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Increase urban freight efficiency with delivery and servicing plan

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ABSTRACT

Delivery and Servicing Plan (DSP) is an innovative logistics concept for more efficient organisation of deliveries from the point of view of the receiver of the goods. DSP actions tested in this study include reducing the number of suppliers, grouping deliveries, selecting less distant suppliers and others. It is shown that DSP can help reduce externalities and lead to a substantial reduction of costs. A new tool was developed to calculate the benefits of different DSP options for businesses and the public sector. Reductions in costs and externalities exceeding 50% have been demonstrated in a few cases. Remaining difficulties with the concept are organisational issues, lack of knowledge, need to give external advisory support for shop owners and the limited number of successful applications to date.

1. Introduction

The paper presents the impacts expected from an innovative approach to retail deliveries based on the Delivery and Servicing Plan (DSP) concept. The definition was born from a practical urban logistics concept developed in London in the context of transport policy needs, mainly to improve the efficiency of goods reception: "DSPs are intended to provide a framework to better manage all types of freight vehicle movement to and from individual buildings" including retail shops, offices, factories, or depots (Browne, Allen, Nemoto, Patier, & Visser, 2012). This is a logistics management concept focusing on efficiency gains that can be realised at the receiver end of the supply chain. The DSPs developed in London are similar to personal travel plans for business and the DSP programme is now an integral part of the London Freight Plan (TfL, 2008). One of the key ideas behind the DSP concept lies in "adjusting the conventional working methods of some of the stakeholders" (Verlinde, Macharis, & Witlox, 2012).

The DSP concept aims to reduce traffic in certain hot-spot areas and main roads in co-operation with businesses. This study presents DSP case studies, presenting new data records and an evaluation of DSP's usefulness, impacts, and potential for future development.

DSP is neither a mainstream area of research, nor a very important field of policy making; as only a few trials have taken place so far, very little investment in real business conditions activities has been made, and little literature has been published. Zunder, Aditjandra, and Carnaby (2012) presented the DSP concept in the context of the Newcastle urban freight policy. The concept is a management oriented, urban freight policy innovation, at an early stage, with some prototypes developed in the last years, but far from reaching a stage where an upscaling and an increasing market share could be envisaged.

The review by Browne and Goodchild (2014) of existing approaches to tackle urban freight challenges recommends primary business and policy-oriented studies on the DSP concept. They argue that "perhaps one of the most striking [gap] that certainly existed until the past few years is the gap between those engaged primarily in urban freight modelling and those working on policy or business-related research issues" (Browne & Goodchild, 2014, p. 88). Modelling could determine the impact of DSP on emissions, congestion and the pattern of demand (Feliu, Ambrosini and Routhier, 2012). On the reduction of emissions, a classical bottom-up data collection approach could be adopted, similar to other studies such as those presented by Edwards and McKinnon (2010), Rizet, Browne, Cornelis, and Leonardi (2012), or Arvidsson, Woxenius, and Lammgård (2013) linking logistics delivery operations with performance measurements and fuel use records. Unlike these emission reduction studies, which are following the supply chain or vehicle approaches, the DSP study limits itself to the final link in the supply chain from the depot to the final customer.

Analysis of the impact on congestion would involve a classical before and after study. It would assess the extent to which DSP increased load factors and resulted in fewer vehicle kilometres for the delivery of a given quantity of goods. The van round of a last mile logistics service provider can be used to illustrate the effect of DSP in reducing distance travelled per parcel. It is assumed that this van is usually filled every day on its delivery round with half its volume capacity at departure from the depot. When DSP is introduced, for example adding one or two additional customers to be delivered by the same van on the same round and in the same area, the van load factor increases, but the total distance of the round increases only marginally. Thus the total distance per load unit diminishes, easing congestion. It is always assumed that the decline

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in kilometres driven for the same total freight demand would reduce the peak traffic. This is a reasonable assumption as the main peak time for van traffic is usually the morning hours, when all stores and clients would expect to receive their goods deliveries.

Demand modelling of this DSP approach could contribute to a better understanding of the behaviour of large freight generators (Comi, Delle Site, Filippi, & Nuzzolo, 2012), by analysing in detail the different types of clients receiving goods in city area, and how they could potentially have their deliveries combined. However, in this study, the small number of case studies limits the scope for this type of analysis.

This study contains new exploratory field research, as no before-after impact studies have been performed on the DSP approach so far. It was possible not only to set up new DSP cases with businesses, but also to collect data on the situation before and after the DSP implementation. The calculation model then makes it possible to measure the benefits for the end-user as well as the reductions in traffic and emissions. Data from the study can be used to benchmark the effects of DSP against those of other interventions and activities which aim to render urban freight more efficient.

In this paper we use an extended, practical, business-oriented characterisation of a DSP. This includes any measure designed to achieve a more rational and efficient use of freight transport for the distribution of business supplies in an urban area, organised and managed from the point of view of the final receiver of the goods. From an organisational point of view, the main DSP actor can be a receiver of goods, or a group of clients with similar business interests. According to this definition, a single shop can start a DSP, or it could be a major organisation or a large group of networking stakeholders in an urban area. The set of potential measures deployed by a DSP includes classical and more innovative freight efficiency and carbon reduction actions.

1.1. DSP action examples

To reduce the number of suppliers, it is necessary to investigate the extent to which their supplies could be channelled through a single, large supplier. In order to group the deliveries of a supplier, it is necessary to check if separate items could be delivered in a single load instead of generating multiple delivery trips.

Reducing the number of deliveries per week is often feasible, for example for frozen food.

One objective is to reduce the delivery distance, and this can be done by switching to a less distant supplier or a carrier with a closer depot.

Another approach to reducing the number of trips is to order less frequently, to centralise the purchasing, and to purchase collaboratively with other businesses.

In a DSP it is possible to channel supplies through a consolidation centre to raise vehicle load factors.

Finally, the use of clean vehicles would help in reducing the emissions.

1.2. DSP decision support tool

Usually decisions about the configuration of deliveries are taken by logistics companies, the headquarters of large groups, or by the suppliers, but rarely by the receiver of the goods. It is very difficult, if not impossible for a shop manager to decide how the deliveries to its premises take place, and how to modify the current patterns. This is often because they lack knowledge of the pattern of delivery. An innovative way of addressing this problem of lack of knowledge was to provide free assistance to the shop owners and the potential future customers of a DSP. In order for this assistance to be accepted by businesses, it was necessary to develop a tool that demonstrates benefits and monetary effects of potential DSP solutions. A practical tool was developed and applied, which shows the impacts of different business solutions relating to deliveries from the point of view of the receiver. This tool has the capacity of being understood quickly by a non-trained user. It was constructed according to principles derived from a previous impact assessment research (Leonardi, Browne, & Allen, 2012), using the before–after approach and incorporating a carbon footprint calculation.

The benefits are expressed for the businesses in terms of cost reduction and for public policy in terms of reducing carbon emissions, congestion and the external costs of freight transport in the urban environment.

The innovative feature of the research was the use of a model to quantify the impact of applying different practices allowing the shop owner or the shopping centre manager to manage its deliveries in a more efficient way. The next section on methodology below explains the development and application of DSP business solutions.

The aims of the remaining sections of the paper are:

- To present the DSP analysis tool. This tool is used to calculate the impacts of decisions potentially leading to changes the pattern of supply to a retail business in urban area
- To show in some cases of the practical use and the benefits of applying a DSP to businesses and to organisations belonging to the public sector
- To demonstrate the case for DSP from the standpoint of a large employer such as a university in a compact city setting.

2. Methodology

2.1. Research approach

The DSP analysis tool was developed in an initial pilot case in a medium-sized UK town. It was applied in several steps. First there was an initial interview with the retail manager in order to take a decision about the envisaged DSP efficiency measures. The DSP implementation and evaluation steps then consisted of data collection, calculation, developing options, deciding on the implementation details for the selected option, collecting evidence on implementation, and finally calculating the internal and external costs impacts. During the first DSP cases, the initial tool and calculation method was refined and readjusted to the specific business situation. The tool was then re-used and the same methodology was consistently applied for several other businesses and an institution.

2.2. Data collection

Key data on the main supplies are collected and central questions were answered. The core principles for the selection of indicators and formula for data processing are similar to those used in previous studies such as Leonardi et al. (2012). To assess DSP changes, the following information was required:

- What are the ‘before’ and potential ‘after’ business situations? What are the supply contracts that could be possibly changed? Is it possible to change the waste service provider contract?
- What are the current sources of the main supplies? Where is the depot of the supplier or carrier distributing the goods?
- Size of the ‘typical’ deliveries in cubic-metres and in kilogrammes
- Frequency of the delivery: how many deliveries are received per week? how many working days per week?
- Vehicle types and changes in fleet: are vans or trucks in use? What is the approximate capacity of the main delivery vehicle?
- What is the real annual fuel use, or what is the average fuel efficiency expected from this type of vehicle and the annual distance covered?

2.3. Analysis: first calculation of current situation (‘before’ DSP implementation)

After the data collection, the current or “before” situation is analysed, the most important analytical step being the calculation of the internal and external impacts of transport. These include the effects on fuel use, fuel costs, and the external cost CO_2 emissions, air pollution, accidents, congestion and noise. The main objective of this analysis is to provide an estimate of the overall costs per delivery paid by the receiver. As a proxy for all transport costs, fuel costs are calculated, knowing that