Effect of Crowding Cost on Optimized Headway of an Urban Bus Route

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Abstract

Discomfort due to crowding in transit is a significant factor driving public transport mode choice. However, few studies account for passenger cost due to crowding in transit as an integral part of planning transit operations. This study explores the optimized headway operations of an urban bus line with attention to crowding costs. An analytical expression for the cost of crowding discomfort of passengers is developed. The cost of crowding discomfort is accounted for by penalizing the average value of riding time (VoRT) of passengers. Accordingly, VoRT is multiplied by a crowding penalty factor (CPF). CPF is formulated as a function of the load factor (L) that represents the crowding level inside the bus. This expression is integrated into an objective function that is the summation of operator and user costs, building on the square root dispatching policy developed by Newell (1971) and extended to 'many to many' demands by Wirasinghe (1990). The objective function is then optimized in terms of headway to obtain the value that minimizes the sum of passenger and operator costs. It is found that, in the presence of crowding costs, the optimum headway is smaller, and depends on bus size, the mean value of riding time, average trip time in the bus route, and the functional form of CPF. The scope of crowding cost on optimized headway is shown using an example.

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