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Simulation of an Urban Logistic Space for the Distribution of Goods in Belo Horizonte, Brazil

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Abstract

Urban goods distribution, which is responsible for the continuous supply of commercial activities, is strongly related to the development of local and national economies. However, the fast and uncontrolled growth of urban centres and the high competitiveness of the distribution services also generate many negative effects. Despite the great population increase and the high development expectations of Belo Horizonte, authorities have not invested enough in city planning, especially the urban mobility of 196,000 freight vehicles fleet that moves along the main streets. With the support of simulation and optimisation tools, the current research allowed us to analyse the impacts of an Urban Logistics Space (ULS) operation in the Central Area of Belo Horizonte. It was possible to verify the potential increase of efficiency in the logistics system and the reduction of adverse impacts generated by the goods distribution in this area.

Keywords: Urban goods distribution; city logistics; urban logistic space; simulation and optimisation

1. Introduction

Many different types of goods are distributed or collected daily on the main streets of the urban centres. Goods transported include food, medication, mail, construction materials, as well as the residue resulting from domestic and industrial activities and so forth.

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Besides being essential for the supply of commercial activities and the economical development of large urban centres, urban goods movement generates several social, environmental and even economical problems, such as increased traffic jams, excessive emission of pollutants and inefficient supply chains.

Due to the strong negative impact of these problems, since the last decades of the twentieth century, freight transportation has played an increasingly important role in the strategic urban planning of different countries. Several interventions have been proposed based on the city logistic concept, whose goal is to search for sustainable solutions that can contribute to local economic development, thus minimizing the impact of urban freight transportation. Among the solutions, we can mention the Urban Logistic Space (ULS), the focus of the present study.

An ULS is an area located within the urban centres used by companies from different sectors, in order to improve the efficiency of products delivery in the region that they operate. ULS participate in the intermediate stage of the goods movement between the factories or the distribution centres, and the end customers. In this space, large trucks may unload the goods carried, which will then be loaded in smaller and cleaner vehicles and delivered to the end customers. The development of a space like this can be complex and long-term, but can greatly reduce the impact of problems caused by urban goods transportation.

However, it must be noted that much still needs to be done so that the transportation of goods becomes effectively part of urban planning. According to Prata & Arruda (2007), it is usual to associate the term urban transportation only with public passenger transportation. Public authorities invest so little in the planning and improvement of urban goods transportation, which is often handled by the private sector.

Given the great importance of this subject the purpose of the present study is to develop a simulation model able to represent the operation of a ULS, and then to generate indicators to evaluate the performance of this space according to different operating configurations, in order to analyze the economic and environmental impacts of the urban goods distribution.

A review of urban goods distribution and the problems originating from it is first presented. In the third section, we consider one potential solution for these problems based on the concept of urban logistics. In the fourth section, a case study is presented. The last section presents the results and conclusions regarding the proposed methodology and its application in Belo Horizonte.

2. Urban Goods Distribution in Belo Horizonte (Brazil)

Urban goods distribution is responsible for the continuous supply of commercial activities within the city centre. Many different types of goods are distributed or collected daily on the main streets of a city. Among the goods transported, there is food, medication, mail, construction materials as well as the residue resulting from domestic and industrial activities and so forth.

In Belo Horizonte, the importance of freight urban distribution can be proved by the growth of the urban population. According to IBGE (2010), the situation in Minas Gerais State is similar to elsewhere in the country; about 80% of municipalities have more than half of their population living in urban areas. In Belo Horizonte, 100% of the population (2,375,151 people) is urban.

According to the National Traffic Department (DENATRAN), in order to ensure that the demands of local businesses are met, a fleet of approximately 196,000 cargo vehicles circulate among the main streets of Belo Horizonte, an increase of about 70% in the last decade.

Even though the freight vehicles represent only 2.3% of the total fleet of the city (1.44 million vehicles), they are primarily responsible for the problems related to urban freight distribution, such as:

- Noise and pollutants emissions, which are harmful to the environment and human health, including, carbon monoxide (CO) and oxides of nitrogen (NOx),
- The high consumption of non-renewable resources, including fuels,
- The deterioration of the urban infrastructure,
- The inefficiency of the logistic system of freight distribution, which is directly implied in the increasing costs associated with these activities.