Last Mile Delivery Activities in the City Centre – Insights into Current Practices and Characteristics of Delivery Trips

11th International Conference on City Logistics
12th-14th June 2019

Khalid Aljohani, PhD Student
kaaljohani@uj.edu.au

Russell. G. Thompson, Associate Professor
rgthom@unimelb.edu.au

THE UNIVERSITY OF MELBOURNE

Outline

- Overview of Last Mile Delivery in the Inner-City Area
- Operational Activities and Issues
- Overview of Data Collections Techniques:
  - Semi-structured Interviews with Couriers, Express and Parcel (CEP) Service Providers
  - Online Survey of Freight Carriers
- Assessment of Last Mile Delivery Network and Delivery Practices of CEP Service Providers
- Characteristics of Delivery Trips in Inner-City
- Discussions and Policy Implications

Introduction

- Last mile deliveries are complex due to (Antún et al. 2018):
  - freight demand,
  - structure of area,
  - sensitive surrounding uses
  - density of the delivery points
- Lack of segmentation of the current practices of last mile delivery
- Limited data on characteristics of light commercial vehicles (LCVs) in the city centre.
- The main contribution of the article is two fold:
  - A) The attributes of the delivery trips occurring within inner-city area
  - b) Ranking of the negative issues on the efficiency of the freight carriers

Overview of Last Mile Delivery in the City Centre

- **Commercial receivers** and **individual consumers** require different type, size and frequency of deliveries
- **High-rise towers** attract large number of express and fragmented
- The rate of successful deliveries on first attempt for **B2B** deliveries is higher than **B2C** (Allen et al. 2018).
- **13-14**% of all online purchase in **UK** weren't successful in first attempt, which resulted in **£771 million** additional costs (IMRG 2014)
- Failure rate for parcel deliveries in the **Netherlands** and **Belgium** is **25**% and **14**% respectively (Buldeo Rai et al. 2018)

Operational Activities and Issues

- The efficiency of freight carriers is affected due to:
  - –exacerbated traffic congestion,
  - –limited parking
  - –loading infrastructure
  - –unsustainable delivery vehicles

- **Allen et al. (2018):** the vehicle delays have increased by **31**% in **London.** Congestion is expected to increase **60**% by **2030**.
- **Marcucci et al. (2015):** inefficient on-street loading zones complicate freight deliveries into the area
- **(UW Supply Chain Transportation & Logistics Center 2018):** Couriers use the kerbside to deliver **87**% of all buildings
- **Allen et al. (2018): 95**% of the deliveries were performed using kerbside in central **London**
- **Jensen (2017):** In 2016, **UPS** paid $US17 million parking fines in **New York.**
- **Alho and e Silva (2014):** parking away from receiver, the size and volume of parcels that couriers could carry is significantly constrained

Overview of Data Collection Techniques

- Two main data collection techniques were applied:
  - **Semi-structured interviews**: with 10 logistics managers of Couriers, Express & Parcel (CEP) service providers in Melbourne, Australia
  - **Online survey**: by depot managers of freight carriers in Melbourne. The survey collected selected operational data including: product type, average vehicle fill rate, decision-maker, number of daily rounds, number of stops, average number of parcels and the rate of successful delivery on 1st attempt
- 55 participants
- 28 % active response rate
- The 55 freight carriers represent 20 % of all freight carriers that operate in Greater Melbourne

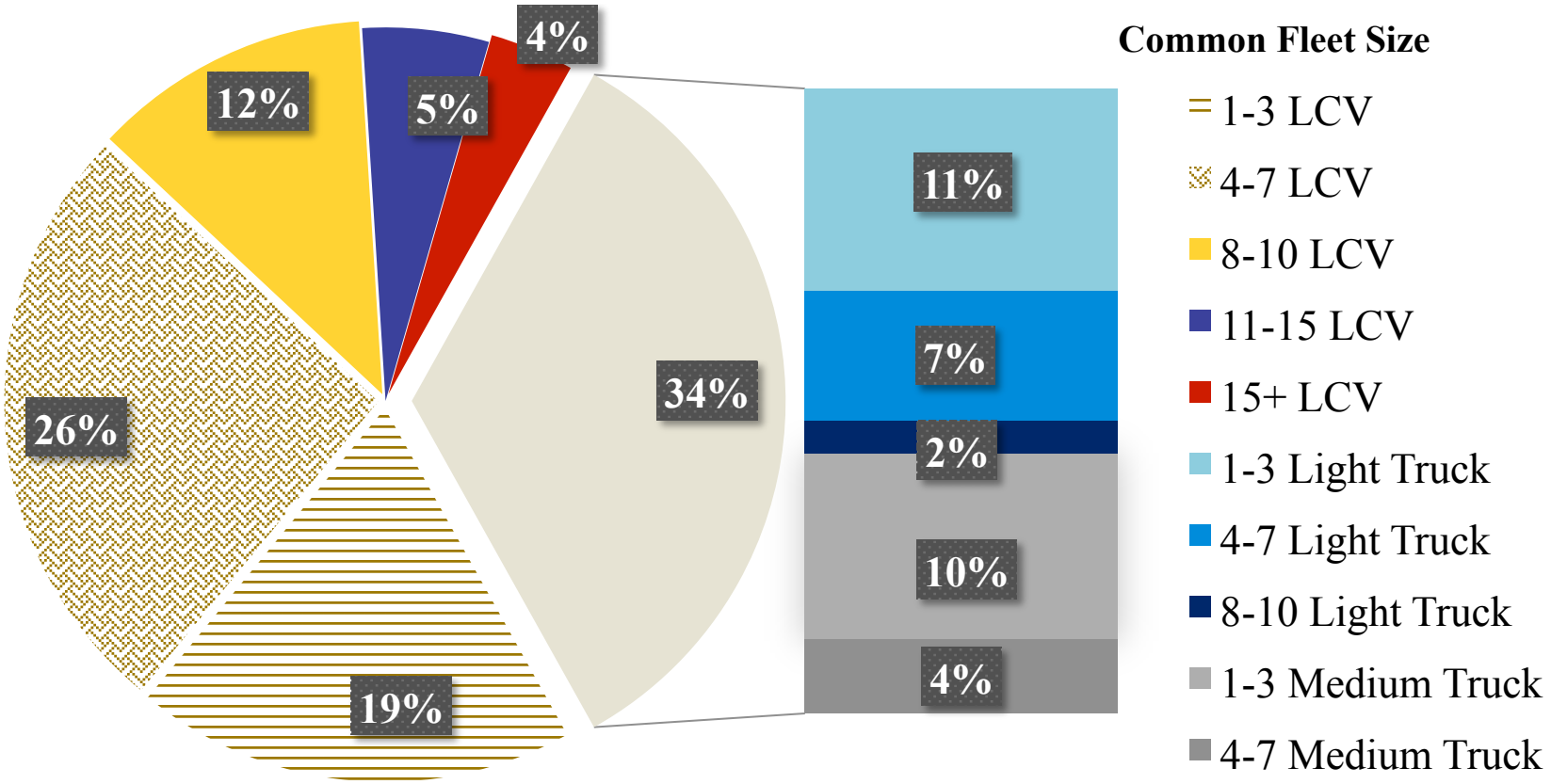
- Large CEPs, inter-state and intra-state consignments transported using heavy trucks with **curtain-sider tautliner trucks** due to:
  - higher **payload capacity**, **secured**, **weather-protected** and **easy access**

- At the depot, large CEPs use **fully-automated** handling and sorting systems
- Major buildings in city centre are usually serviced by an assigned delivery vehicle
- Delivery **vans:** for delivery and pick up in the **city center** and **residential areas**
- **Trucks:** in suburban areas and for deliveries to **commercial** receivers

- The driver loads parcels into the vehicles depending on **loading capacity, number of delivery rounds and parcel size**
- CEP companies apply different approaches scheduling parcel pick-up jobs:
  - Large CEPs schedule jobs for vans in busy zones in the afternoon
  - Some CEPs schedule jobs during both the morning and afternoon
- For the **first** round, vans would leave at **7** AM and around **60**% loaded
- For the **second** round, vans would leave at **12** PM and around **40-50**% loaded
- Large CEPs schedule **third** delivery round for **3** PM
- Couriers usually deliver **5-8** parcels per stop

Characteristics of Delivery Trips in Inner-City

- Typical fleet size for each vehicle class utilised by the participating freight carriers

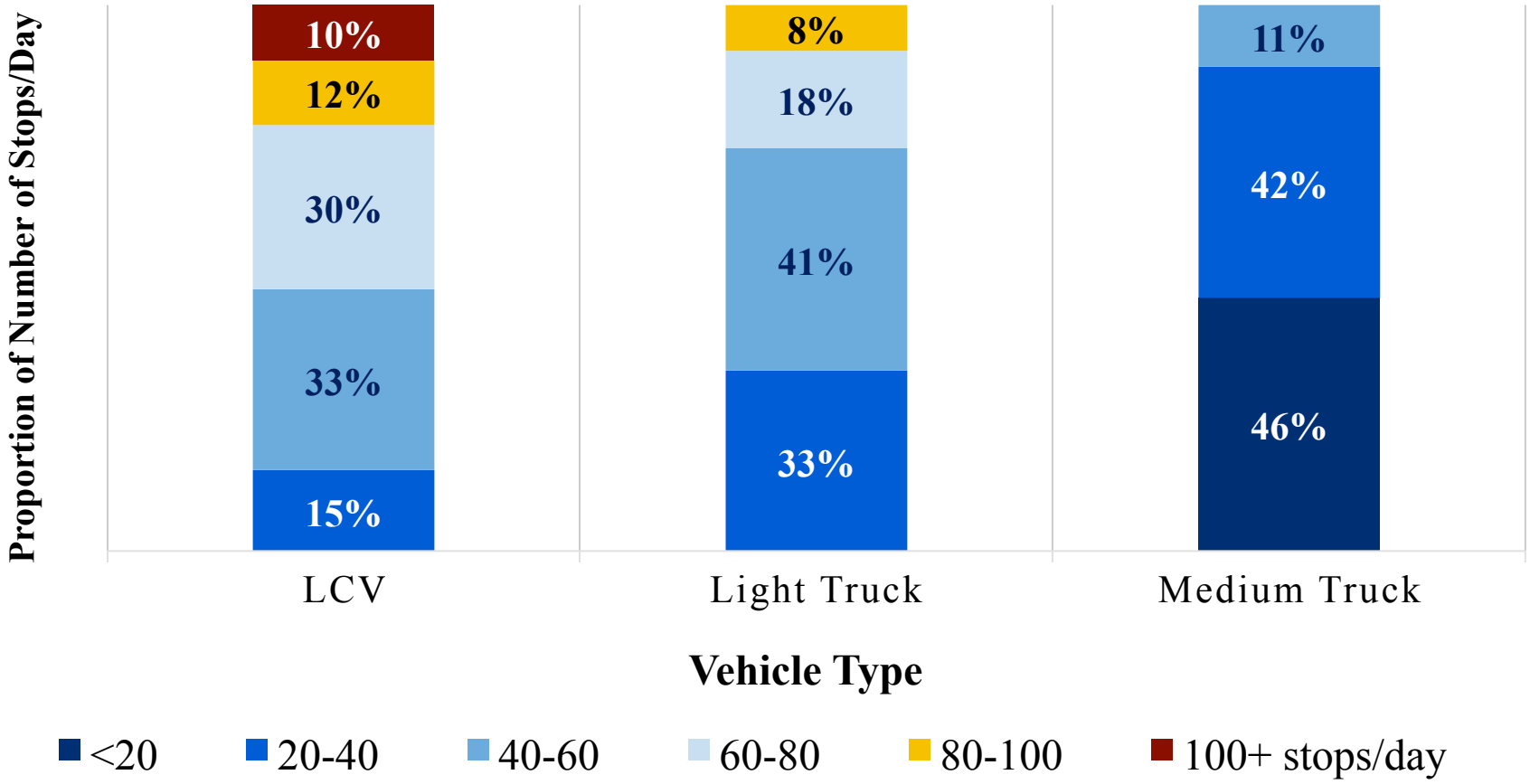


Characteristics of Delivery Trips in Inner-City

- Most common fleet size includes **4-7** delivery vans.
- About **9**% of freight carriers send more than **10** delivery vans
- **31**% of of freight carriers use a **routing** & **scheduling software**
- **60**% of freight carriers perform a **single delivery round** per day
- **31**% of freight carriers perform a **morning and afternoon** delivery.
- **9**% of freight carriers perform **three** rounds per day; two delivery and a single pickup round
- **70-80**% of **B2B** deliveries are delivered on 1st attempt. **60**% of **B2C** are delivered on 1st attempt

Characteristics of Delivery Trips in Inner-City

The distribution of the daily number of stops for each vehicle class.



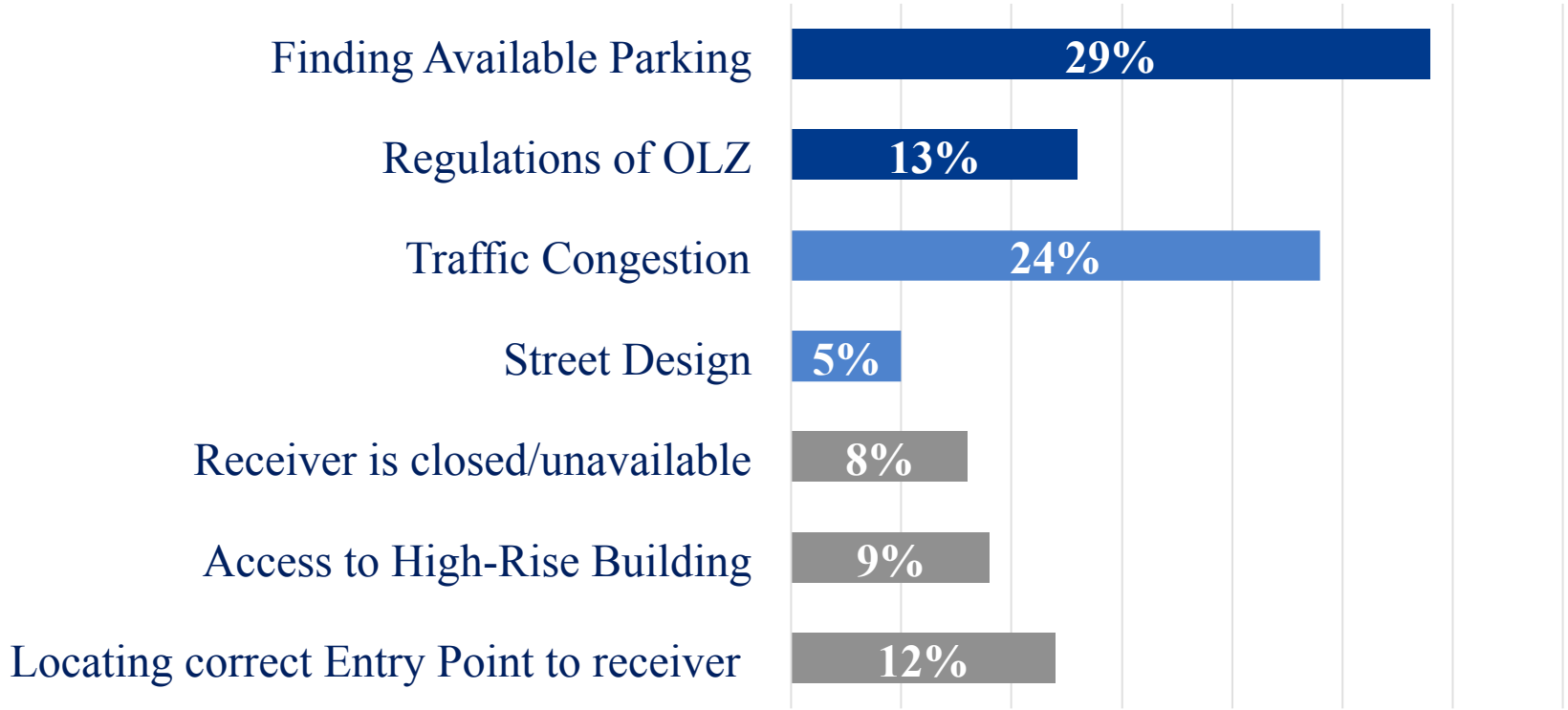
Characteristics of Delivery Trips in the City Centre

- On average: vans typically perform daily between **60-80** stops
  - less than 50 stops for deliveries to retailers
  - 60 stops to food outlet
  - 65-75 stops for express parcel deliveries to commercial and residential receive

- The average number of stops for other vehicles in the city centre is:
  - Light truck: **40-45** stops
  - Medium truck: **25-30** stops

Ranking of Operational Issues

100-point allocation assigned by participants to the operational issues based on their influence on efficiencies of the carriers' activities in the inner-city area



- *Inferential Analysis of The Relationships between The Characteristics of Delivery Trips and Operational Issues*
  - To explore potential associations between the **property of freight carriers**, **characteristics of the delivery** and **the operational issues**
  - Two Non-parametric test methods were applied : **Kruskal-Wallis H** and **Spearman's rho correlation** (Washington et al. 2010)

- Three Kruskal-Wallis H tests were performed to access relationships between::
  - **Vehicle type** vs **characteristics of the delivery**
  - **Vehicle type** vs **operational challenges**
  - **Product type** vs **operational challenges**

Relationships Between Vehicle Type *vs* Characteristics of The Delivery Trip

First Kruskal-Wallis H test:

- Significant differences in all attributes of the delivery trip between vehicle types
- LCV has a higher fill-in rate than LT (p =0.068, r = .5) and MT (p < .001, r = .59)
  - LCV fill-in rate **60-70**%
  - LT and MT fill-in rate of **50-60**% and less than **40**% respectively
- Higher number of stops for LCV than HT (p < .001, r = .66)
  - LCV 40 to 60 stops, while stops 20 to 40 drops
- Medium trucks delivers a significantly higher number of parcels per stop than LCV (p = .026, r = -.40)

Relationships Between Vehicle Type *vs* Operational Challenges

Second Kruskal-Wallis H test:

To evaluate difference in operational between types of vehicle

- HT drivers reported higher difficulty in finding available parking than LCV
  - HT a rating higher than 30%, whereas LCV/LT a rating of 25%
- LCV drivers higher difficulty in access to high-rise buildings than HT
  - LCV drivers reported a rating of 12.5%, whereas HT drivers stated 0%
- LT and HT drivers have higher difficulty to street design.
  - LCV reported a rating of 0%, while LT and HT 10% and 20%, respectively

Relationships Between Product Type *vs* Operational Challenges

A series of Spearman's rho correlation analyses to explore significant relationship between operational challenges and number of drops:

- Strong and negative relationship between street design and number of drops.
- For LCV, strong and negative relationship between finding available parking and number of drops
- For medium trucks, negative relationship of medium strength between traffic congestion and number of drops
- No significant relationships for light trucks.

Discussions and Policy Implications

- Increasing movements of express deliveries make it difficult to offer low-cost delivery
- Preference to operate delivery vans in the **CBD** area due to improved **manoeuvrability**, **capability** and **reliability**
- Deliveries to **other** parts, the **efficiency** of the carriers **doesn't** suffer from the longer travelled **distance** and heavy **congestion**
- Somewhat different figures for the characteristics of delivery trips with respect to similar studies in Europe and USA
  - Example: higher figure (**53**%) for the main decision-maker (the driver) of the delivery route and order than **36**% reported by **Torino-based** study (Pronello et al. 2017)

Conclusion

- Ameliorating the last mile delivery in the congested inner-city area offer a win-win and efficient solution:
  - freight demand management (FDM) policies
  - enhancing the parking and loading infrastructure
- large receivers and building managers should coordinate their deliveries
- Freight behavioural research should be undertaken.
- The regulations and allocations of the on-street loading spaces need to be updated
- Internet of Things (IoT) technologies, license plate recognition, Smart Occupancy Signs and booking applications should be considered to be used

THE UNIVERSITY OF MELBOURNE

References

- Visser, J., Allen, J., Browne, M., Holguín-Veras, J. and Ng, J., 2018. Light Commercial Vehicles (LCVs) in urban areas, revisited. *City Logistics 1: New Opportunities and Challenges*, pp.29-43.
- *Buldeo Rai, H., Verlinde, S. and Macharis, C., 2018. The "next day, free delivery" myth unravelled: Possibilities for sustainable last mile transport in an omnichannel environment. International Journal of Retail & Distribution Management.*
- Aljohani, K., 2016. Integrating Logistics Facilities in Inner Melbourne to Alleviate Impacts of Urban Freight Transport. 38th Australasian Transport Research Forum, Conference Proceedings, Melbourne, Victoria, Australia. Retrieved from: https://atrf.info/papers/2016/files/ATRF2016_Full_papers_resubmission_185.pdf
- Marcucci, E., Gatta, V. and Scaccia, L., 2015. Urban freight, parking and pricing policies: An evaluation from a transport providers' perspective. Transportation Research Part A: Policy and Practice, 74, pp. 239-249.
- Jensen, T.F., 2017. Viewpoint from UPS. Presentation No. 21812. Transportation Research Board 96th Annual Meeting
- Alho, A.R. and e Silva, J.D.A., 2014. Analyzing the relation between land-use/urban freight operations and the need for dedicated infrastructure/enforcement—Application to the city of Lisbon. Research in Transportation Business & Management, 11, pp.85-97., Washington D.C., 8-12 January 2017.
- Washington, S.P., Karlaftis, M.G. and Mannering, F., 2010. Statistical and econometric methods for transportation data analysis. Boca Raton, Florida, USA: CRC press
- Pronello, C., Camusso, C. and Valentina, R., 2017. Last mile freight distribution and transport operators' needs: which targets and challenges? Transportation research Procedia, 25, pp.888-899.