Model to Identify the Optimum Feeder Bus Route for an Urban Rail Transit Station Based on Capacity of Feeder Buses

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Abstract

Urban rail transit systems are very cost-effective as compared to other transit modes though they cannot provide wider service coverage for the users. Feeder buses play a major role in filling the service gaps left by urban rail transits. The effectiveness of the feeder bus of an urban rail transit depends on its bus route length, frequency, capacity, and travel time. As all parameters are interconnected, changing one will impact others. This study discusses a mathematical model to identify the optimum feeder bus route for an urban rail transit station. The effectiveness of the feeder bus can be optimized by reducing the total cost of /the feeder bus service. The total cost includes both the user's costs and the operator's costs. Several service parameters influence the components of the total cost equation. The parameters discussed in this study are route length, frequency, bus capacity, travelling and waiting times, walking distance and passenger behaviour characteristics. Assumptions were made regarding passenger behaviour because it varies for every passenger according to several factors. For example, bus stop spacing and maximum walking distances were assumed to be constants, and all roads were assumed to be in grid mesh format. First, a simple model was developed that has one trip generated to the railway station. Then it is further extended to one bus stop from which several trips are directed to a railway station. After that, a model that has several bus stops in a feeder bus route that connects to a railway station was developed. From there, an optimized many-to-one feeder service model was identified. In different instances, there will be changes in the values of the parameters in the mathematical model. By using the mathematical model, we can check which set of parameters best suits the optimized route. This can be further extended to a many-to-many demand model that has several railway stations and bus stops that are interconnected with each other.

Keywords: Feeder Bus, Urban Rail Transit, Cost, Mathematical Model

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