Recent developments in modelling City Logistics in Melbourne

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Abstract

This seminar will introduce City Logistics and describe recent models developed for improving the sustainability of goods movement in Melbourne, including a collaborative freight system for suppliers distributing goods to retailers as well as a Central Business District (CBD) routing system for couriers.

Distribution systems in metropolitan regions are typically characterised by suppliers operating their own vehicle fleets, distributing only their goods to their customers on a regular basis. In sectors where there are multiple suppliers servicing common customers, there is an opportunity to develop collaborative systems combine distribution networks to reduce the distance travelled by delivery vehicles. This can result in substantial savings in transport operating costs as well as environmental costs.

With the collaborative system, one supplier is selected for the location to exchange goods between suppliers where goods with destinations near other suppliers are transferred to these suppliers. In the first level, the model decides the hub location, the transfers between the suppliers and the hubs and the consequent inventory levels at each supplier. The inventory level acts as linking variables between this first level and the distribution network, which decides on the routes of the suppliers.

This seminar will describe a model developed for designing supplier exchange networks as well as routes from suppliers to customers. A set of time periods (days) are specified when exchanges between suppliers can occur as well as when distribution to customers can occur. Constraints are defined for handling inventory levels of products at suppliers after supplier exchanges, vehicle capacities as well as demand and supply conditions.

Determining efficient routes for couriers in CBDs is becoming more challenging due to growing levels of congestion. New technologies allow on-street loading zones to be booked to reduce waiting times and circulation. Couriers when planning deliveries need to consider both driving and walking routes to optimise their activities. A bi-level optimisation model for determining the best routes for minimising operating and environmental costs will be presented. A genetic algorithm was developed to find (near-)optimal solutions. The output can provide guidance for couriers as well as planners who are involved in determining duration limits at loading zones.
Russell is an Associate Professor in Transport Engineering at the University of Melbourne. He has a Bachelors Degree in Mathematics (RMIT University), Masters in Transport Engineering (Monash University) and a PhD in Traffic Engineering (The University of Melbourne). For the last 15 years he has been involved in numerous local freight studies, including the Melbourne’s Freight Movement Model and the Victorian Freight and Logistics Plan. Russell is a Team Leader of the Volvo Centre of Excellence in Sustainable Urban Freight Systems and Vice-President of the Institute for City Logistics based in Kyoto. Currently, Russell is actively involved in several urban freight projects in Melbourne including High Productivity Freight Vehicles and Loading Dock Booking systems. He is currently supervising research projects involving modelling logistics sprawl, collaborative freight systems, road pricing, urban consolidation centres and multi-modal freight systems.

Russell has also contributed to a number of international studies relating to urban freight, including the European Union’s Best Urban Freight Solutions (BESTUFS) project and the OECD report on urban distribution. He has co-authored over 10 books and 100 refereed publications. Russell recently co-edited a book, “City Logistics: Mapping the Future” (CRC Press, 2015) that presents a range of innovative solutions to increase the efficiency and reduce the impacts of freight in cities.