De-conflicting freight streetside operations for liveable streets

From conflicts identification to right-of-way decisions modelling

Castrellon, J-P., Browne, M., Sanchez-Diaz, I., Cherrett, T., Crosk, J., Mcleod, F., Oakey, A.

JUAN PABLO CASTRELLON

PhD student

Chalmers University of Technology

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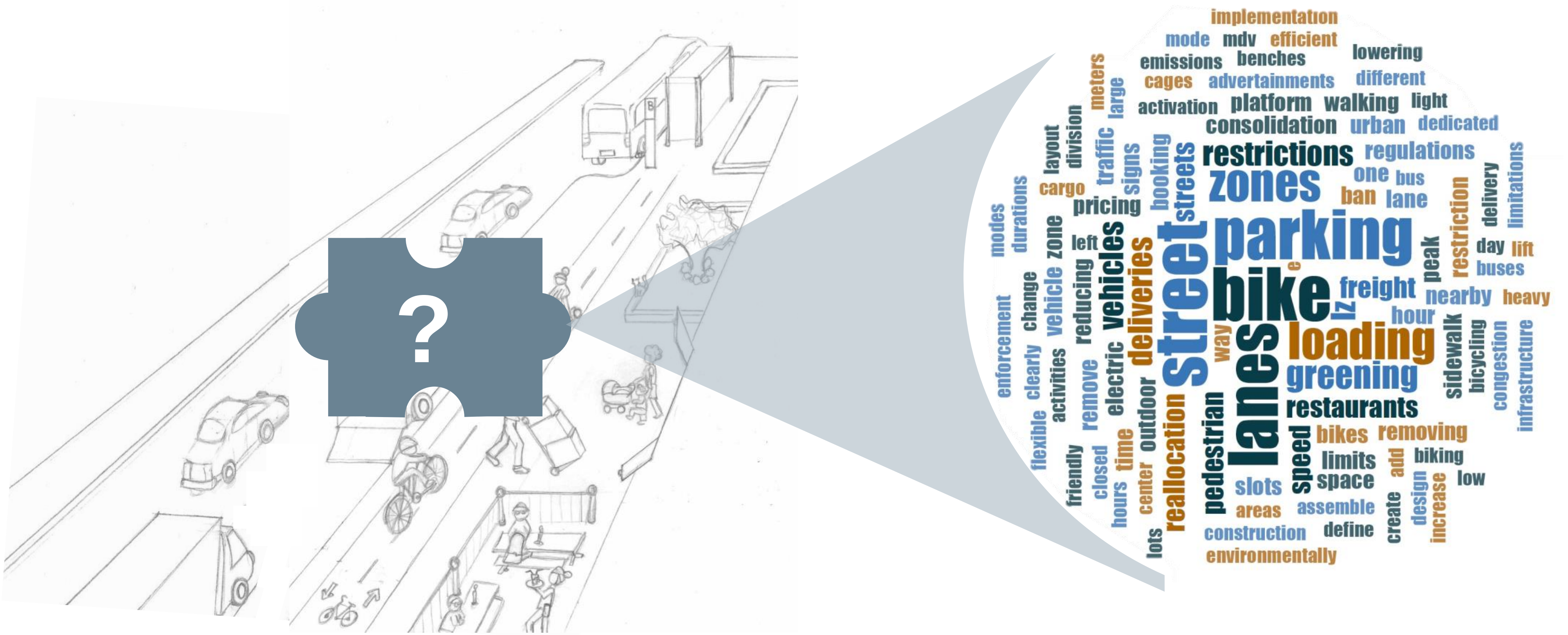
OUTLINE

1. Motivation
2. Research approach
3. Data collection
4. Results
5. Conclusions

1. MOTIVATION

COMPETITION FOR THE PUBLIC SPACE

Streets are contested public infrastructure with demand from more than 160 legitimate uses (Allen et al., 2022).



1. MOTIVATION

Liveable streets - public spaces that promote social interactions in safe, healthy, inclusive and welcoming environments (Sanders et al., 2015).

- Complete streets – focus on street uses and functions (Hui et al., 2017)
- Healthy streets – focus on public transport and active mobility (Plowden, 2020)
- Flex zones – focus on demand (OECD, 2018).
- …

Williams and Carroll (2015) coined the ***liveability and freight movement paradox*** to the fact that actions fostering liveable spaces create conditions that increase freight demand while reducing freight access, e.g., mixed land use, vibrant streets, active mobility, and road diets.

1. MOTIVATION

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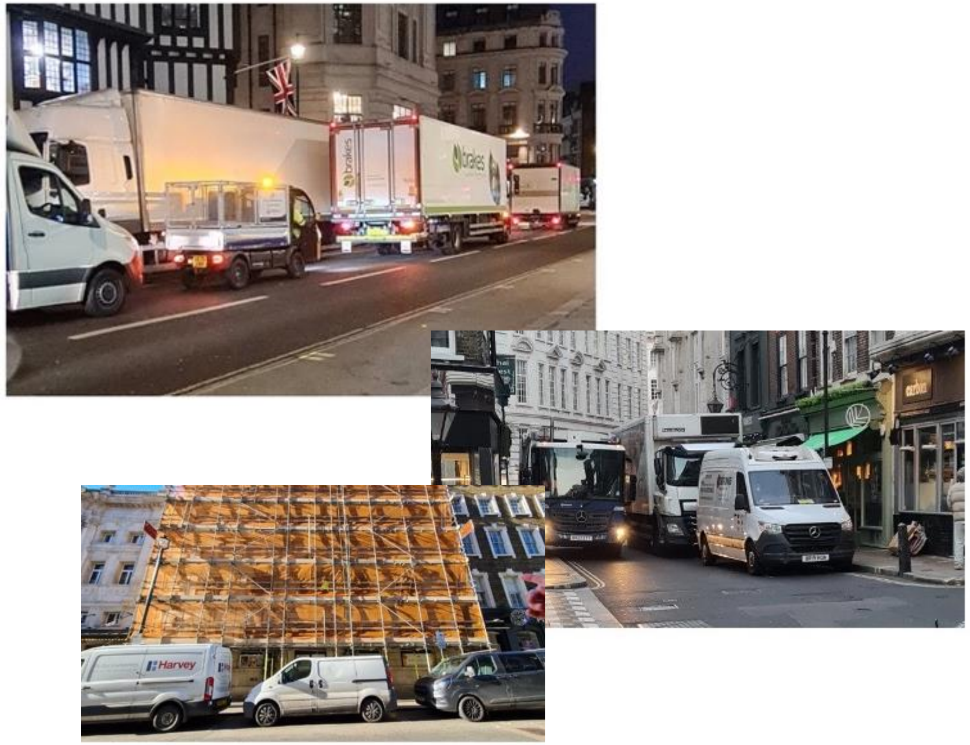
Freight vehicles spend 40-80% of their operational time parked due to (un)loading operations (Sánchez-Diaz et al., 2020).



Unsustainable impacts of freight parking

- Freight vehicles contribute to 15% of urban GHG (Hammami, 2020) and 50% of the particulate matter (PM) (de Marco et al., 2017).

- Cruising for parking occurs in 70 – 80% of last-mile deliveries in Europe. 3rd most important cause of congestion. (Lopez et al., 2016).

- Last-mile deliveries represent up to 75% of total logistics costs (Gevaers, van de Voorde and Vanelslander, 2011).

2. RESEARCH APPROACH

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PURPOSE

Space-sharing conflict: Tensions among different transport modes in the use of streetside space (Fabricius, V. et al., 2022)

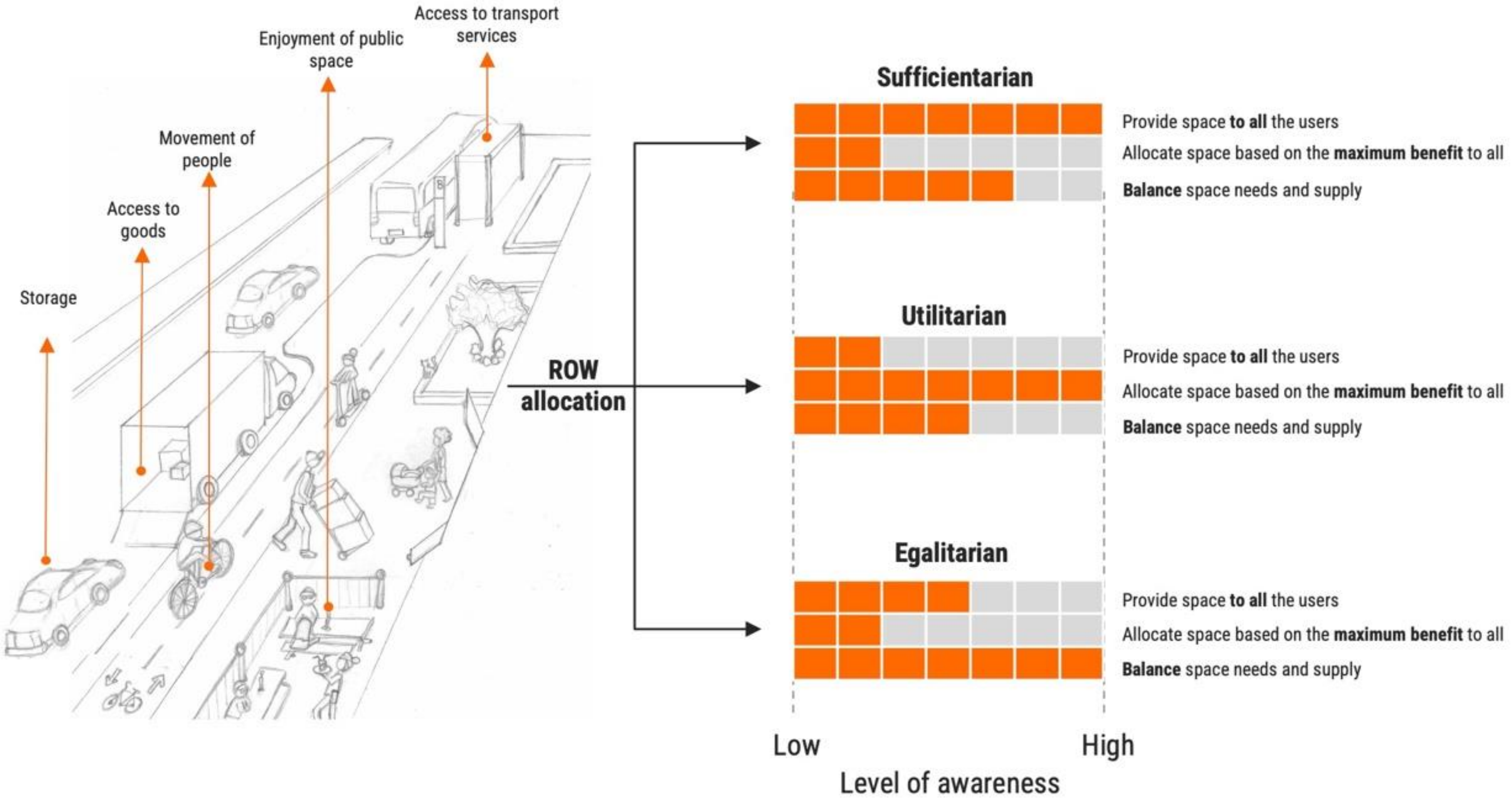
This research investigates streetside conflicts on urban streets to better understand the challenges in fostering liveable streets and potential modelling approaches to face them.

Right-of-way allocation problem: optimisation of the distribution of the available space for the fulfilment of the street functions (Rodriguez-Valencia, 2014)

2. RESEARCH APPROACH

FRAME OF REFERENCE – a fairness approach

Most ROWAP research contributions do not explicitly refer to any distributive justice principles, but implicitly can be related to one of these three principles. (Lefebvre-Ropars et al., 2021):



2. RESEARCH APPROACH

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METHODS

Research design	Method(s)	Contribution to the paper's aim
Case study *Seven streets in London's West End*	**Interviews** *Interviews to CLFQP members*	Streets' selection and understanding of freight-related streetside conflicts
	Direct observation *Field visits during peak and off-peak hours / shadowing*	Infrastructure supply inventory and quantification of users' interactions
	Data visualisation *Parcel deliveries*	Validation of streets' selection
	ROWAP conceptual modelling *Distributive justice principles modelling*	Analytical tools to conduct ROW decisions involving conflict categories and their impact on users' perceived value of streetside access

3. DATA COLLECTION

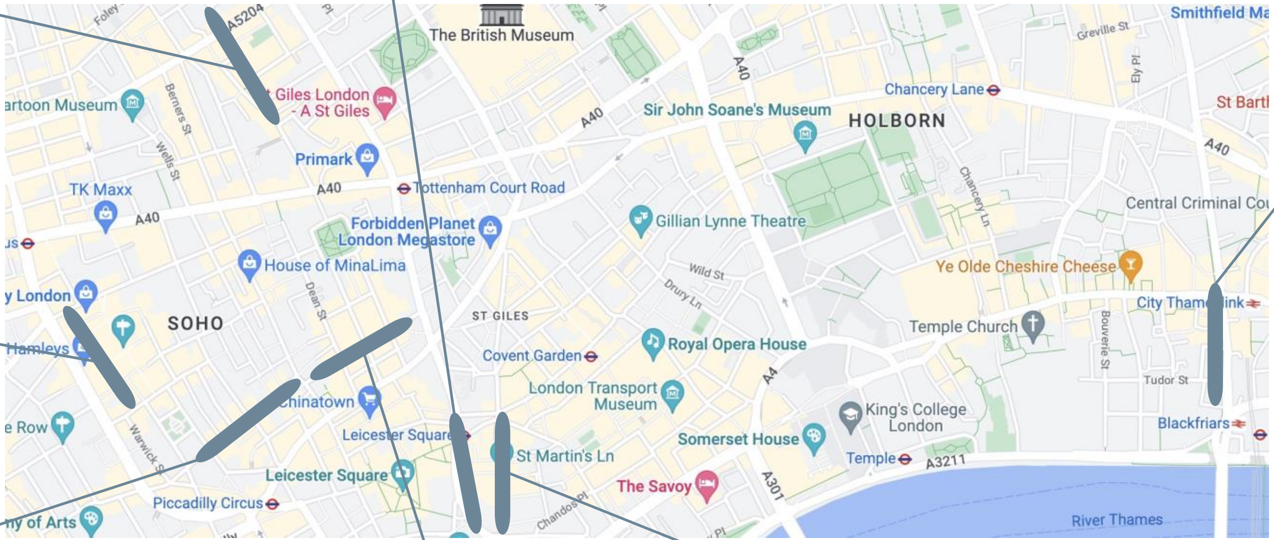
STREETS SELECTION

Charing cross street
Interactions: Public transport station

Charlotte street
Interactions:
Parklets, scooters, cargo bikes

New building street
Interactions: Cyclists - Bike lane

Kingly street
Interactions:
Contradicting street signs, Households, other freight operations



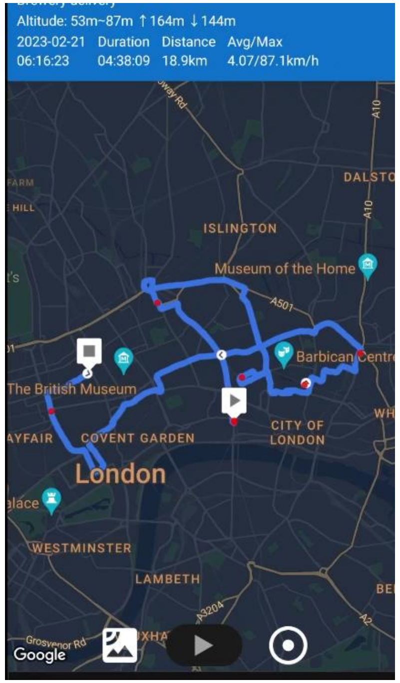
Brewer street
Interactions:
Households parking, Taxi zone

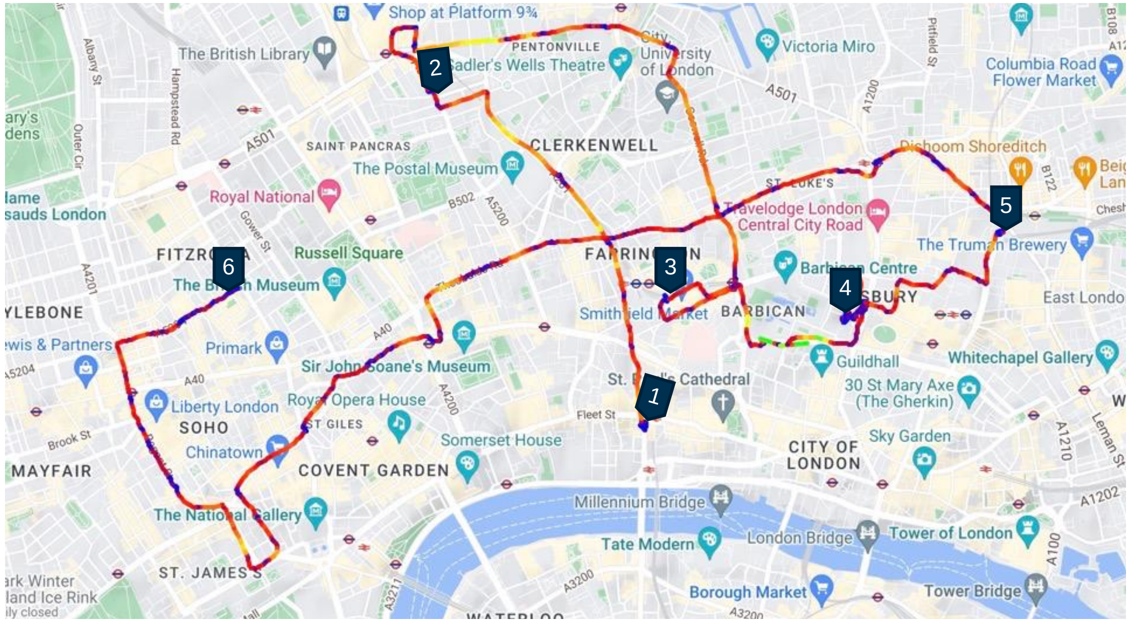
Old compton street
Interactions: Private parking, Taxi zones, Service vehicles

St Martin's lane street
Interactions: Construction deliveries

3. DATA COLLECTION

BREWERY DELIVERY OPERATION





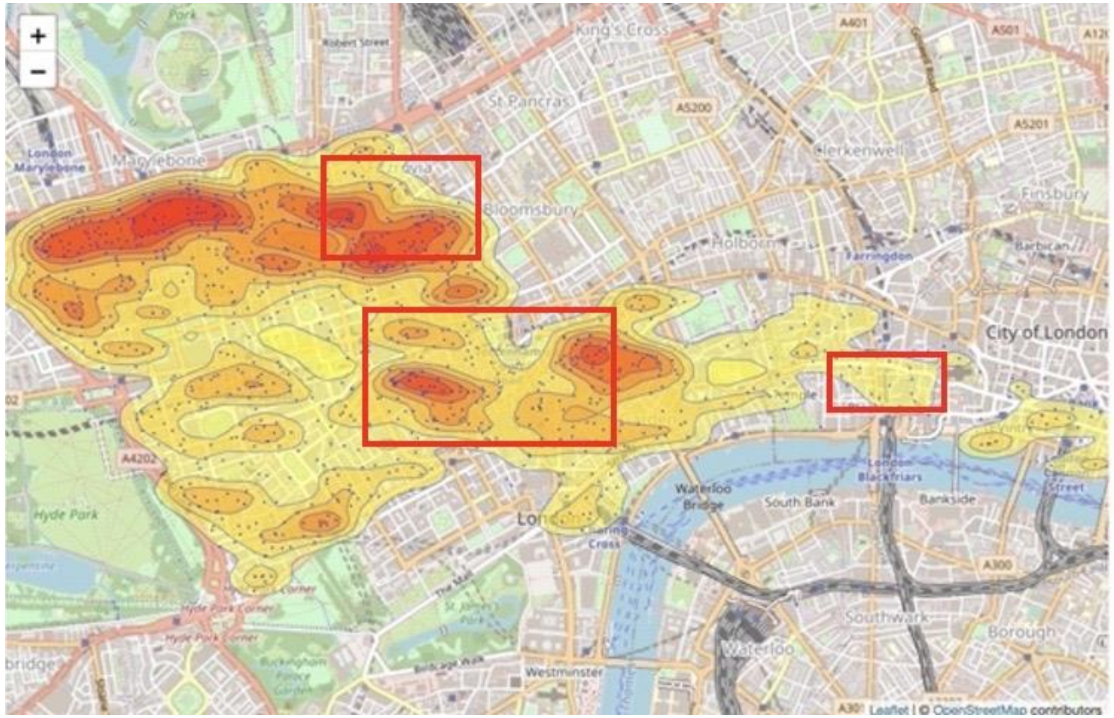
Dwell time:		Interactions while parked:
t_0 = 6:19		
34’	1	Cyclists: 126 Pedestrians: 45
11’	2	Pedestrians: 24
13’	3	Pedestrians: 43
51’	4	Off-street
10’	5	Pedestrians: 94
Waiting – 26’	6	Not delivered
t_f = 10:55		

Stop time (37%): 1h45’
Driving time (63%): 2h53’

Cyclists: 126
Pedestrians: 206

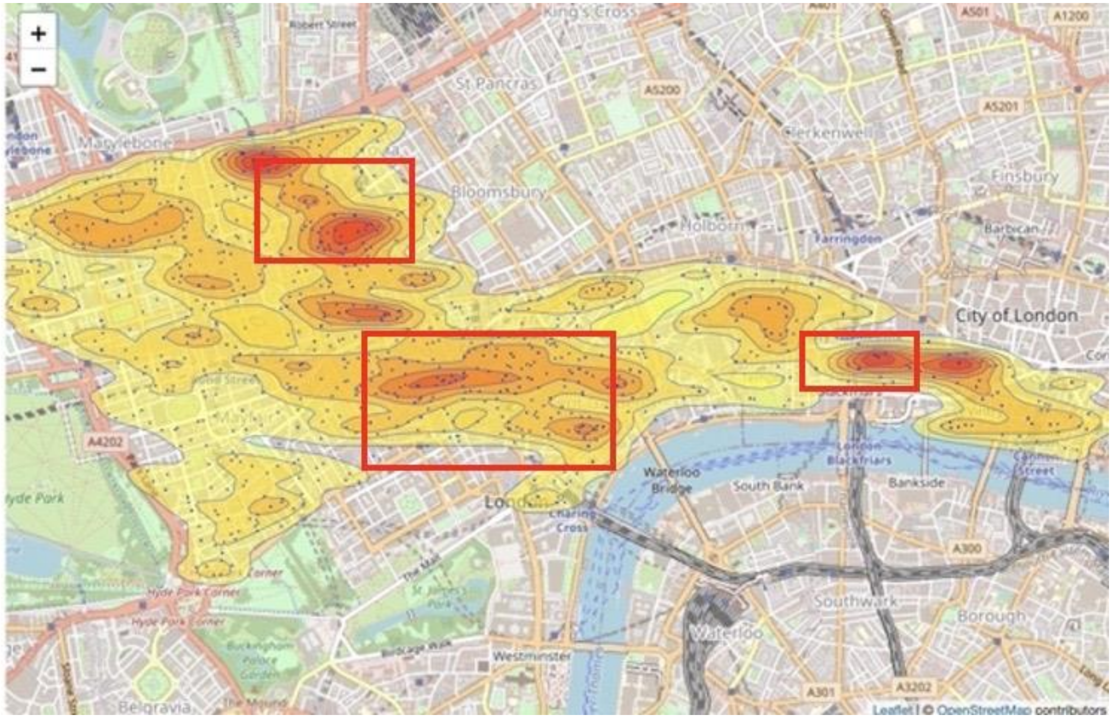
3. DATA COLLECTION

Major parcel courier data on May 19th, 2021 and August 18th, 2022 - Delivery drop-offs in the area of interest.



19/05/2021

Total parcels: 207 out of 1436 in West End of Central London.
14.4%



18/08/2022

Total parcels: 303 out of 1757 in West End of Central London.
17.2%

4. RESULTS

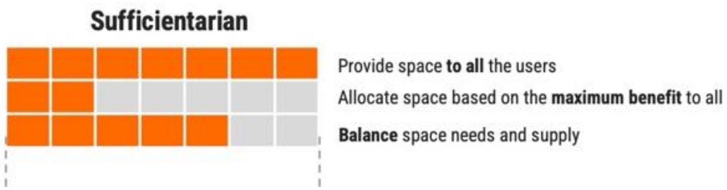
Conflicts
1. Crashes 2. Traffic obstruction 3. Failed deliveries 4. Re-scheduled deliveries 5. Distant deliveries

STREET CONDITIONS	REACTIONS OF FREIGHT OPERATORS: Double parking	Parking at banned zones	Operational changes	Portering
Access restriction (time/space)	Traffic obstruction (freight, cars, bikes, pedestrians)	Traffic obstruction (cars, bikes, pedestrians)	Failed delivery / re-scheduled delivery	Distant delivery
Lack of LZ	Traffic obstruction (cars, bikes, pedestrians)	Traffic obstruction (cars, bikes, pedestrians)		Distant delivery
Parking oversupply to private vehicles		Traffic obstruction (cars, bikes, pedestrians)		Distant delivery
Construction works			Failed delivery / re-scheduled delivery	Distant delivery
Overlap with public transport infrastructure		Traffic obstruction (public transport and pedestrians)		Distant delivery
Overlap with bike lanes		Traffic obstruction (cars, bikes)		Crashes with cyclists / Traffic obstruction (bikes) / Distant delivery
Overlap with high pedestrians flow		Traffic obstruction (pedestrians)		Crashes with pedestrians / Traffic obstruction (bikes) / Distant delivery
Overlap with street furniture		Traffic obstruction (cars, bikes)		Distant delivery / Crashes with furniture
Service vehicles parking	Traffic obstruction (cars, bikes, pedestrians)	Traffic obstruction (cars, bikes, pedestrians)		Distant delivery
Freight intense zone	Traffic obstruction (cars, bikes, pedestrians)			

4. RESULTS (work-in-progress)

Sufficientarian

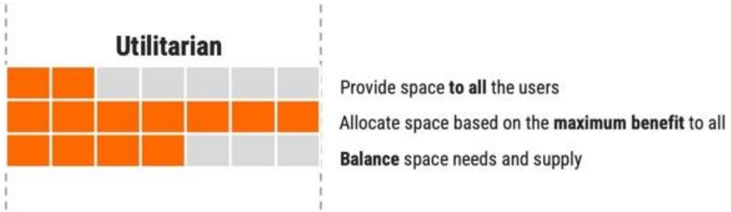
Min VL subject to kerbside capacity, users demand (sensitivity analysis).



- Penalty term added when demand is not satisfied
- Unfeasible sufficientarian approach forces the implementation of either utilitarian or egalitarian approach

Utilitarian (Public sector perspective)

Min VL subject to kerbside capacity and social welfare goals.



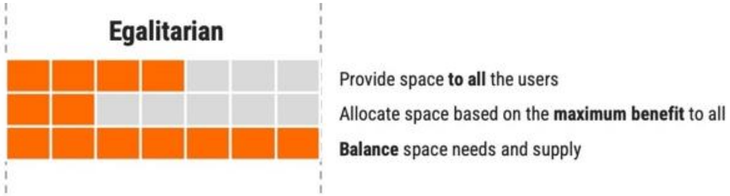
- Time-varying optimal allocation by type of street

Egalitarian

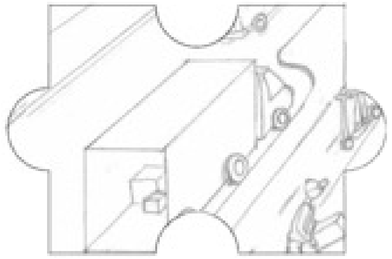
Game theory How much is each actor willing to give up?

Needs gap analysis

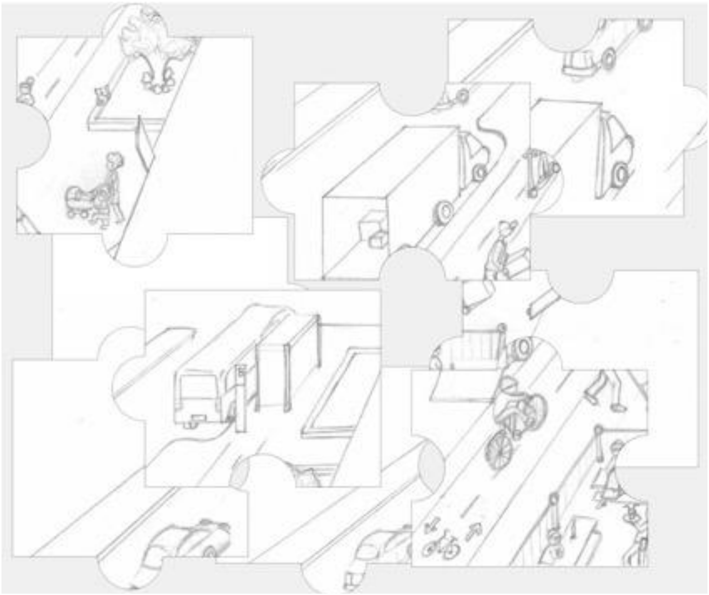
(Lefebvre et al, 2021)



5. CONCLUSIONS



- Streets are complex and contested – demands are rising but space remains the same.
- ROW decisions serve as a vehicle for local authorities to fulfil their service, accessibility, and economic interests in the public space.
- Empirical evidence from the case study showed that current ROW policies pose challenges for freight operations, which can lead to conflicts on the streets.
- Validation of conflicts, street conditions and reactions of freight operators, is needed before conducting modelling efforts. Available data?



The jigsaw puzzle is not solved. Challenge: balancing space demand of multiple users while satisfying liveability conditions.

6. REFERENCES

1. Allen, Julian & Piecyk, Maja. (2022). Freight transport and the kerbside. The future of loading and unloading in urban areas. Centre for Sustainable Road Freight. Technical report ENG-TR.027
2. de Marco, A., Mangano, G., & Zenezini, G. (2017). Classification and benchmark of City Logistics measures: an empirical analysis. 21(1), 1–19.
3. Fabricus, V., Habibovic, A., Rizgary, D., Andersson, J. & Wärnestål, P. Interactions Between Heavy Trucks and Vulnerable Road Users—A Systematic Review to Inform the Interactive Capabilities of Highly Automated Trucks. Frontiers in Robotics and AI. 9:818019. doi: 10.3389/frobt.2022.818019
4. Gevaers, R., van de Voorde, E. and Vanelslander, T. (2011) 'Characteristics and typology of last mile logistics from an innovation perspective in an Urban context', City Distribution and Urban Freight Transport: Multiple Perspectives, pp. 56–71. https://doi.org/10.4337/9780857932754.00009
5. Hammami, F. (2020). The impact of optimizing delivery areas on urban traffic congestion. Research in Transportation Business & Management, 37, 100569.
6. Lefebvre-Ropars, G., Morency, C., Negron-Poblete, P., 2021. Toward a framework for assessing the fair distribution of space in urban streets. Transp Res Rec 2675, 259–274. https://doi.org/10.1177/0361198121995196
7. Lopez, C., Gonzalez-Feliu, J., Chiabaut, N., & Leclercq, L. (2016). Assessing the impacts of goods deliveries' double line parking on the overall traffic under realistic conditions. Information Systems Logistics and Supply Chain: ILS Conference 2016: Building a Resilient Future.
8. Ornelas, D.A., Nourinejad, M., Park, P.Y., Roorda, M.J., 2023. Managing parking with progressive pricing. Transp Res Part C Emerg Technol 149, 104040. https://doi.org/10.1016/J.TRC.2023.104040
9. Rodriguez-Valencia, A., 2014. Urban Right-of-Way Allocation Problem: Considering All Demands.
10. Sanchez-Diaz, I., Palacios-Argüello, L., Levandi, A., Mardberg, J., & Basso, R. (2020). A time-efficiency study of medium-duty trucks delivering in urban environments. *Sustainability (Switzerland)*, *12*(1), 425.
11. Sanders, P., Zuidgeest, M., & Geurs, K. (2015). Liveable streets in Hanoi: A principal component analysis. Habitat International, 49, 547–558. https://doi.org/10.1016/J.HABITATINT.2015.07.001

Juan Pablo Castrellon

PhD student - Chalmers University of Technology

juanpabl@chalmers.se