation results indicated statistically significant improvements of 3.2% in bus service reliability and 0.9% for bus efficiency, while negative traffic-related impacts were found in the form of increased overall delay to the corridor of 1.0% on a vehicle basis or 0.6% on a person basis. These results are also comparable and consistent with the results of other research as reported in this paper.
Source: http://ntl.bts.gov/card_view.cfm?docid=23853

This paper includes the results of a study on the impact of transit signal priority on the delay experienced by buses and private vehicle traffic at the busiest intersection along one transit route in Eindhoven, the Netherlands (population 300,000). Three signal priority conditions were tested, for one AM and one PM period each, during the 3-day data collection period:

- No priority providing no signal priority for transit buses approaching the intersection;
- Absolute priority providing a green phase to each bus regardless of whether or not it was running ahead of schedule; and
- Conditional priority providing priority to a bus only when it was behind schedule.

To assess the impact of priority on all vehicular traffic, the study measured the average total vehicular delay. This delay is defined as the difference between the actual time it took a vehicle to traverse the intersection and the time it took a typical unimpeded vehicle to do the same. Data recorded by in-vehicle computers, used to determine the schedule deviation status of the buses for the priority system, enabled the determination of the delay experienced by transit buses.

The study found that average total vehicular delay experienced during the three busiest hours at the intersection increased by 40 seconds per vehicle under absolute priority. There was no significant change in delay with the buses operating under conditional priority. This pattern held true for all of the surveyed hours, with absolute priority causing large delays to other traffic, while conditional priority causes little, if any additional delay. Buses experienced an average of 27 seconds of delay without priority. This figure dropped to 3 seconds per bus with absolute priority. During conditional priority, the bus delay fell in between these values. 90% of all buses received zero-delay service under absolute priority. Only 74% of the late buses experienced zero-delay service under conditional priority. The authors state that this indicates a need to improve either the schedule deviation tracking system, the traffic signal controllers, or the communication between the two, in order to ensure priority treatment for late buses.
Source:
http://www.benefitcost.its.dot.gov/ITS/benecost.nsf/ID/C34BE2BE4B18C8C285256997006A801E