

Integration of Public Transport Prioritization and Bicycle Signal Coordination in Traffic Signal Control

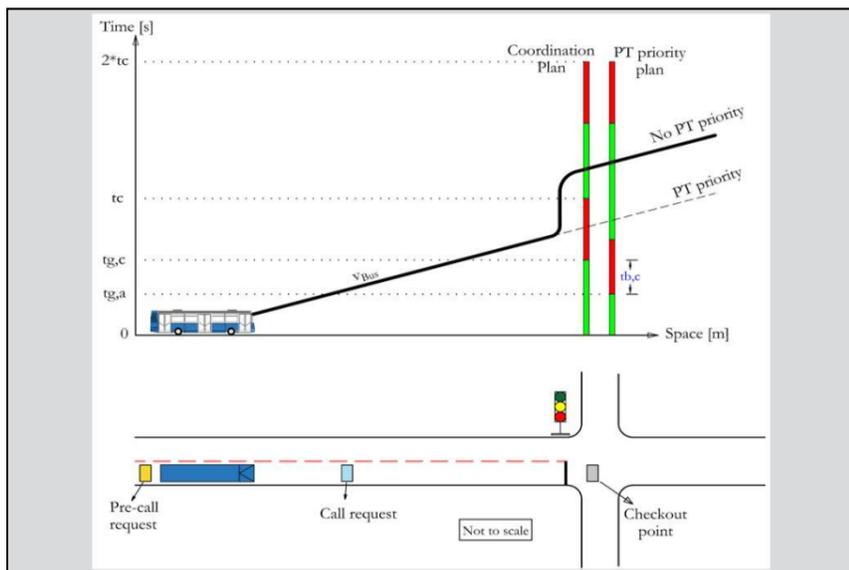
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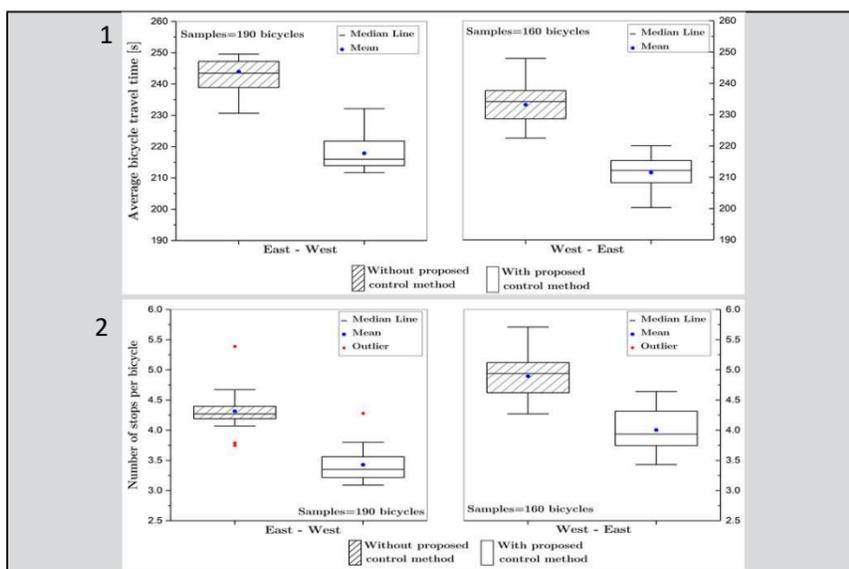
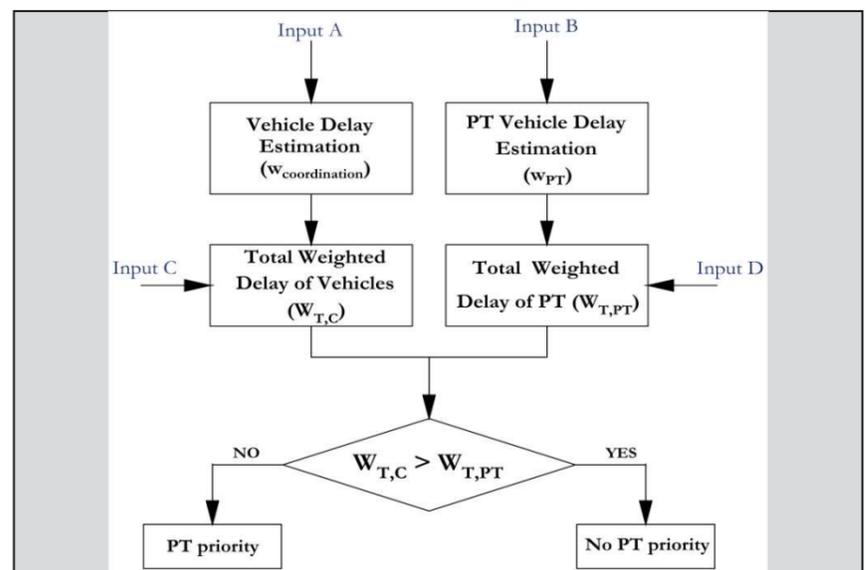
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Traffic signals are used to ensure safety for all road users and to increase capacity for minor traffic streams, whereas they cause delay for major traffic streams. Delays caused by the traffic lights can be reduced with the traffic signal coordination. Traffic signal coordination is a method used to coordinate traffic signals along a series of consecutive intersections such that vehicle and bicycle platoons are able to cross the intersections without stopping. On the other hand, public transport (PT) priority strategies aim to prioritize the PT vehicles to pass the intersection with no or minimum delay. Although, PT priority enhances the attractiveness of PT mode at isolated intersections, it disrupts the planned operation of signal coordination and results in reduction of green wave quality, in particular, for bicycle signal coordination. The main objective of this thesis is therefore to develop a control method to minimize the negative impact of PT priority on bicycle signal coordination.

The control method developed in this thesis activates when a PT vehicle approaches a coordinated intersection. The arrival of PT vehicle at pre-request point is detected and sent to the control method. The proposed control method estimates the delays by a delay estimation model based on two conditions: (i) when PT vehicle is prioritized, it estimates the delays of coordinated vehicles (bicycles). (ii) when no PT prioritization is provided, the delay of PT vehicle is predicted. These estimated delays are afterwards weighted and the total delays are calculated. The control method compares the total delays of PT vehicles and coordinated vehicles and decides whether to provide priority or to keep the coordination mode.

The control method requires sort of information such as vehicle arrival rates, the PT priority request time, the traffic signal configuration, vehicle passenger occupancy, and the green split of the signal plan in coordination and PT priority operation modes.



Microsimulation based evaluation method is used to examine the performance of the proposed control method on Schellingstrasse, Munich. A corridor with bicycle signal coordination system and PT priority strategy for bus lines in the direction of coordination and tram lines crossing the coordinated artery.

The findings of this experimental test after 20 simulation runs show significant reduction in bicycle travel time, delay and number of stops per vehicle in the directions of coordination, while the travel time and delay of PT vehicles remained unchanged. The average bicycle travel time reduced by 11% from east to west, and 9% from west to east. Similarly, the number of stops per bicycle within the coordinated artery decreased by approximately 20% in both directions of coordination.