National Freight Data Hub Submission

Introduction

This submission outlines a number of areas where I believe the National Freight Data Hub can enhance the efficiency and sustainability of urban freight systems. It elaborates on my presentation at ATRF 2019 (see Appendix A).

Urban Freight Problems

Australia is one of the most urbanised countries in the world, with Sydney and Melbourne’s population growing at unprecedented rates. Australian cities have low population densities with large metropolitan areas that presents challenges for goods distribution. Urban traffic congestion is a growing issue with average driving speeds declining markedly in Australia’s capital cities in the last 5 years (AAA, 2018).

Congestion costs in Australian cities are rising rapidly and were estimated to be $16.5 billion in 2015 and are predicted to increase to $37.3 billion by 2030 (BITRE, 2015). Trucks due to their large size, limited acceleration and braking capabilities have a significant effect on urban congestion. Traffic congestion is also a significant contributor to social and environmental costs such as crashes, emissions and noise.

Existing freight operations in Australian cities are dominated by owner (not for profit) carriers that operate independent networks, with low levels of vehicle utilisation and efficiency. The Physical Internet (PI) based on open, shared, integrated and dynamic networks provides a promising paradigm for dramatically improving the efficiency and sustainability of urban freight systems.

Increased level of service expectations due to eCommerce (especially B2C), just-in-time manufacturing and rapid response retail logistics is increasing the number of freight movements using vans and small trucks. Currently most freight trips only carry a small percentage of their carrying capacity. There is also a large proportion of unladen trips travelling back to or from depots without any load.

Urban congestion and its effects are major issues for governments, industry and residents living in Australian cities. The Federal Government will invest $4 billion over the next 10 years through the Urban Congestion Fund to reduce congestion in urban areas. Air quality and noise impacts from freight vehicles are major health issues for residents living in Australian cities. Rapid urbanisation and associated congestion is creating many challenges for improving the efficiency and sustainability of Australian urban freight systems.

Hyperconnected City Logistics

City Logistics provides a multi-stakeholder and multi-objective framework for designing and evaluating solutions that address social and environmental as well as economic issues (Thompson and Taniguchi, 2001). The Physical Internet (PI) based on the analogy of the digital internet provides an enabling paradigm for creating more open, shared, dynamic and integrated freight networks (Montreuil, 2010). Hyperconnected City Logistics has recently been used to describe how city logistics can be enabled using PI concepts to improve the efficiency and sustainability of urban freight systems (Crainic and Montreuil, 2016).
The PI transforms urban freight networks from being Point to Point (P2P) to Hub and Spoke networks (H&S) with less vehicle kilometres travelled (VKT) and has major potential for congestion alleviation and reduced externalities. A recent study undertaken in Melbourne estimated a 70 percent reduction in VKT by trucks when utilising shared high productivity vehicles and exchange hubs for transporting general freight between key freight areas (Thompson, et al. 2019).

**Benefits of Hyperconnected City Logistics**

There will be major benefits from collecting data that can be used for evaluating and implementing PI orientated city logistics solutions, including:

(i) *Reduced need for road infrastructure spending* due to the reduction in congestion. The Federal Government has committed to investing $4 billion over the next 10 years through the Urban Congestion Fund, to reduce congestion in urban areas, and

(ii) *Reduced social* (especially crash and noise related health) *costs and environmental* (especially emission) *costs*.

**Data for facilitating the implementation of Hyperconnected City Logistics**

Transforming existing freight and logistics systems into PI orientated networks requires the data for the development and application of advanced modelling methods. Data is required for enhancing the implementation of new technologies in urban areas such as high productivity vehicles and parcel lockers as well as new types of infrastructure such as urban consolidation centres and automated transhipment hubs.

Data is also required for developing optimisation methods: strategic and operation decision support tools for:

(i) network design and operation using multi-echelon models addressing the hub location problem for designing transfer and temporary storage hub networks, and

(ii) Real time vehicle routing and scheduling, incorporating multimodal (synchronmodality) systems with multiple objectives (eg. financial and social costs).

*Gamification* methods need to be developed to collect data relating to how stakeholders such as shippers and carriers will react and make decisions in new operating environments presented by future PI systems. In particular, data on how price and levels of service provided will influence demand is required.

*Stated preference (SP) surveys* are required for understanding how key stakeholders such as shippers and carriers will participate in open competitive and shared systems, particularly how they will utilise opportunities from on-line platforms (eg. auctions) and transfer stations (eg. UCCs and parcel lockers). Data from SP surveys will be vital to determine the most important features of software platforms for facilitating the sharing of resources.

A variety of data is also required for measuring the performance of urban freight systems (Appendix B). Measures of performance or criteria should be based on values, goals and objectives that are reflected in public policy.

A range of surveys are required for evaluating city logistics schemes such as Urban Consolidation Centres (Thompson, 2015). Surveys of stakeholders are required for identifying their problems and key performance indicators as well as determining the best range of data collection methods to be
implementing for predicting the effects of city logistics solutions. Monitoring performance before and after trials of new schemes is also necessary.

**Urban Consolidation Centre (UCCs)**

UCCs provide an opportunity to reduce congestion and freight costs in inner city areas. There are number of surveys that need to undertaken to facilitate their effective implementation, including:

(i) Receivers willingness to participate based on the characteristics of joint delivery services such as the number of daily deliveries, valued added services (e.g. temporary storage) and real time delivery status,
(ii) Carriers willingness to pay for joint delivery services, and
(iii) Support levels provided by administrators (e.g. marketing & preferential parking)

**Social Cost Benefit Analysis (SCBA)**

A range of surveys are required for the quantification and monetarization of the social and environmental costs of freight such as noise, emissions and crashes. These data are necessary for incorporating SCBA into the evaluation of city logistics solutions.

**References**

Appendix A

Slides from presentation at ATRF 2019

National Freight Data Hub

ATRF Canberra, 30th September 2019
Freight data needs

Freight Trips

- Origins & Destinations
- Type of goods
- Vehicle utilisation

Facilitate implementation of the Physical Internet (PI)

Network Performance

Improved vehicle loading tonnes moved by km driven (tonne-km / vehicle–km ratio) is a key driver of emissions decrease

Reducing number of empty trips or km driven, increasing use of available capacity in vehicles (optimising 3 measures of capacity: volume, weight & space floor) & reducing overall km driven by vehicles while delivering same amount of goods (ITF 2018:26)
AIMES

AIMES is the world's first multimodal urban testing ecosystem for implementing and testing of emerging connected transport technologies at large scale and in complex urban environments.

Vehicle to Infrastructure (V2I using DSRC)
AIMES Freight Projects

Signals: speed guidance & priority (off-peak)
Route guidance (incident management)
Loading bay: guidance & booking systems
ETA Prediction

Expectations for the NFDH

Facilitate Hyperconnected City Logistics

- Real-time schedule orientated FMS
- Extending IAP concepts with KM

SCBA for planning & evaluation of UCCs & IMTs

- noise, emissions, congestion & crash costs
- vehicle age, fuel & loads (weight or volume)
Appendix B

Hierarchical Approach for identifying Performance Measures

Urban Freight Improvement Program

- Government Strategies
- Values
- Industry Consultation
- Planning Policies

Goals
- Improve Health & Safety
- Minimise Community Impacts
- Reduce Freight Operating Costs
- Increase Supply Chain Efficiency

Objectives
- Reduce Crashes
- Reduce Crash Severity
- Arterial Road Access
- Reduce Impact & Intrusion
- Reduce Noise Impacts
- Reduce Delays
- Reduce Congestion
- Improve Access to KFA
- Increase Efficiency
- Loading Facilities
- Increase Travel Time Reliability
- Reduce Transport Costs
- Increase Accessibility to FAC

Performance Measures

- # crashes
- # HS & Injuries
- # FV in SA
- Noise Levels
- Travel times
- LOS
- Delay Time
- # FV
- # pi
- Travel times
- Travel speeds