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Abstract

Capacity constraints in transportation networks solicit a reassessment of space allocation among different travel modes. Typically, the network space is distributed among the available transport modes where some benefit from an exclusive usage while others compete over the same space. Because the average occupancy of buses is the highest, they are usually allocated dedicated lanes where speeds are larger than in the rest of the network. Private vehicles and ride-hailing drivers use the remaining portion of space that is highly subject to congestion. In this study, we delve into a privileged network usage strategy targetting ride-splitting services. In the event that pooled rides are allowed to use underutilized bus lanes, we investigate the ride-hailing solo/pool demand split that minimizes the total passenger hours traveled (PHT) for all network commuters. For this purpose, we model the accumulation in the system under steady-state conditions using a Macroscopic Fundamental Diagram theory and we show the potential to reduce network delays for all commuters without causing significant disturbances to bus operations. We additionally compute the Wardrop equilibrium and examine the price of anarchy by comparing the results to the minimum PHT under system optimum. Finally, we investigate the influence of the operator's pricing policy on the existence of equilibrium.

Keywords

Multi-modal networks, Network delays, Public transportation, Regulations, Ride-splitting services, Space allocation.