In Search for Space: Integrating Hubs for Freight and Passengers Based on Case Studies in Rotterdam

van Duin, Ron; van Es, Marco; van Son, Kees; Arends, Erik; Kiba-Janiak, Maja

Publication date
2023

Document Version
Accepted author manuscript

Citation (APA)
van Duin, R., van Es, M., van Son, K., Arends, E., & Kiba-Janiak, M. (2023). *In Search for Space: Integrating Hubs for Freight and Passengers Based on Case Studies in Rotterdam*. 1-4. Paper presented at 5th VREF Conference on Urban Freight, Gothenburg, Sweden.

In Search for Space: Integrating Hubs for Freight and Passengers Based on Case Studies in Rotterdam

J.H.R. van Duin*, Rotterdam University of Applied Sciences, Delft University of Technology, The Netherlands, j.h.r.van.duin@hr.nl/j.h.r.vanduin@tudelft.nl
M. van Es, Rotterdam University of Applied Sciences, The Netherlands, m.b.van.es@hr.nl
Kees van Son, AT Osborne, The Netherlands, kees.vanson@atosborne.nl
Maja Kiba-Janiak, Wroclaw University of Economics and Business, Poland, Maja.Kiba-Janiak@ue.wroc.pl

*Presenter Ron van Duin

1. Purpose

The Unesco (2019) states that about 55% of the world's population lives in urban areas. This proportion is expected to increase to 75% by 2050 (Unesco, 2019). This gives enormous pressure on the allocation of space. Both passenger and freight movements are causing a lot of congestion in our cities. To reduce congestion and air pollution many cities are considering to lower down the speed limits to 30 km/hour in the inner cities. This gives a lot of pressure on on-time deliveries and causes spatial challenges for the policymakers. Traditionally the coexistence of passenger mobility and urban freight transport is considered as two separate systems. Each system has its own field of expertise and integration of both systems is seldom seen in practice. Aviation is the only sector where the integration of these two systems has become a core business due to limited space capacities in airplanes.

Despite the aviation sector there appears to be little scientific literature based on research on combining these two transport systems, an exception forms the air transport industry. The studies found over land are about adding freight to existing public transport systems (van Duin et al., 2019; Galkin et al., 2019) or innovations in crowd-shipping (Marcucci et al., 2017). In theory, these innovations seem possible, however, in practice, they prove difficult to implement due to the complexity, resistance, and juridical issues to these initiatives.

In addition, mobility hubs, i.e., an emerging term referring to nodes with smart and new mobility (electric, shared mobility), are mentioned as an opportunity for bringing together sustainable modes of transport and changing unsustainable mobility behaviour (Enbel-Yan & Leonard, (2012); Bell, 2019; Franken, 2021). Witte, Gonzalez, and Rongen (2021) show in the exploration of the concept of mobility hubs that freight also can be considered as a possible function added to the mobility hub.

This research tries to investigate whether and under which conditions the various innovations are possible at a mobility hub. Therefore, this research aims to answer the research question:

'*Which logistics flows and logistics innovations can be added to different types of mobility hubs under which conditions?*'

This work is a continuation of our earlier work (Chetouani et al., 2023).

2. Research Approach

The research consists of several steps. In the first exploratory phase, via a literature review information is gathered about mobility hubs, logistics flows, and innovations that enable a combination of passenger and freight transport. After this, stakeholder insights from theory and practice are obtained based on stakeholder analysis and interviews with experts. In the

design phase, the information obtained from the exploration phase is analysed based on requirements analysis and presented in frameworks. Finally, the frameworks are validated based on case studies with multi-disciplinary student teams.

Literature review
The aim of the literature review is to provide the reader with an up-to-date overview of the literature in a specific area (Van Wee & Banister, 2016). Various online databases can be consulted for relevant articles on hub characteristics and combinations of passenger and freight transport. According to Van Wee and Banister (2016), a literature review can add value in several ways, such as providing empirical insights in which the state of knowledge, gaps in the literature, or weaknesses of methodologies are presented. In this exploratory research, a literature review is conducted to define, characterise and categorise mobility hubs and to categorise freight flows and logistics hubs. In addition, possibilities are being explored for a combination of passenger transport and freight transport at a mobility hub.

Stakeholder analysis
Passenger transport systems have different stakeholders in both the public and private fields with different interests. The private side of city logistics is especially difficult because of the diversity of transported goods, the heterogeneity of the transportation means, and the involvement of multiple stakeholders with usually different goals and priorities (Rześny-Cieplińska et al., 2021). Therefore, a stakeholder analysis forms an essential part of the research (Rześny-Cieplińska et al. 2021; Spickermann et al., 2014). A stakeholder analysis was applied to generate knowledge about the relevant actors to gain insight into their behaviour, interests, and resources they have to influence the decision-making processes.

Interviews
According to Holloway and Galvin (2016), interviews are the most commonly used method of data collection. Due to the limited availability of information on the topic of logistics functions at mobility hubs, semi-structured interviews are held in this research. The interviews were held with 14 experts with the aim of collecting as much information as possible about combinations of passenger and freight transport. Due to COVID-19, the interviews were conducted online and lasted approximately 45 minutes each. The interviews were recorded and transcribed verbatim. For all interviews, transcription approval is requested from the interviewees, and changes are made if necessary.

Design study
In the design phase, a systematic approach was used to arrive at requirements for various innovations and ultimately frameworks that can be used to explore which logistics functions can be added to mobility hubs. For this, a requirement analysis and design technique were performed. The overarching principle of Systems Engineering (Blanchard & Fabrycky, 1990), an academic framework for product design, is followed in these techniques. Systems Engineering can be defined as a management technology that helps structure a problem through formulation, analysis, and interpretation.

Case studies
A case study is a form of qualitative research that allows in-depth, multi-faceted explorations of complex issues in real-life settings (Crowe, et al., 2011). The purpose of the case study within this research is to validate the presented frameworks. In Rotterdam, about 10 mobility hubs (mostly Metro hubs) have been investigated by the students. The student teams are formed multi-disciplinary with students from logistics management, civil engineering, spatial

planning, facility management, construction, and real-estate management. They also provided insights into the usability of the frameworks and indicated points for improvement for the frameworks.

3. Findings and Originality

Using the information obtained from the literature and interviews, frameworks have been created (Chetouani, 2021). For each mobility hub type, the framework shows which innovations and which freight flows have potential. Three colours are used for this. The green colour indicates that the innovation can be easily added to the mobility hub, the orange colour indicates that it can be added under certain conditions and finally, the red colour means that it will be difficult to add the innovation to the mobility hub.

Neighbourhood hub framework

Out of the freight flows, (consumer) parcels seem to be the most likely addition, and construction or catering is the least likely to happen. Parcels are light in weight and easy to transport for shared mobility users. Construction and catering flows are characterized as heavy and large flows, while in neighbourhoods no heavy transport takes place. Furthermore, it is not possible to bundle (facility) service people because there is no space for this on this hub

Neighbourhood hub	**Freight flow**				
Innovation	Consumer parcels		Construction	Catering	Facilities
	Parcels	*Groceries*			
Parcel lockers					
Crowdshipping					
Cargo hitching					
Sharing public space					

City hub framework

Out of the freight flows, (consumer) parcels again appear to be the most promising. Construction is now possible under conditions because a city hub offers more space for the transshipment of large goods. Moreover, cargo hitching is an option because public transport is available.

City hub	**Freight flow**				
Innovation	Consumer parcels		Construction	Catering	Facilities
	Parcels	*Groceries*			
Parcel lockers					
Crowdshipping					
Cargo hitching					
Sharing public space					

City outskirts hub framework

Consumer parcels also have the most potential at this hub. Moreover, sharing public space has a lot of potential at this hub because a lot of space is available in this type of hub since it is located in places on the outskirts of cities. For construction, there is even now an option coloured green. In addition, it can be noted that most innovations are possible with this hub.

City outskirts hub	Freight flow				
Innovation	Consumer parcels		Construction	Catering	Facilities
	Parcels	*Groceries*			
Parcel lockers					
Crowdshipping					
Cargo hitching					
Sharing public space					

For 10 mobility hub locations (mainly METRO station), the framework has been applied and the students have come up with some potential solutions to integrate passenger and freight flows at these locations in Rotterdam.

4. Research Impact

To the best of the authors' knowledge, few studies have been found examining the addition of freight or logistics to mobility hubs. Neither research has been found that investigates under which conditions the above-mentioned innovations regarding a combination between passenger transport and freight transport can be possible.

5. Practical Impact

As space is scarce in our cities, the integration of passenger and freight flows can be an interesting policy instrument for municipalities. For the current mobility hubs, it is already possible to facilitate the design of the passenger hub in such a way that logistics functions can be added. The usage of parcel lockers seems to be a logical way to go, however, in the long run, new designs of mobility hubs can be made in such a way that 24-hour operations for several kinds of freight and passenger flows can be facilitated.

6. Discussion Questions

Do you see opportunities for freight/passenger sharing at mobility hubs in your own town?

Which drivers/enablers/barriers/blockades do we encounter when integrating freight and passenger flows?

Would you like to work with us on the further development of the morphological chart of Joint freight/passenger hubs?

References

Bell, D., (2019). Intermodal mobility hubs and user needs. *Social Sciences* 8(2), 65. https://doi.org/10.3390/socsci8020065.

Blanchard, B.S., & Fabrycky, W.J. (1990). Systems Engineering and Analysis, Fourth Edition. Prentice Hall International Series in *Industrial and Systems Engineering*.

Chetouani, I., (2021). *Exploring integrated hubs. An exploratory study into the possibility of allocating logistics functions to mobility hubs*. Master Thesis, Delft University of Technology.

Chetouani, I., van Duin, R., Vleugel, J. M., van Wee, G. P., van Son, C. B. H., & Arends, H. H. (2023). Hubs for Freight and Passengers? Exploring the suitability of adding logistics functions to mobility hubs. In *Proceedings of the 102nd Annual Meeting of Transportation*

Research Board (pp. 1-15). Transportation Research Board (TRB). https://trid.trb.org/view/208744

Crowe, S., Cresswell, K., Robertson, A., Huby, G., Avery, A., Sheikh, A., (2011). The case study approach. *BMC medical research methodology* (11), 100.

Enbel-Yan, J., Leonard, A., (2012). Mobility hub guidelines: Tools for achieving successful station areas. *ITE Journal* 82(1), 42-47.

Franken, M.C., (2021). *Effects of e-mobility hubs in residential areas on car use and ownership*. Master Thesis, Delft University of Technology.

Galkin, A., Schlosser, T., Galkina, O., Hodáková, D., Cápayová, S.,)(2019). Investigating using urban public transport for freight deliveries. *Transportation Research Procedia* (39), 64–73.

Holloway, I., Galvin, K., (2016). *Qualitative research in nursing and healthcare*. John Wiley & Sons.

Marcucci, E., Le Pira, M., Carrocci, C.S., Gatta, V., Pieralice, E., (2017). Connected shared mobility for passengers and freight: Investigating the potential of crowdshipping in urban areas. *Proceedings of 5th IEEE International Conference on Models and Technologies for Intelligent Transportation Systems*, 839–843.

Rześny-Cieplińska, J., Szmelter-Jarosz, A., Moslem, S., (2021). Priority- based stakeholders analysis in the view of sustainable city logistics: Evidence for Tricity, Poland. *Sustainable Cities and Society* 67, 102751.

Spickermann, A., Grienitz, V., Heiko, A., 2014. Heading towards a multimodal city of the future?: Multi-stakeholder scenarios for urban mobility. *Technological Forecasting and Social Change* 89, 201–221.

UNESCO (2019). *As urbanization grows, cities unveil sustainable development solutions on World Day*. UN NEWS, 30 October 2019. Website https://news.un.org/en/story/2019/10/1050291, visited at 3 April 2023.

Van Wee, G.P., Banister, D., (2016). How to write a literature review paper? *Transport Reviews* (36), 278–288.

Van Duin, J.H.R., Wiegmans, B., Tavasszy, L.A., Hendriks, B., He, Y., (2019). Evaluating new participative city logistics concepts: The case of cargo hitching. *Transportation Research Procedia* (39), 565–575.

Witte, J., Gonzalez, M.A., Rongen, T., (2021). *Verkenning van het concept mobiliteitshub.* Website https://www.kimnet.nl/publicaties/rapporten/ 2021/05/31/verkenning-van-het-concept-mobiliteitshub, visited at 3 April 2023.