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Review

Planning, operation, and control of bus transport systems: A literature review

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A B S T R A C T

The efficiency of a transport system depends on several elements, such as available technology, governmental policies, the planning process, and control strategies. Indeed, the interaction between these elements is quite complex, leading to intractable decision making problems. The planning process and real-time control strategies have been widely studied in recent years, and there are several practical implementations with promising results. In this paper, we review the literature on Transit Network Planning problems and real-time control strategies suitable to bus transport systems. Our goal is to present a comprehensive review, emphasizing recent studies as well as works not addressed in previous reviews.

Contents

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1. Introduction

City growth in terms of surface and population is one of the most important global trends of the last century. Too often the speed of this phenomenon has prevented an organic or well-planned urban development. Instead, cities worldwide are suffering from long travel times, severe traffic congestion, pollution, road accidents, etc. Public transport is considered an important backbone of sustainable urban development, since it should allow more efficient movements across a city. However, public transport systems often struggle to provide a good level of service at an affordable cost for the public administration and the user: these systems need to provide a high level of service in order to be attractive to the non-captive user, while at the same time affordable for the low income segments of the population. To achieve this, public systems inevitably face the need of subsidies that are increasingly contested by society.

These systems vary quite a bit around the globe. Very often multi-modal, they provide different integration opportunities across services: while some cities provide fare integration citywide, in others, all services compete as independent alternatives. While some cities have relied on the operations of private companies, others maintain this responsibility within a public agency. Planning, operating and controlling a public transport system, which is the focus of this document, is very challenging. Several actors with different goals are involved: the authorities, users, non-users, and operators. And not all users or non-users are identical since their traveling needs vary significantly in space and time. They are also different in their socioeconomic characteristics, which affects their choices: gender, age, income, knowledge of the system, and disabilities. Also, users and non-users interact in the city in a space that is increasingly limited: road congestion and limited vehicular capacity implies that each traveler's decision will affect the experience of many others. The urban context in which all this activity happens is very dynamic and often unpredictable, so such key elements as demand and travel times follow inherently stochastic time-dependent patterns.

The last decades have seen the development of new technologies aimed at improving the information available for planning and operating public transport systems: fare-box and Automated Fare Collection systems (AFC); Automatic Passenger Counter systems (APC); and Automated Vehicle Location systems (AVL), and Geographical Positioning Systems (GPS), among others. These tools are increasingly being installed in public transport systems. Their use has allowed a better understanding