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Reduced urban traffic and emissions within urban consolidation centre schemes: The case of Bristol

Paddeu Daniela [a]*, Fadda Paolo [a], Fancello Gianfranco [a], Parkhurst Graham [b], Ricci Miriam [b]

[a]*University of Cagliari, Via Marengo, 2, Cagliari 09124, Italy*
[b]*University of the West of England, Frenchay Campus Coldharbour Lane, Bristol BS16 1QY, UK*

Abstract

Urban freight consolidation centres (UFCCs) can provide a significant contribution to reducing the negative impacts of freight transport to city centres whilst at the same time providing a more seamless, higher-value logistics experience for their users. The paper draws on the experiences of the Bristol-Bath freight consolidation centre (BBFCC), established in 2002 to serve Bristol city centre and uniquely extended in 2011 to cover Bath, each served by electric lorries; it appraises the benefits of shared 'final mile' freight services, presenting a model for the evaluation of the reduction in traffic and polluting emissions based on Bristol, with a view to optimising future UFCC design. Data about the number of deliveries made by heavy goods vehicles (HGVs) of different types to the BBFCC and the number of deliveries made from the BBFCC to the two shopping centres covering a period of 17 months are analysed. The correlation between the type and number of HGVs delivering to the BBFCC and the number of deliveries made to the retailers by the BBFCC is explicated by means of a multiple linear regression model. Its development is based on analysing parameters as R Square value (total and adjusted), F-statistics and p-values for each coefficient. An estimation of the number of HGVs re-routing to the BBFCC and the pollutant emissions avoided in the urban centre is appraised. The pollutant emissions reduction is based on factors drawn from the UK National Atmospheric Emissions Inventory. Results suggest that the proposed approach may yield HGV movements avoided in Bristol city centre of 75.5% on average. Also, by considering the whole study period, reductions amount calculated is equivalent to 28,677 Kg of CO2, 122.29 Kg of NOx, 2.31 Kg of PM10, 20.32 Kg of CO and 9,854 Kg of fuel. Nevertheless, emissions reductions are significant, but currently limited by small scale, due to the low number of participants. Emissions reductions in the host cities are identified as a result of sharing delivery vehicles for the final leg. The regression model showed high correlation coefficient values (over 85%) for deliveries to the Bristol city centre thanks to the BBFCC. The linear regression models developed provide a useful tool for local authorities

* Corresponding author. Tel.: +39-070-675-5267; fax: +0-000-000-0000 .
E-mail address: daniela.paddeu@unica.it

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and logistics/transport planners in optimising the planning of UFCCs to reduce freight traffic, associated emissions and to improve logistics and transport performance.

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Keywords: Polluting Emissions; Sustainable Freight Transport; Urban Freight Consolidation Centres (UFCCs);

1. Introduction

Freight transport and distribution represent a strong tool for the social and economic development in the urban context, but also a serious problem in terms of negative externalities. In fact, it is responsible for increasing congestion, pollution and reducing the quality of life for people that live in and visit cities. In sum, it is responsible for increasing the economic, social and environmental costs of transport. The Urban Freight Consolidation Centre (UFCC) concept emerged to reduce the negative impacts caused by freight transport in city centres while ensuring an efficient freight distribution with high added value. UFCCs aims to relieve congestion through a process which involves the goods destined for the city centre being delivered to a remotely-located UFCC where they are consolidated into a single delivery made by a high load-factor vehicle in order to reduce the number of heavy good vehicles (HGVs) circulating in the urban area and so improve air quality.

According to Comi and Rosatia (2012) "today, there is a growing interest to support systems able to support decision-makers to understand the structure of freight urban system". However, despite the evident benefits related to the UFCC schemes, their use is not widespread due to financial issues: the initial public funding for the feasibility studies and trials that are generally required to support the initial phase of operation limit their development. Also, city logistics systems have high complexity and the lack of knowledge of logistics, as well as organizational-restrictive conditions, limit their implementation by the municipal authorities (Jarosław and Maja. 2012).

The paper presents an original model for the evaluation of the relations between vehicles-in/vehicles-out and the reduction in traffic and polluting emissions, based on the experiences of the Bristol-Bath Freight Consolidation Centre (BBFCC), with a view to optimising future UFCC design. The BBFCC, on which the evaluation is focused, started working in 2002 with support from the European Project Civitas VIVALDI: the deliveries were made to the city centre of Bristol. Later, in 2011, the logistics service provided by the BBFCC was extended to cover a second neighbouring city centre. Bath. The BBFCC offers high value-added services and makes the deliveries by means of electric lorries. The model proposed in this paper analyses data collected for the CIVITAS Renaissance project and also provided by the operator of the BBFCC for a period of 17 months. The number of deliveries made by different types of HGV to the BBFCC and the number of deliveries made by the BBFCC to the two shopping centres are examined in order to evaluate the number of urban HGV movements avoided and the related pollution reduction.

2. State of Art: the overview of the phenomenon

The EC has attributed the transport sector within being the largest cause of unsustainability. Road transport is the main cause of this: it is the main mode used and the most polluting. The demand for freight and passenger transport is qualitatively more exigent and quantitatively growing more and more (EC. 2010). Thus, new regulations and policies to increase the sustainability of this sector are needed. For these reasons the EC has proposed a policy of promoting "best practice" for urban transport.

The factors influencing fuel consumption can be divided into five categories: vehicle, environment, traffic, driver and operations (Demir et al, 2014). Most fuel consumption models are focused on vehicle, traffic and environmental influences and they do not consider driver related issues which are relatively difficult to measure (Demir et al, 2014).

It can be assumed that CO_2 emissions are directly related to fuel consumption and therefore can be easily calculated if the amount of fuel consumption is known (Demir et al, 2014).

According to Hickman et al. (1999) transportation emissions and energy consumption for heavy goods can be calculated by means of a methodology called MEET, based on on-road measurements. This model has been widely used by several researchers as for example, Kim et al. (2009) who investigated the relationships between freight