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A collaborative urban distribution network

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Abstract

Many urban areas are experiencing an increase in the number of trucks and vans delivering goods to retailers as well as a decrease in the utilisation of delivery vehicles. This leads to increased emissions, noise and conflicts with pedestrians. Large metropolitan areas often have a number of retail centres with outlets being regularly serviced by wholesalers. Urban distribution systems are typically characterised by suppliers operating their own vehicle fleets, distributing only their goods to their customers on a regular basis. Within specific sectors there is an opportunity to combine urban distribution networks to reduce the number of vehicles required for deliveries as well as the distance travelled by delivery vehicles. This can result in substantial savings in transport operating costs for carriers as well as reduced emissions and noise from freight vehicles.

It is common in urban distribution networks for suppliers to distribute only their goods to retail outlets. This involves each supplier operating vehicles to carry each retailer's goods and vehicles must visit each retail outlet regularly from the supplier's warehouse. While routes and schedules can be optimised for each wholesaler, vehicles generally have low utilisation.

This paper estimates the benefits of a collaborative distribution network that involves suppliers sharing the use of vehicles as well as their storage areas. With the collaborative system, a transfer route is used to transfer goods between suppliers where goods with destinations near other suppliers are transferred to these suppliers. This allows delivery routes from suppliers to be developed with higher utilisation and lower travel distances. A hypothetical urban distribution system is used to estimate the performance of the collaborative distribution system. The process used to transform independent distribution systems to collaborative networks is also presented.

Keywords: Collaborative urban distribution; delivery network design

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1. Introduction

Urban areas are experiencing an increase in the number of trucks and vans delivering goods to retailers as well as a decrease in the utilisation of delivery vehicles. This leads to increased emissions, noise and conflicts with pedestrians. Large metropolitan areas often have a number of retail centres with outlets being regularly serviced by wholesalers. Urban distribution systems are typically characterised by suppliers operating their own vehicle fleets, only distributing their goods to their customers on a regular basis. Within specific sectors there is an opportunity to combine urban distribution networks to reduce the number of vehicles required for deliveries as well as the distance travelled by delivery vehicles. This can result in substantial savings in transport operating costs for carriers as well as reduced emissions and noise from freight vehicles.

Urban distribution involves vehicles delivering goods from warehouses to retails outlets using vans and trucks. It is common in many retail sectors for a moderate number of suppliers or shippers to service a large number of the same retail stores in an urban area. Independent networks are typically established by each supplier. Such networks are characterized by the delivery frequency and load sizes.

Physical distribution systems can be structured using different types of routes, routes can be developed for transporting goods, from a distribution centre to terminals, between terminals, and between terminals and demand points (Daganzo, 2005).

Transhipment networks can be developed where goods are transferred from depots at terminals and separate routes developed from terminals (Daganzo, 2005). Levels of routes are defined, the higher level used to transport goods between the depot and terminals with the lower level routes servicing customers from the terminals.

Fischer *et al.* (1993) showed that by transferring orders between shippers (horizontal and enhanced cooperation) in regional distribution can substantially reduce distances travelled by vehicles.

The OECD study on urban distribution recommended that consolidation of goods delivery is a key to achieving sustainable urban goods transport (OECD, 2003). Consolidation was seen as being able to counter the increasing demands for frequent and just-in-time delivery as well as restrictions of limited spatial infrastructure and environmental demands. Improved vehicle utilisation reduces vehicle trips thus lowering the financial and environmental costs of deliveries. Consolidated loads can often be delivered by smaller vehicles with reduced vehicle kilometres. This can help counter the additional transhipment costs. Voluntary co-operation within specific sectors of the private sector seems to offer good potential for being a successful city logistics scheme.

However, collaborative distribution systems based around public logistics terminals can be expensive to establish and operate. This paper describes how an existing urban distribution network for a sector operating with independent delivery systems from suppliers can be transformed into a collaborate network to reduce the amount of distance travelled by vehicles. In this type of network, suppliers share existing storage space with other suppliers at their warehouses as well delivery vehicles. This can reduce transport costs as well as emissions from urban distribution.

2. Urban distribution networks

2.1. Independent distribution systems

It is common in urban distribution networks for suppliers to distribute only their goods to retail outlets. This involves each supplier operating vehicles to carry each retailer's goods and vehicles must visit each retail outlet regularly from the supplier's warehouse. While routes and schedules can be optimised for each wholesaler, vehicles generally have low utilisation.