URBAN LOGISTICS AS AN ON-DEMAND SERVICE

Best practices for implementation from the ULaaDS trials

ULaaDS D6.6: Best practices for implementation and application guidelines for Industry, Operators and Cities
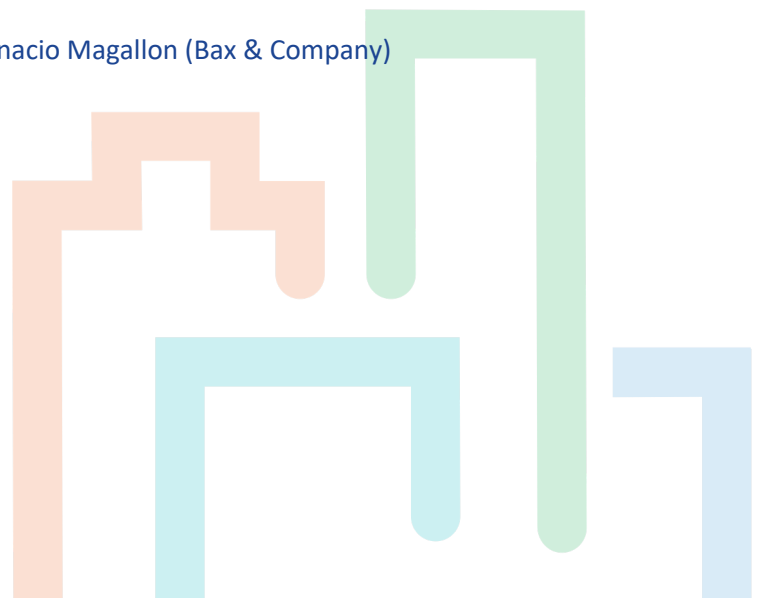
Date: 29/02/2024

Author(s): Niccolò Corti, Lorena Axinte, Víctor Ferran, Ignacio Magallon (Bax & Company)

CIVITAS
Sustainable and smart mobility for all

THE CIVITAS INITIATIVE IS CO-FUNDED BY THE EUROPEAN UNION

Deliverable details

Project acronym	Project title
ULaaDS	Urban Logistics as an on-Demand Service

WP	Deliverable title
6	Best practices for implementation and application guidelines for Industry, Operators and Cities

Document history

Version	Date	Author(s)	Status*	Dissemination level**
V1	16.02.2024	Niccolò Corti, Lorena Axinte, Victor Ferran, Ignacio Magallon (BAX)	Draft	CO
V2	22.02.2024	Howard Weir (TOI), Arianna Americo (EUR)	Feedback on draft	CO
V3	27.02.2024	Niccolò Corti, Lorena Axinte	Final	PUB

*Status: Draft, Final, Approved, Submitted (to European Commission).

Dissemination Level: **PU: Public; **CO**: Confidential, only for members of the consortium (including the Commission Services); **EU-RES** Classified Information - restraint UE; **EU-CON**: Classified Information - confidential UE; **EU-SEC**: Classified Information - secret UE

Contractual delivery date	Actual delivery date	Deliverable type*
29.02.2024	29.02.2024	R

*Deliverable type: **R**: Document, report; **DEM**: Demonstrator, pilot, prototype; **DEC**: Websites, patent fillings, videos, etc; **OTHER**; **ETHICS**: Ethics requirement; **ORDP**: Open Research Data Pilot.

Project abstract

ULaaDS sets out to offer a new approach to system innovation in urban logistics. Its vision is to develop sustainable and liveable cities through re-localisation of logistics activities and re-configuration of freight flows at different scales. Specifically, ULaaDS will use a combination of innovative technology solutions (vehicles, equipment and infrastructure), new schemes for horizontal collaboration (driven by the sharing economy) and policy measures and interventions as catalysers of a systemic change in urban and peri-urban service infrastructure. This aims to support cities in the path of integrating sustainable and cooperative logistics systems into their sustainable urban mobility plans (SUMPs). ULaaDS will deliver a novel framework to support urban logistics planning aligning industry, market and government needs, following an intensive multi-stakeholder collaboration process. This will create favourable conditions for the private sector to adopt sustainable principles for urban logistics, while enhancing cities' adaptive capacity to respond to rapidly changing needs. The project findings will be translated into open decision support tools and guidelines.

A consortium led by three municipalities (pilot cities) committed to zero emissions city logistics (Bremen, Mechelen, Groningen) has joined forces with logistics stakeholders, both established and newcomers, as well as leading academic institutions in EU to accelerate the deployment of novel, feasible, shared and ZE solutions addressing major upcoming challenges generated by the rising on-demand economy in future urban logistics. Since large-scale replication and transferability of results is one of the cornerstones of the project, ULaaDS also involves four satellite cities (Rome, Edinburgh, Alba Iulia and Bergen) which will also apply the novel toolkit created in ULaaDS, as well as the overall project methodology to co-create additional ULaaDS solutions relevant to their cities as well as outlines for potential research trials. ULaaDS is a project part of ETP ALICE Liaison program.

Keywords

Urban logistics, policy recommendations, research trial implementation, lessons learned

Copyright statement

Executive summary

Through the ULaaDS project, three European cities explored different sustainable last-mile logistics solutions which were implemented collaboratively by both public and private stakeholders. This document gathers their experience, summarising the most important lessons learned and formulating policy recommendations at the local, national and European levels. The ultimate aim is to show pathways that facilitate the introduction of innovative solutions in the field of urban logistics.

Given that the research trials have been analysed from different angles in other ULaaDS deliverables (e.g., business models, impact assessment, etc.), our work focused strictly on the key variables which allowed or deterred a trial from reaching its objectives. To this end, we consulted 14 representatives involved in the 7 research trials, ensuring that both public and private stakeholders express their opinion.

Although none of the findings are particularly striking, this deliverable shows once again, the variables which lead to the successful implementation of urban logistics projects:

- the importance of multi-level collaboration – between logistics companies, between companies and public authorities, between different administrative levels

- the necessity to have clear, yet flexible rules and regulations, especially at regional and national levels, to allow urban authorities to implement the actions they need locally

- the value of sharing lessons learned, both when trials success and when they do not, and to disseminate such findings across wider types of stakeholders (e.g., the so-called 'hard to reach', such as SMEs that might have more limited capacity)

The deliverable explores these ideas, delineating recommendations at three policy levels, as well as for companies. Responding to a need which arose during the project, we developed in-depth recommendations for both cities and companies looking to implement out of home delivery solutions, such as parcel lockers.

The final part of this deliverable presents the framework for parcel lockers which helped the City of Groningen in finding the right space and determining the requirements for its tendering process. Such insights can serve as a guide for public authorities looking to develop a well-thought, coordinated approach. They are also beneficial for parcel locker providers interested in improving their services and adapting to different city requirements, including accessibility and aesthetics. Although complex, Groningen's approach is replicable in other contexts, too, allowing public and private stakeholders to work together in the transition towards sustainable urban logistics. This way, municipalities can ensure that their ambitious zero-emission policies can be implemented with less pushback from the local community.

Table of contents

List of figures

List of tables

1. Introduction

To explore innovative solutions in urban logistics, the ULaaDS project included the implementation of different research trials in three lighthouse cities: Bremen (Germany), Groningen (The Netherlands), and Mechelen (Belgium). This document analyses the trials' outcomes based on insights provided by the stakeholders directly involved, both public authorities (cities hereon) and private partners. The ultimate scope is to synthesise lessons learnt during implementation, and offer policy recommendations at the local, national and European levels to facilitate the introduction of innovative solutions in the field of urban logistics.

Trailing is fundamental to understand the impacts of new solutions and technologies in real-world scenarios. The ones who implement the trials (most often private partners, although ULaaDS shows exceptions, too), and those who contribute to their implementations (mostly cities and other public authorities) hold valuable knowledge on the challenges faced, the impacts achieved, and the potential for transitioning to a fully-fledged solution.

For this reason, WP6 conducted an assessment phase towards the end of the project, to delineate policy recommendations for local, national, and European levels. This assessment involved questionnaires for all the participants directly involved in the trials, asking them for suggestions and insights on the trial implementation and their potential improvements.

Their answers are further discussed and analysed in the next sections. Consulting stakeholders directly involved in the implementation of pilots provides a good understanding of which parts were well calibrated for implementing innovative solutions, which acted as obstacles, and what supportive actions could help address these issues. For these reasons, their opinions laid the right groundwork for broader learning outcomes, which can function as a set of policy recommendations at different institutional levels.

While the resulting policy recommendations remain relatively broad, we have also delved into the specifics for a particular research trial – Groningen's parcel lockers. The framework for parcel lockers (Annex 2) was developed by Bax & Company using input from the city and the University of Groningen. The results are not only useful for public authorities, but also for private operators interested in making logistics services more accessible and better integrated in the local context.

Structure of the document

A chapter on methodology follows after this introduction. This second section explains the questionnaire setup and offers a brief presentation of the cities' research trials. Given that many other deliverables have delved into the ULaaDS research trials (e.g., D4.7 Summary of Practical Research Trials, D5.6 Implementation Roadmap for Satellite Cities, etc.), the current document focuses specifically on the lessons which might facilitate the implementation of similar trials or projects.

Thus, the core of this deliverable is the analysis of answers that city representatives and industry provided, available in Section 3. Section 4 closes with a series of policy recommendations for different stakeholders at different levels, to extend the project's durability and uptake.

2. How did we come to these conclusions?

Given the breadth of experiences across the ULaaDS trials, it was important to understand what the challenges were, what could have been improved and what kind of public support might have helped to achieve the initial goals. To answer these questions, the stakeholders actively involved in implementation offered their expert opinions.

To understand the trials' success in achieving initial goals and derive lessons for future projects, the ULaaDS stakeholders (including both public and private partners) were sent separate questionnaires. Each city implemented two trials, with the city of Bremen also conducting a simulation. Table 1 reports the overview of the three lighthouse cities and their respective research trials.

Table 1: Overview of trials and stakeholders consulted

	Bremen	Groningen	Mechelen
Trial 1	Containerised last mile solution (implementation of micro-hubs)	E-vehicles sharing (one electric van, one cargo bike and one carver) in the inner city	Inner city trial for last mile delivery with cargo bikes
Trial 2	Cargo bike sharing service	Logistics services at P+R site (parcel lockers)	Cargo-hitching with autonomous vehicle in the industrial area
Trial 3	Cargo-hitching simulation	-	-
Number of responses collected from public stakeholders	2	1	2
Number of responses collected from private partners involved	4	1 (representative of multiple companies)	4

In total, 14 stakeholders responded to the questionnaires: nine among operators and companies and five from the three Lighthouse cities. At least one representative from each company and one from each city provided feedback on the project.

The complete version of the questionnaires can be found in Annex Table 1: Questionnaires for Companies and Operators, and for Cities' Representatives. The two versions of the questionnaire formulated for companies/operators and for public stakeholders were almost identical. The only difference is that companies and operators were asked an additional initial question on which trial they took part in (whereas for cities, the questionnaire was already tailored to the number of trials

which took place in each one). The answers analysed in the following sections come from the following questions:

- What were the most important factors that enabled or deterred from achieving the goal?

- What type of support from the local level could have improved the trial, and how?

- What type of support from the national level could have improved the trial, and how?

- What type of support from the European level could have improved the trial, and how?

The answers from cities and from private partners are addressed separately. This is because, although certain answers are common between the two, public stakeholders tend to have more of a "regulatory" perspective (e.g., their perspective focuses on ensuring compliance with laws, regulations, and policies, to protect public interests). On the other hand, companies provide suggestions that are more relevant for their own context (e.g., they value time and economic return more than the public entities do).

3. What did we learn from the ULaaDS research trials?

3.1.1 Lessons from the Lighthouse Cities

The following part analyses the answers provided by representatives of the lighthouse cities, structuring responses at three different levels: local, national, and European.

3.1.1.1 Bremen

Two pilots and one simulation took place in the city of Bremen. The first pilot involved the implementation of containerised last-mile logistics in the city centre: smaller and zero-emission vehicles carried out deliveries in this area, aiming to replace vans and trucks. This was facilitated by the installation of a transhipment container outside of the inner city, where larger vehicles could consolidate parcels and packages that could then be picked up by cargo bikes. The second trial focused on free of charge cargo bike sharing. Cargo bikes were made available around certain points of interests, such as shops and supermarkets, incentivising people to replace cars, while also prioritising local shops.

Local level

At the local level, many factors played a role in determining the success of the trial. Nonetheless, the existing public-private partnerships, and the strong willingness to collaborate coming from the business community was key.

> *The most important factors that enabled achieving the goal were having a strong business community to build on, and the right set of players involved. It also allowed us to build on insights from previous experiences.*

A positive environment where both businesses and the local government are willing to collaborate is a very important factor for innovation in urban logistics. The pilot on cargo transhipment at the micro hub required a deep rethinking of logistics operations. Thus, it relied on collaboration and consensus among different stakeholders. If the local community of stakeholders had been opposed to change, the results of the trial would have likely been disappointing.

Another enabling factor was Bremen's bike-friendliness, especially compared to other German cities.

*Bremen is a cycling-friendly city: conditions for cycling are good. The
infrastructure and the sustainable mobility culture create a positive image of
cycling and using cargo bikes. These factors contributed to the success of the
trial.*

Cargo bikes were involved in two trials and were an essential part of the project. Hence, the city's cycling culture, as well as the readiness of the biking infrastructure was crucial in determining success (even though the Rytle cargo bikes are quite wide and cannot always rely on the bike lanes). In addition, the city's biking culture meant that citizens perceived the use of cargo bikes for city logistics as a positive initiative.

Figure 1: Cargo bikes for last mile deliveries in Bremen

On the other hand, some other factors could have been improved to either make the implementation of the trial easier, or to lead to better results.

In the first place, a framework favouring "light" operators over conventional operators could have been beneficial to the trial's success. This could have meant, for example, exempting cargo bikes from certain restrictions, allowing the use of on-street parking, using bus lanes, allowing access to pedestrian areas, and so on.

In parallel, stricter enforcement of existing rules for conventional operators might have led to more positive results. Examples include restrictions to certain vehicles when accessing low-emission zones, and fines for parking on bike lanes or for double parking.

Nonetheless, a key result of this trial was that it provided insights into delivery of heavier goods and pallets by cargo bike. This creates the potential to replace the movements of large trucks in the city centre with smaller vehicles and thanks to ULaaDS, the city now has the necessary evidence to further prioritise cargo bikes.

Figure 2: Delivery vehicle blocking the bike lane in Bremen

Another point that could have been improved entails the involvement of stakeholders, which requires intensive resource investments for cities too. Having more personnel or more budget to hire an external agency that could act on the city's behalf would allow for sustained stakeholder engagement.

Lastly, especially for the shared cargo bikes trial, stronger financial support could have better sustained the activities in the trial and reduce the reliance on sponsors and volunteers.

Local funding for station-based cargo bike rental network would have enabled to test ULaaDS trial against commercial business case

National level

Moving to the national level, clearer rules on access, traffic signs and loading/unloading zones would make it harder for traditional operators to keep operating in the cities' centres with large/polluting vans. In Germany, these matters are addressed in the Road Traffic Act, which is a federal act valid for all traffic users across the Federal State. Therefore, these changes cannot be implemented directly by cities, requiring multi-level governance.

Similarly, if the National or Federal State had already established regulations on cargo bikes, the trial's implementation would have likely proceeded more smoothly. It is very resource-intensive for cities to make the first steps in unregulated matters, and that is why the respondents believe that certain issues should already be covered by national laws.

Dissemination of best practices or guidelines covering these new issues at the National level would also improve the implementation of innovative solutions in cities. Similarly to what was noted for regulations, best practices could provide blueprints for implementing innovation.

European level

Regarding the European level, participants noted how dissemination of prior knowledge from other cities would make implementing these trials easier – a finding which is actually widespread amongst most respondents.

3.1.1.2   Groningen

In Groningen the first pilot aimed to implement logistics facilities at a P+R location. The pilot aimed to combine the benefits of a park and ride parking spot with the ones of parcel lockers. The second trial concerned the sharing of sustainable cargo vehicles (a cargo bike, a Carver and an electric van), for business owners in the inner city. The city centre will become a zero emission zone by 2025, and the pilot aims to allow shopkeepers to comply with new regulations without the need for them to own a private vehicle.

Local level

At the local level, two factors enabled the success of the trials, and two would have the potential to improve them.

For what concerns the shared vehicles trial, the user-friendliness of the application for reserving the vehicles was an essential aspect for success. The attractive pricing for the shop owners also played a very important role.

Reducing the distance between the shop owners and the location of the shared cargo bike could have improved the success of the trial. Large distances deter users from walking to the location and using the service, while an available cargo bike in close proximity to users would have probably made the cargo bike more popular. In addition, evidence from the trial showed that shopkeepers were willing to walk larger distances to reach the electric van, given the higher perceived utility.

Figure 3: The Carver sharing vehicle in Groningen

The locker trial could have benefitted from a clearer legal framework to make installation easier at the selected location, easier permit issuance and an improved integrated urban planning policy that secures public space for such functionalities in the limited public domain. To overcome this limitation, the City of Groningen, together with the University of Groningen and Bax & Company worked during the ULaaDS implementation on a parcel locker framework which set the ground for

the tender launched in 2024. The entire framework is available at the end of this document (in Annex 2) and constitutes a detailed example of best practice for implementation of parcel lockers.

Figure 4: White label locker in Groningen

National level

Structural subsidy schemes for shared electric vehicles and the best practices sharing on other trials in the Netherlands, are seen as points to improve at the national level. In addition to the previous point, sharing experiences and knowledge from other Dutch cities would make implementing these solutions easier.

European level

Like in the other cities' cases, respondents believe that communicating experiences from other trials in Europe would also improve the success of trials such as Groningen's.

3.1.1.3 Mechelen

In Mechelen, another form of cargo transhipment was tested, involving the use of smaller and zero-emission vehicles for first- and last-mile logistics activities in the city centre. The trial attempted to set up a collaborative logistics platform, where logistics companies using motorised vehicles would hand off part of their cargo to a smaller operator. They would then carry out these operations with smaller vehicles, with the purpose of limiting kilometres driven and space occupation by larger delivery vehicles.

The second trial explored the possibility of combining the delivery of parcels (via parcel lockers installed on an autonomous vehicles) with autonomous public transport.

Local level

At the local level, Mechelen's trial showed how engaging with local business might be essential for a pilot to succeed. In the case of collaborative logistics in the city centre, local shopkeepers were scarcely involved and engaged. This led to a low participation in local fora, and low input from the stakeholders from or to which deliveries would have mostly been made. Ultimately, the pilot in the

city centre was not successful, which teaches the important lesson of putting more effort in communicating the benefits of an innovative initiative also to players who are not directly involved in the pilot, but on which the success of a pilot is based.

Moreover, even the stakeholders directly involved were not actively engaged in the project. Companies were initially doubtful about the benefits they would have from participating in the pilot, and were reluctant to fully commit to the cause. It required a relatively large amount of time to elaborate satisfactory conditions for all parties, ultimately leading to the pilot's failure. Contractual agreements pushing collaboration among the parties were seen as potential tools to maintain stakeholders engaged and committed.

If stricter policies concerning entering the city were created, traditional operators might have been more willing to engage in the pilot to test new solutions. Stricter Urban Vehicle Access Regulations (UVAR), time-based access regulations, load factor restrictions are all examples of how the city could have promoted cargo bike transhipment over traditional operations.

Specific to the autonomous cargo-hitching case, more flexibility in technical and regulatory requirements and stronger local support would have allowed the vehicle to be tested in different scenarios or even real urban environment set-ups. The autonomous cargo-hitching project took place in the industrial area of the city, which was rather limited.

National level

At the national level, the existence of general and overarching legislative frameworks would ease bureaucratic burden for the stakeholders and, in turn, the success of trials such as Mechelen's. Having a ready to use legislative ground would reduce the cities' struggle to pave the ways in uncharted legal territories, consuming excessive time and resources.

More specifically, in the case of autonomous cargo-hitching, easier permit issuance and higher collaboration among public entities would improve the success of trials and innovation in urban logistics. New technologies can create confusion at the institutional level, particularly on the role of each party (for example who should issue which permit). Public authorities need to work across levels and departments when such issues arise, to clarify responsibilities and procedures.

Figure 5: Autonomous vehicle in Mechelen

European level

For what concerns the European level, the respondents suggest that more importance should be given to cargo bikes, for example by setting common frameworks on which it is easier to build on. These frameworks could help cities to include cargo bikes in their urban planning policies, setting up the conditions that prioritise cargo bike usage in specific locations, contexts and operations. When cities can build on something that already exists, procedures are clearer, and it becomes simpler to implement innovation.

Such expectations are in line with the European Declaration on Cycling adopted by the European Commission in October 2023. The declaration states that the EU should support local authorities in the implementation of the cycling declaration, by providing funding and guidance especially when it comes to building and expanding cycling infrastructure and capacity building. In terms of funding, the European Commission will continue to support cycling via the Social Climate Fund, European Regional Development Fund, Cohesion Fund, European Agricultural Fund for Rural Development, Technical Support Instrument, and the Recovery and Resilience Facility.

3.1.2 Industry Insights

The perspective of private partners on the implementation of the trials differs from the public stakeholders' views. Private partners offer an entrepreneurial standpoint on the topic, valuing some resources differently than public stakeholders. Interestingly, although private stakeholders operated in different locations and across different trials, their opinions often coincided. For this reason, we have analysed their answers in the section below, reflecting mostly on the local level. As answers were similar for the national and European level across cities and stakeholders, the analysis is provided in the following section.

Recommendations from the industry

Time plays a very important role. Prolonged implementation time led to confusion and loss in engagement among stakeholders. Therefore, these trials should be accelerated to consider the

stakeholders' needs. If time-consuming project planning leads to stalling a company's operations for too long, the company might decide to drop out of the project for economic reasons. Moreover, the personnel turnover in the private sector is often more frequent, making the implementation of long projects challenging.

The roles of cities can also be differently analysed from a private perspective. For companies, a supportive city is of extreme importance for engagement and trial implementation. Engaged public parties can help to lower the bureaucratic burden for companies, especially in terms of permits. Moreover, cities sometimes function as glue to keep all the parties interested and engaged in the project.

Some respondents called for a broader promotion of the project. If a project is not promoted at the local level, local businesses and inhabitants might not be aware that a more sustainable alternative for inner city logistics is available, reducing the potential uptake.

More specific to the case of Mechelen's autonomous driving cargo-hitching, testing the solution in peripheral/industrial areas was deemed by some stakeholders as insufficiently representative of real-life scenarios. Receiving more support at the local level on changing the location of the pilot or having more flexibility in adapting the pilot, could have enhanced the trial.

Similarly to the city's stakeholders, when it comes to innovative technologies, operators and companies call for clearer regulations. Understanding responsibilities, having a pre-existing regulatory framework clarifying how new technologies should or could be used, having in place some flexible measures that can be adopted during trials or pilots, would help in setting up these projects.

3.1.3   Common findings across cities and stakeholders

As it could be noted in the previous sections, it was often the case that similar answers were provided not only across trials in the same city, but also across cities and by both operators and public stakeholders.

Annex Table 2 shows an overview of the answers for all three locations, from both city representatives and companies/operators. The table makes it easier to understand the points on which most of the stakeholders converged. For instance, stakeholder engagement experiences in Bremen and Groningen were crucial for success, while at the same time, the low engagement levels in Mechelen were responsible for the trials' limitations.

Another common point appeared across cities regarding enforcement. When more sustainable alternatives for running logistics operations are being explored, stricter implementation of existing rules (e.g. rules on double parking, low emission zones, occupation of bike lanes or sidewalks, etc.) would reduce the convenience of operating in "less sustainable" ways.

Clarity at the national level when it comes to laws and regulations for innovations is another point brought up by many stakeholders across cities. Lockers, autonomous driving, cargo bikes: these technologies and innovations have rarely been investigated at the national level. Therefore, cities and companies often operate in "grey areas" when running pilots, wasting resources and time on

bureaucratic issues. Nonetheless, the ULaaDS satellite and follower cities will still benefit from the lessons learned by the frontrunner lighthouse cities.

Lastly, many stakeholders have emphasized the need for gathering and sharing best practices at the European level. The ULaaDS partners strongly believe that having examples from other cities in Europe would facilitate the implementation and replication of pilots and projects.

4. Recommendations from ULaaDS' best practices

The trials allowed a diverse consortium of stakeholders to understand the implications of introducing innovation in urban logistics. The following section includes a series of policy recommendations derived from the lessons learnt during the pilots. These are directed to decision-makers at the city, national and European levels, and to companies interested in innovating in urban logistics.

4.1 Recommendations for the local level

4.1.1 More flexibility in laws and regulations

More flexibility in regulations concerning autonomous driving would have improved the outcomes of the trial.

Urban logistics and urban mobility are very fast-changing environments, difficult to predict. To keep up with these changes, cities need to be ready also from a legislative perspective. Nonetheless, legislative changes/adaptations are often time-consuming and incompatible with short/medium-term projects such as Horizon Europe ones. Still, public authorities can foster a more flexible ground when experimenting with new technologies and solutions. Cities could, for example, develop faster processes to issue permits, create or lift rules (at least temporarily), and more generally consider cases individually. Other ULaaDS deliverables (e.g., 6.4 & 6.5) offer actionable steps for how public authorities can become nimbler and better prepared to deal with innovations and uncertainties.

4.1.2 Use existing regulations in a smart way, and if necessary, adapt them

If the city would have a stricter policy concerning entering the city (UVARs, time windows, load factors, compulsory use of city hub for logistics companies, etc.), competing parties would be more willing to consider alternative modes of pick up and drop off.

When innovations in urban logistics make it to the market, and hold the potential to create more liveable and sustainable environments (such as sharing cargo bikes, micro-hubs, self-driving vehicles, etc.), cities should use their policy-making capabilities in two ways:

- Enforcing existing laws aimed at limiting the negative impacts of traditional technologies, which negatively impact the liveability of cities. For example, sanctioning double parking for vans, bike and bus lane occupancy by delivery couriers, limiting access to low emission zones, etc. This would push companies to operate in a more sustainable way and spark innovation in decarbonised last-mile logistics.

- Adapting existing laws so that they favour companies operating in a more sustainable way. For example, exempting cargo bikes from bans on time-restricted access to the city centre, or allowing cargo bikes and other light electric freight vehicles to use bus lanes, park for free on all types of parking spots, etc.

4.1.3   Collaboration is key

The support from the municipality was very good. Granting a "special permit"
to use the transfer area ("Umweltladepunkt") was paramount for the success of
the project.

Cities should maintain a positive and proactive approach towards innovations in urban logistics. They should be prepared to collaborate with research institutions, private companies, associations of shop owners, citizens, etc. This is because cities often do not possess enough expertise within their structures, especially when it comes to very innovative solutions. Maintaining an open channel with a broad, diverse, and competent range of stakeholders is the key to successfully fostering innovation in the city. This means that cities need to be willing to dedicate time and resources to stay updated and in contact with innovators.

4.1.4   Check the infrastructure

Innovation in urban logistics requires adequate infrastructure. Introducing cargo bikes, for example, necessitates a solid and well-developed cycling infrastructure, or at least speed limits that allow cyclists to use roads safely by reducing speed differentials. The large-scale deployment of EVs depends on the development of a reliable charging infrastructure. Cargo transhipment compels cities to have a clear overview of possible locations for locating micro hubs, for example.

Therefore, cities should constantly work on improving their infrastructure. At the same time, they should also maintain a proactive approach in scanning and keeping track of the state of their infrastructure. This would enable them to understand which change they are better prepared for and where to improve.

4.1.5   Culture for sustainability and innovation

Looking for national and European projects and taking part in trials is a great way for cities to remain connected to innovation and to multiple stakeholders. Besides keeping the city up to date, this participation can also shape the way municipalities operate and perceive innovation. Getting used

to these kinds of projects makes it easier to participate to future projects, leading to a cycle of participation-innovation.

In addition to creating an internal open culture, cities should raise awareness and engage citizens in sustainability and innovation, to increase acceptance of new solutions.

4.2 Recommendations for the national level

4.2.1 Clear processes for successful innovation

A framework for releasing testing permits would have improved the outcome of the pilot. In our case it took 6 months to obtain one, mostly because of our energetic insistence with the minister of transport. The departments were unsure about who was responsible for delivering the permit. A framework, rules and regulations for testing new technologies would have helped.

Very often, innovation is limited by gaps and uncertainty in national laws and regulations, for which cities do not have a remit. This is typically because legislative bodies are ill-prepared to regulate or deal with new technologies. Preparing clear, yet flexible national regulations for pilots in urban logistics could have three main benefits: 1) testing the technology in a safe environment to make better decisions later on, 2) allowing the industry to optimise the final product without too many constraints, and 3) facilitating cross-comparison within the state.

Certainly, finding the balance between innovation and safety is also a key factor. Nonetheless, laws often constitute barriers, as was the case of the autonomous driving vehicle in Mechelen. Flexible regulations could mean issuing permits more rapidly but for a limited period, delegating certain powers to faster legislative bodies such as city councils or regional governments, creating temporary laws to enable the technology to operate, etc.

4.2.2 Look ahead and promote best practices

A diffusion of best practices and experiences from other cities at the national level would have improved the implementation and the results of our trial.

Dedicating resources in tracking the changes in the urban logistics landscape might also play an important role. At the national level, policy makers could keep track of their most advanced cities' experiences, to facilitate best practices sharing.

Similarly, understanding the advancements of other states might reduce the amount of work for lawmakers: they would not have to start a legislative process from scratch. Exchanges at this level could also foster further collaborations in other sectors, learning from each other's strengths.

4.3 Recommendations for the EU

4.3.1 Increase effort in dissemination for the 'hard to reach'

*Sharing experiences from other trials in Europe would facilitate implementing
ours*

After the piloting phase, the dissemination of best practices and lessons learned is fundamental for technologies and innovations to replicate and scale up, especially in the field of urban logistics. Such resources are relevant both for follower cities willing to adapt their policies to innovations, and for companies that would like to change their way of operating in a more sustainable way. Nonetheless, the reality is that many European stakeholders (e.g., logistics SMEs) do not have the absorptive capacity to actively look for such results and/or engage in EU projects (e.g., lack of experience or capacity to bear the administrative burden).

For this reason, it might be beneficial for future EU projects and for dissemination efforts to concentrate on collectives rather than on individuals. Reaching single cities or small enterprises is challenging, resource-intensive and very often ineffective. Contacting groups of stakeholders, on the other hand, can be much more effective.

For cities, investing effort in disseminating results and best practices amongst organisations for cities and regions (e.g., Eurocities, Polis, C40, etc.) could be more efficient and could reach more stakeholders.

Similarly, to reach small and medium enterprises, targeting European, regional, and local alliances (ALICE, VIL) or associations of shopkeepers (as it was the case for GCC in Groningen) could also be easier than reaching out to single firms.

4.4 Recommendations for companies

4.4.1 Prepare for collaboration

Bringing innovative logistics solutions to a city means cooperating with many parties, including both public entities and competitors. Most cities aim to provide a level playing field, rather than advantages to the strongest players. For this reason, companies will often need to join forces, and aim to develop win-win solutions, where multiple factors besides profit must be evaluated.

4.4.2 Stay up to date with changes and opportunities in urban policies

Given the EU's decarbonisation objectives, European cities are actively implementing strategies and policies to reduce their emissions. The logistics industry will unavoidably be affected, making it necessary to stay informed and adapt to changes. Logistics companies can stay up to date with changes in urban policies by establishing regular communication channels with local government

authorities and urban planning departments, joining organizations, or advocacy groups to gain insights into upcoming policy shifts. There are various funding mechanisms that companies can use for adaptation and innovation, including lump sum funding in Horizon Europe which aims to secure easier access to the programme.

Acronyms

Acronym	Meaning
AI	Artificial Intelligence
AV	Autonomous Vehicles
D	Deliverable
EC	European Commission
GA	Grant Agreement
ICT	Information and Communication Technology
LF	Load Factor
LSP	Logistics Service Provider
O	Objective
ODD	On-demand Delivery
P	Product
PPP	Public Private Partnership
PM	Person Month
SUMP	Sustainable Urban Mobility Plan
SULP	Sustainable Urban Logistics Plan
T	Task
UC	Use Case
UCC	Urban Consolidation centre
UFT	Urban Freight Transport
ULaaDS	Urban Logistics as an on-Demand Service
WBS	Work Breakdown Structure
WP	Work Package
VUR	Vehicle Utilisation Rate
ZEV	Zero Emission Vehicle

Annex 1

Annex Table 1: Questionnaires for Companies and Operators, and for Cities' Representatives

Questionnaire for companies and operators	Questionnaire for the Cities' Representatives
Research trial in which you were involved	Please give a brief explanation of the main goal of this research trial
Please give a brief explanation of the main goal of this research trial	What were the most important factors that enabled or deterred from achieving the goal?
What were the most important factors that enabled or deterred from achieving the goal?	What type of support from the local level could have improved the trial and how?
What type of support from the local level could have improved the trial and how?	What type of support from the national level could have improved the trial and how?
What type of support from the national level could have improved the trial and how?	What type of support from the European level could have improved the trial and how?
What type of support from the European level could have improved the trial and how?	
Anything else you'd like to share?	

Annex Table 2: Overview of answers for all pilots

Factor		Bremen				Groningen			Mechelen		
	Quality of the factors	Trial 1	Trial 2	Trial 3	All trials: Operators perspective	Trial 1	Trial 2	All trials - Operators perspective	Trial 1	Trial 2	All trials - Operators perspective
LOCAL	Positive	collaboration, strong community, culture,	strong existing players, strong infrastructure, culture	-	commitment, local support, permit, collaboration, promotion, maintenance	user friendly app, attractive pricing	-	strong existing players, involvement, cooperation, collaboration	-	-	collaboration, cooperation, engagement (+)
	To improve	lack of framework, lack of personnel, lack of engagement, strict law enforcement	more funding	absence of prior experience on the field	duration (too long), subsidies	proximity	permits, frameworks, integrated urban planning	long implementation time	more flexibility	stricter policies, clearer contract agreements, lack of collaboration	lack of regulations, lack of flexibility, lack of clarity, willingness of experimenting
NATIONAL	To Improve	clear legislation, clear legal framework, digital enforcement	national guidelines, financial support	clearer frameworks	promotion of more sustainable mobility (new frameworks), stricter law enforcement	subsidy scheme, best practices diffusion	best practices diffusion	-	more flexibility, change in legislation, more cooperation for pilots	new frameworks or guidelines	coherent framework, flexibility on permits for pilots, cooperation for pilots, cooperation among sectors
EUROPEAN	To improve	promotion and support of pilot projects with more power on EU entities rather than local or national	promotion and support of pilot projects	best practices diffusion, support for pilots,	collection and diffusion of best practices	best practices diffusion	best practices diffusion	Provide guidelines	more flexible legislation for pilots	new legislation	policies alignment, best practices diffusion, exchange regulations, framework for innovations, support measures,

Annex 2
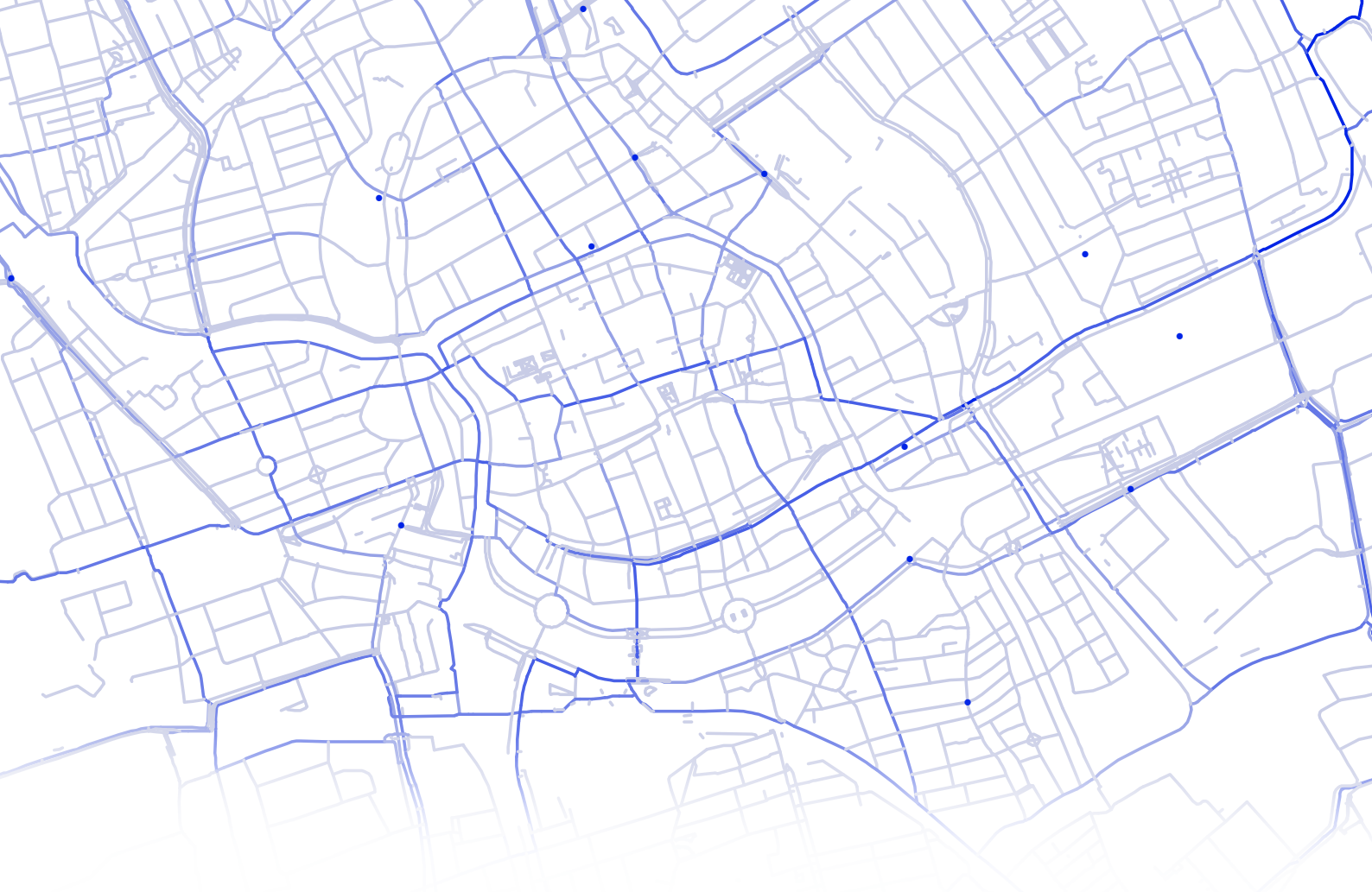
FINDING THE RIGHT SPACE FOR URBAN LOGISTICS

A FRAMEWORK FOR OPEN PARCEL LOCKER SYSTEMS

EXECUTIVE SUMMARY

Like many innovations, parcel lockers took cities by surprise, developing much more rapidly than associated policies and regulations. Some public authorities are trying to find a middle ground between allowing such services to spread freely on streets, while managing the additional pressure they might bring to public spaces, traffic, and overall quality of life.

The City of Groningen, in collaboration with the University of Groningen and Bax & Company, is one of the few public authorities to have developed a framework for an open parcel locker system. The extensive development process included:

- **Interdepartmental collaboration within the city**

- **Stakeholder engagement via logistics fora within the ULaaDS project**

- **Academic studies led by the University of Groningen**

- **A benchmarking of other international practices**

- **A spatial analysis for the potential placement of parcel lockers**

The following pages summarise the benchmarking exercise, as well as the process and results of the spatial analysis conducted by Bax & Company. Despite a very limited number of good practices, we have analysed and compared other parcel locker frameworks and approaches from Austria, Norway, the UK, the US, and Singapore. The search for other examples and best practices from around the world led us to conclude that work in this direction is still emerging. When led by public authorities, most parcel locker programmes are rather experimental in nature, and only some of the existing guidelines (e.g., from Austria) provide a thorough overview of aspects to consider for implementation.

The spatial analysis followed different stages in continuous consultation with the city's employees, helping Groningen find the most suitable spots for parcel lockers. The aim was threefold:

1. **To ensure accessibility for active travel, avoiding car travel for parcel pick-ups**

2. **To complement the existing private parcel locker networks, adding facilities in underserved areas**

3. **To develop an integrated approach which embeds logistics services in the city's mobility hubs strategy**

The following insights can serve as a guide for public authorities looking to develop a well-thought, coordinated approach. They are also beneficial for parcel locker providers interested in improving their services and adapting to different city requirements, including accessibility and aesthetics. Although complex, Groningen's approach is replicable in other contexts, too, allowing public and private stakeholders to work together in the transition towards sustainable urban logistics. This way, municipalities can ensure that their ambitious zero-emission policies can be implemented with less pushback from the local community. This is bolstered by tangible support for businesses and citizens, ensuring sustained economic activity within the city.

1. A BENCHMARKING OF CURRENT PRACTICES

THE NEED FOR A PARCEL LOCKER FRAMEWORK

Parcel lockers are rapidly becoming as ubiquitous as ATMs in our daily lives. Much like ATMs revolutionised banking accessibility, parcel lockers can be a game-changer in the realm of package deliveries. While this transformation should be benefitting inhabitants equitably, regardless of their location or circumstances, accessible parcel locker networks carry certain environmental implications.

The impact is neither inherently positive, nor negative, as much depends on their use. In theory, parcel lockers could save emissions as logistics service providers can consolidate deliveries and reduce the number of kilometres driven, while also avoiding failed deliveries. In practice, the displacement factor – the shift in transportation patterns from courier deliveries to recipients collecting their parcels – plays a key role. When recipients use their cars – particularly in suburban and rural areas, emission savings are lost.

Besides, parcel locker networks have an impact on the public realm. Even when placed on private land, lockers need to be replenished/emptied, requiring careful planning to avoid congestion and safety issues. As various providers may wish to install their own single label[1] closed networks, an overly high density could potentially lead to public backlash, especially if considerations around noise and aesthetics are overlooked.

For these reasons, public authorities across the world have started to consider how best to strike a balance between offering enhanced and more accessible logistics services to their inhabitants, and working on broader objectives, such as improving quality of life. Approaches range from proactively setting rules and regulations, to reactively addressing market failures as they arise.

Both have their merits and drawbacks, highlighting the complex regulatory landscape that surrounds parcel locker implementation.

Our benchmarking exercise is based on case studies from five different countries (Austria, Norway, the UK, the US, and Singapore), demonstrating that despite the large-scale implementation of parcel lockers across the world, there is no universal approach for public authorities to follow. Apart from Groningen, relatively few other public authorities have adopted a **proactive** approach to develop **ex-ante** regulations that could set up clear rules for logistics service providers.

Business and operational models are a widely discussed (and contentious) topic in the deployment of parcel lockers. Most public authorities support an **open network** which is carrier-agnostic and can be used by any courier firm, to avoid duplication of single label lockers. Despite the public authorities' preference, **closed networks** are much more common. These tend to be single/private label, being used by a specific parcel locker provider (and, potentially, its chosen logistics partners).

Potential **functions and types of users** are closely connected to the type of business and operation models. Generally, public authorities prefer both categories to be as diverse and broad as possible.

Potential functions	Potential users
Pick-up / drop-off	Courier express parcel services
Web shop	Local businesses
Returns (products)	Other service providers
Returns (packaging)	Online shops / marketplaces
Locker / short term storage	Private individuals

[1] Note on terminology: open networks are not necessarily white label, as they can be provided by a certain company and branded by it, while allowing other companies to use it (e.g., BPost in Mechelen). Similarly, closed networks are not necessarily single label, as various selected providers might be included in the agreement.

Public authorities often have more control over **parcel locker placement** on public grounds, bringing municipalities, landowners, and suppliers into the decision-making process. In Austria and the UK, public land use requires approvals and has the potential to generate rental income. To bypass planning permissions and encourage trip chaining, providers often opt for private areas, like shopping centres, transport hubs or gas stations. In Austria, restricted-access sites like residential complexes and company buildings are also utilised for parcel locker placement. This approach enhances flexibility and minimises bureaucratic hurdles.

In terms of **infrastructure** requirements, the Norwegian VIV network emphasises the need for power-independent operation, neutral design, and the removal of advertising.

Oslo suggests colour coordination, placement against a wall, and alignment with municipal aesthetics requirements. Austria lists essential features such as stable internet and power, levelled floors, and space for expansion. New York's security measures include cameras and anti-theft mechanisms. Installation sites should prioritise circulation space, avoid street furniture conflicts, maintain pedestrian flow, and not obstruct windows, fire escapes, or public art. Generally, all guidelines aim to ensure efficient and harmonious parcel locker deployment.

Centre for London offers some examples of **place-based integration** aiming to blend parcel lockers with existing elements, thereby providing a more pleasant urban environment and boosting their overall acceptance (Figure 1).
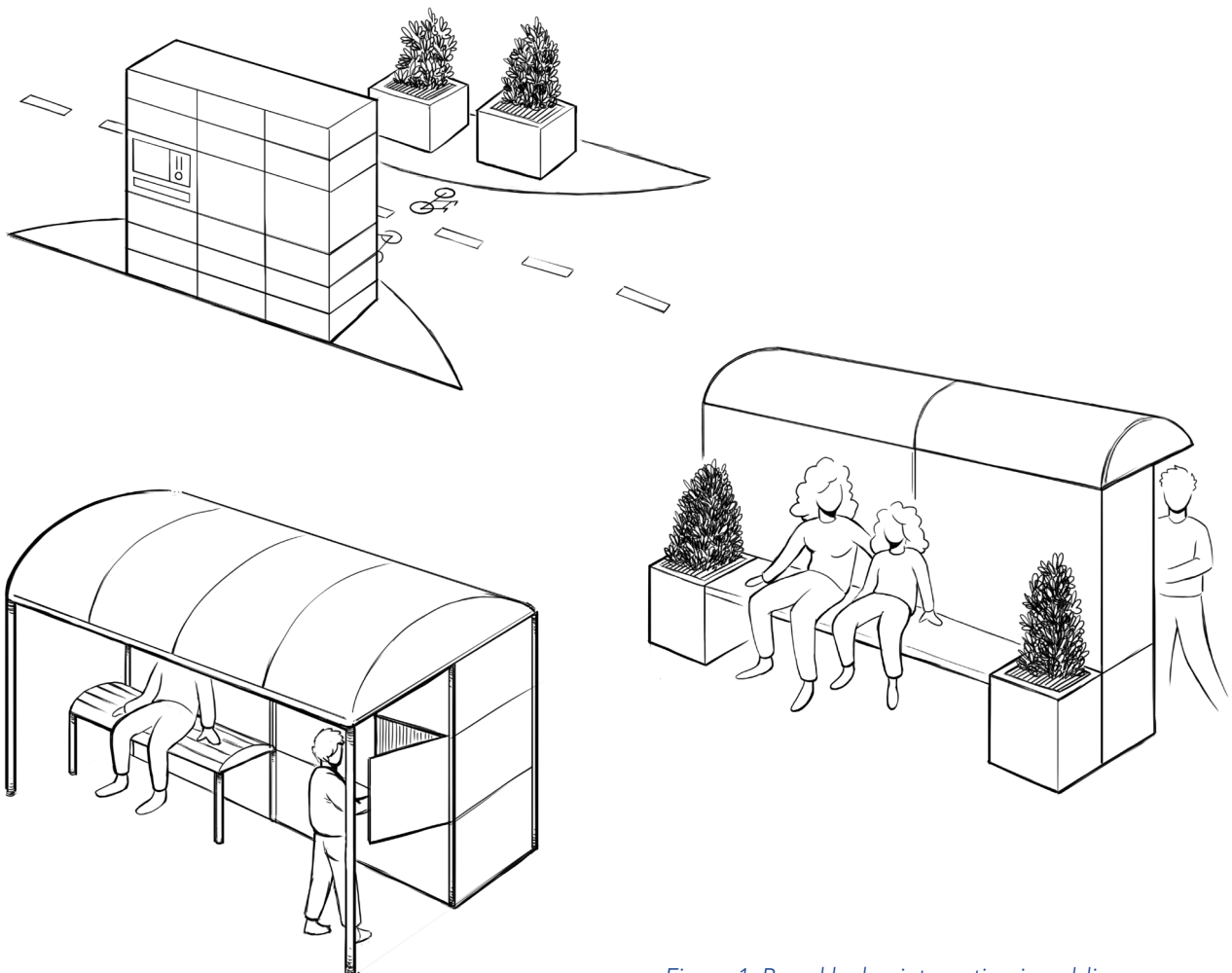

Figure 1: Parcel locker integration in public space (Visual inspired by Millie Mitchell / Centre for London)

To ensure a universally accessible service, public authorities also include certain **accessibility** requirements.

The Austrian Guidelines provide some useful illustrative examples that align with European standards and regulations (Figure 2).

Besides the physical design, users should have the option to choose accessible delivery to ensure their parcels are stored at a reachable height.
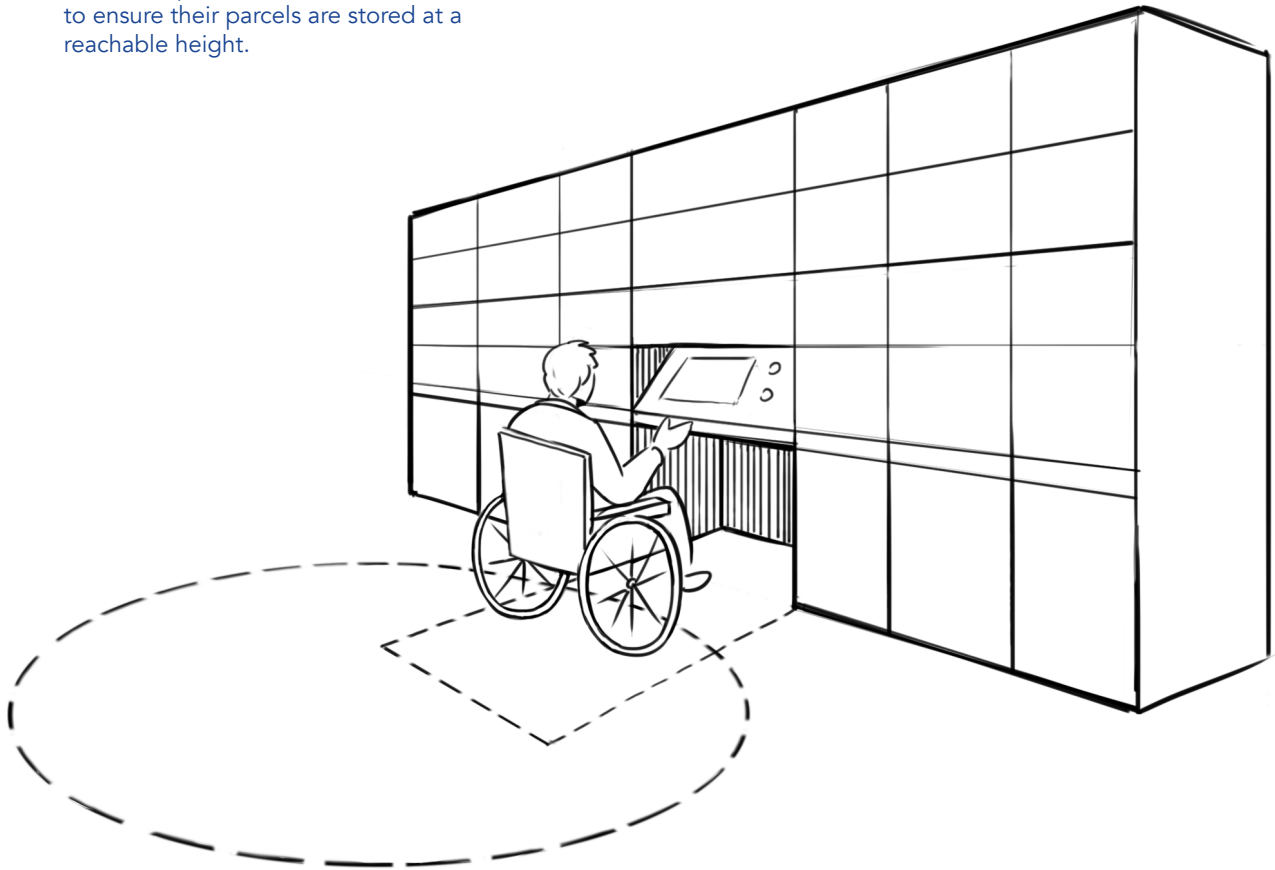

*Figure 2: Barrier-free design of the installation site (Visual inspired by Bernhard Hruska / Architektur B4)*

RECOMMENDATIONS

To simplify matters for public authorities, and Groningen in particular, the following recommendations are structured into *key* and *nice to have*. This should allow municipalities to determine priorities and reach a **common ground** during consultations and negotiations with logistics service providers.

KEY RECOMMENDATIONS:

1. Public authorities should leverage their power to regulate **public spaces**, either through a dedicated framework for parcel lockers, or through other connected policies (e.g., accessibility requirements, aesthetics of historical city centres, etc.). Interventions in private areas should also be made if parcel lockers become disruptive (e.g., causing traffic, congestion, noise, etc.), but they might be the area of a different department.

2. Negotiating for an **open parcel locker system** would allow for a more diverse range of providers, users, and applications. This could have negative implications for the number of vehicles used to deliver and pick up parcels. Although consolidation in a specific hub and delivery by one single company could reduce the issue, it could also lead to a de facto monopoly.

3. While installation requirements may vary, cities should always ensure that parcel lockers are **safe to use** (e.g., situated in well-lit locations), **accessible** (e.g., providing sufficient manoeuvring space for wheel-chair users), and **do not interfere with other space users** (e.g., impeding pedestrian flows).

4. Given the scarcity of data on urban logistics, **data reporting** agreements could help public authorities to better understand urban freight conditions, enable them to track parcel locker usage and make any necessary changes.

OTHER ASPECTS TO CONSIDER:

1. Ideally, parcel lockers should be able to operate without power supply, using a sustainable energy source such as solar.

2. Paying attention to aesthetics is important, particularly when preserving the architectural heritage of historic city centres.

3. Universal design could increase user accessibility, regardless of age and abilities, ensuring more equitable access to this service.

4. Parcel lockers could be modular, allowing for expansion during peak periods like Christmas, or for downsizing to make space for other uses when demand is lower.
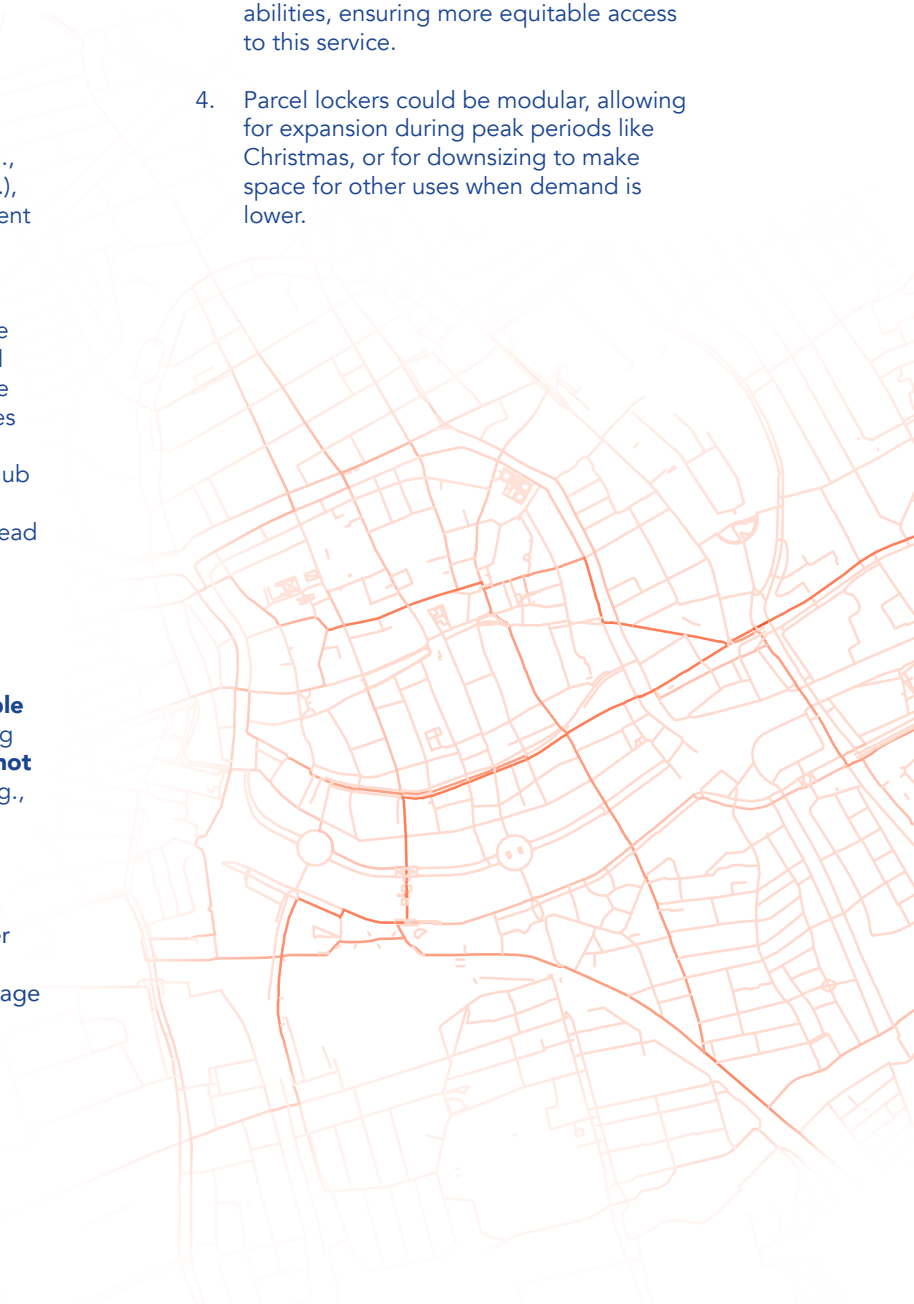
2. WHERE SHOULD PARCEL LOCKERS BE PLACED IN GRONINGEN'S PUBLIC SPACES?

WHY AND HOW WE STUDIED THIS

Taking a proactive approach, the City of Groningen wanted to ensure that parcel lockers are available and accessible for most, if not all, of their inhabitants. Given that the location and density of lockers can impact the recipients' choice of transport, we conducted a series of spatial analyses to identify the most suitable locations for an open network of parcel lockers.

WHAT WE FOUND

1. UNDERSTANDING THE CITY CONTEXT

Figure 3 illustrates the city's neighbourhoods and their respective population distributions. The darker shades reflect the denser areas, pointing towards potential higher demand for logistics services.

To identify areas where people are most likely to use active transport, we used the **Space Syntax betweenness centrality analysis**. Figure 4 illustrates the network segments most used by bicycles. Centrally located streets and streets that connect different neighbourhoods tend to have high centrality values, meaning that they carry a higher flux of users, swiftly connecting different origins and destinations within a given radius (in this case, 10 km).

The **kernel density** of the betweenness centrality (Figure 5) highlights areas in the city with the densest usage of network segments. The highest values cover the central region of the city and areas adjacent to the canals. In these canal areas, traffic tends to be funnelled onto fewer roads, particularly around bridges.
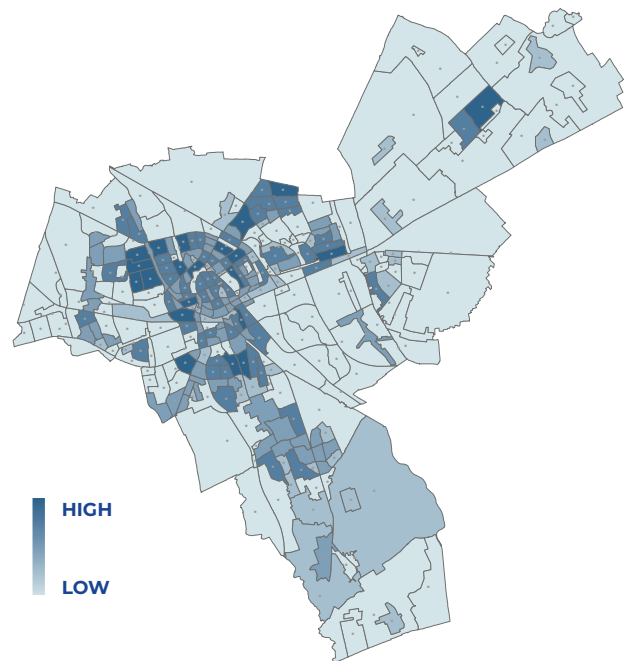
The analyses followed three main steps:

1.   Understanding the city context:
      • Demand: where do most people live?
      • Infrastructure: where are people most likely to walk and cycle?
      • Priorities: where would the city prefer to locate parcel lockers?

2.   Finding the ten most accessible public spots

3.   Filling the gaps in existing private networks

HIGH

LOW

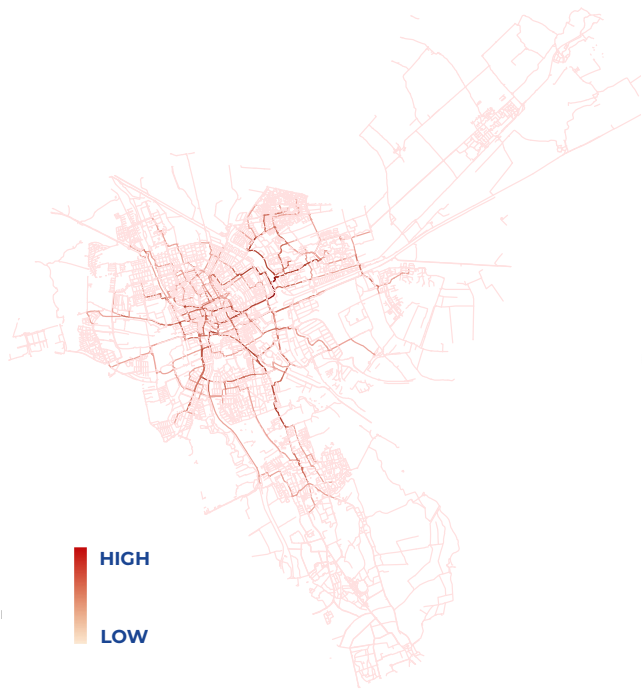*Figure 3: Neighbourhoods and population density in Groningen*

*Figure 4: Streets most
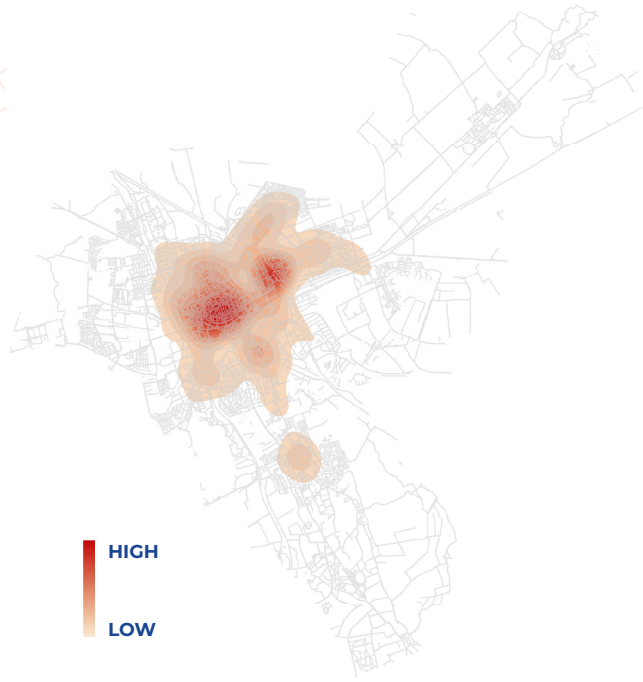likely used by cyclists*

*Figure 5: Density of streets
most likely used by cyclists*

For context, we also considered the city's
preferred locations. Groningen is working
towards a strategy for transport hubs,
integrating both mobility and logistics
solutions as and when required.

The map below illustrates the potential types
of hubs suitable for hosting parcel lockers:

- **Buurthub** or neighbourhood hub (green),
  twenty-six units
- **Park & Ride** (yellow), five units
- **Stations** (orange), five units
- **Wijkhub** or bigger hub (red), five units

- BUURTHUB
- PARK & RIDE
- STATIONS
- WIJKHUB
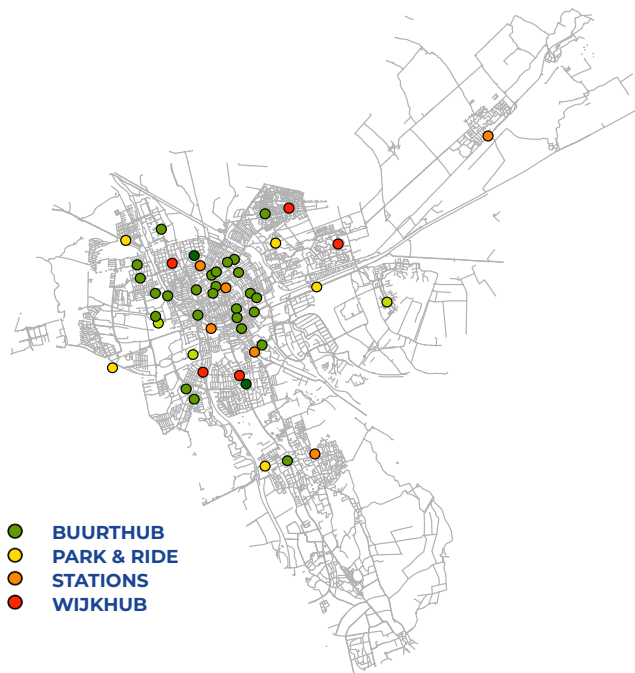
*Figure 6: Types of mobility hubs
developed by the city of Groningen*

2. FINDING THE TEN MOST ACCESSIBLE PUBLIC SPOTS FOR PARCEL LOCKERS

As a second step, we used **location-allocation models** to assess the top ten locations that could cater to a majority of the city's population. This analysis was carried out in two phases: first we considered all possible locations where parcel lockers could be placed, including neighbourhood hubs, and then we selected only large hubs, stations, and P&R, which the city might choose to prioritise (Figure 7).

Figure 8 shows the coverage of these ten selected lockers at five, ten, and fifteen minute **cycling intervals**. Figure 9 is a visualisation of this coverage, with an overlay of the population density distribution, showing how the most densely populated neighbourhoods would be covered by these optimal locations.

It's noteworthy that in both scenarios, the locations derived from our analysis coincide with those of the two main providers, indicating their strategic site selection. These results guided us in analysing the potential gaps in the existing private offer for parcel lockers and other pick-up and drop-off points (PUDOs)[2].

_____

[2] PUDOs is a wider term, encompassing parcel lockers and other collection and delivery points, such as partnering shops and individuals collaborating with Logistics Service Providers (typical mostly in the Dutch context).
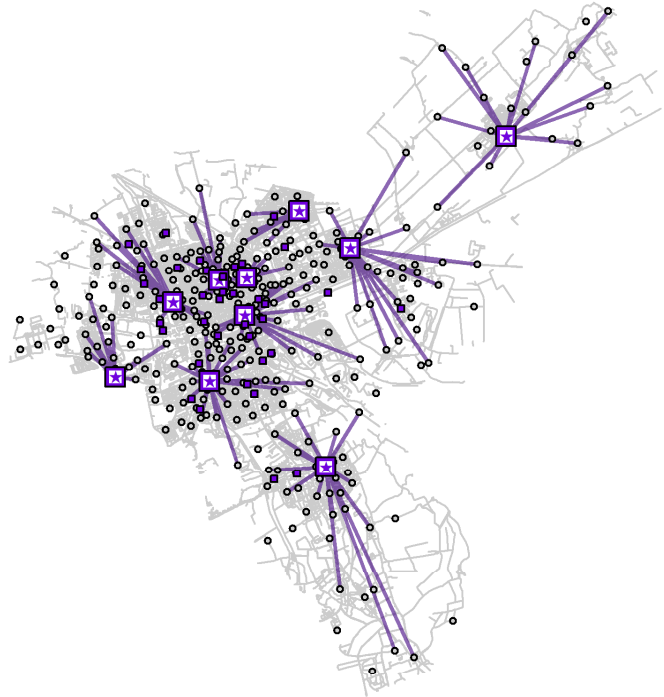

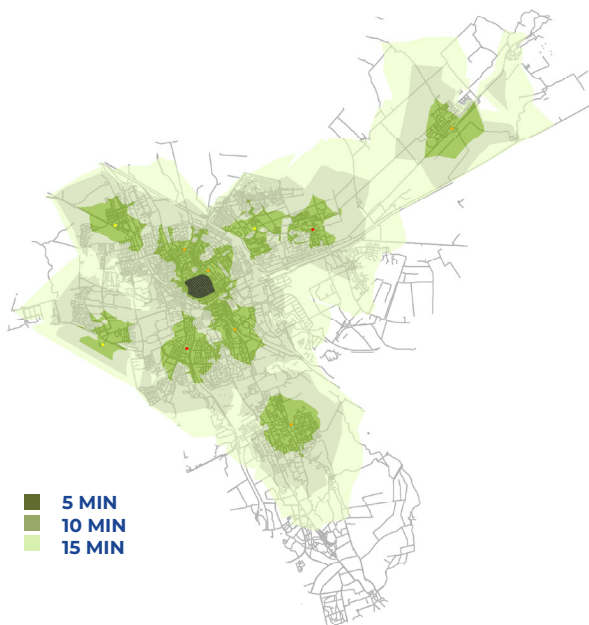*Figure 7: Optimal location of ten lockers in the city*

5 MIN
10 MIN
15 MIN

Figure 8: Area coverage for 10 optimally-located lockers at five minute intervals for cyclists
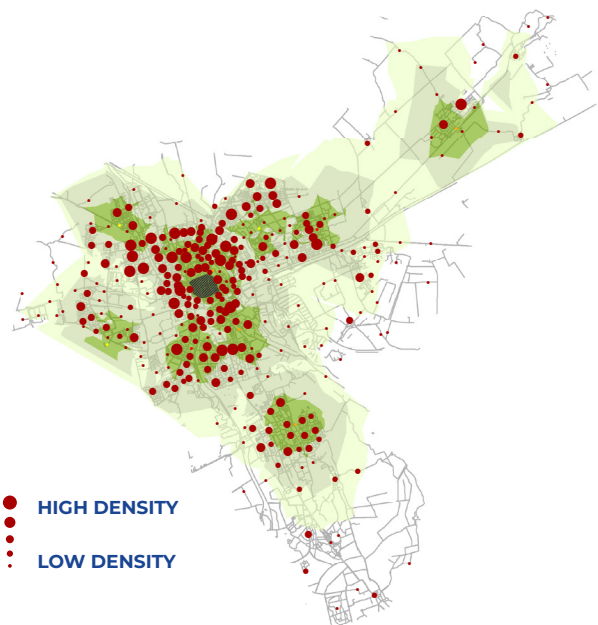

HIGH DENSITY

LOW DENSITY

Figure 9: Area coverage for lockers at five minute intervals for cyclists and population density

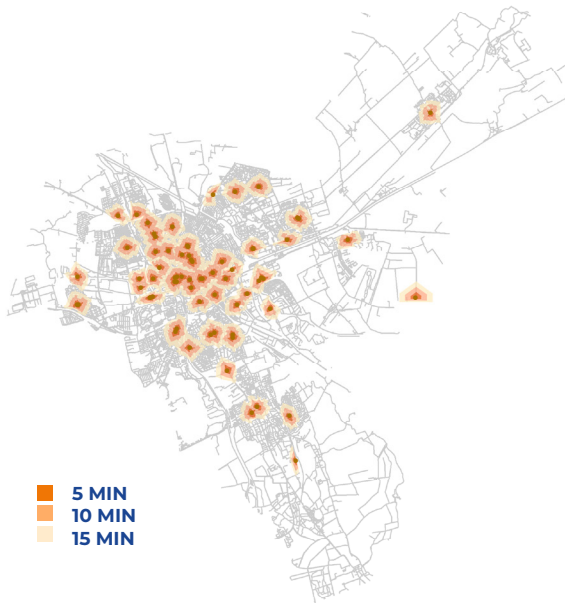### 3. FILLING THE GAPS IN EXISTING PRIVATE NETWORKS

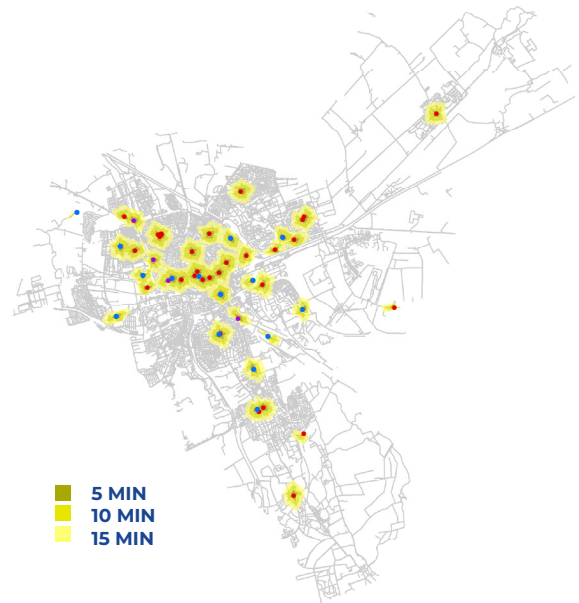*Figure 10: Area covered by PostNL lockers at five minute intervals for pedestrians*

Figure 11: Area covered by DHL lockers at five minute intervals for pedestrians

Given that the PUDO networks of some of the biggest logistics service providers, such as PostNL and DHL, are within a **ten-minute bike ride** for the majority of the population, we tried to pinpoint any potential gaps. Our results show a disparity for parcel lockers, with areas such as Ten Boer and Haren being underserved.

Furthermore, **pedestrian accessibility** to both PostNL (Figure 10) and DHL (Figure 11) PUDOs is quite restricted, highlighting areas the city should prioritise to enhance pedestrian reach. By superimposing the coverage of the two main brands for pedestrians (Figures 10 and 11) onto all potential new locations (in planned hubs) suggested by the city of Groningen (Figure 12), the following three spots could help fill the gaps, as illustrated by Figure 13 on the following page:

1. Meerstad
2. S.O.J. Palmelaan
3. Martiniplaza
This location does not coincide with any existing PUDO. Although it would not cover an area of high population density, it's strategically positioned to cater to areas that are lacking adequate service.
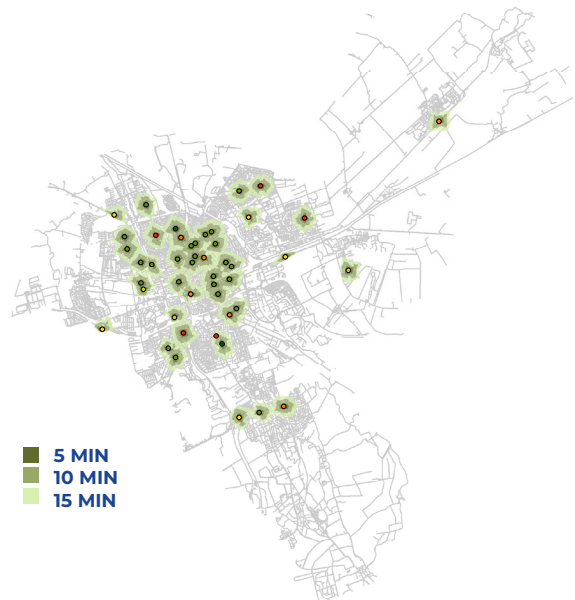

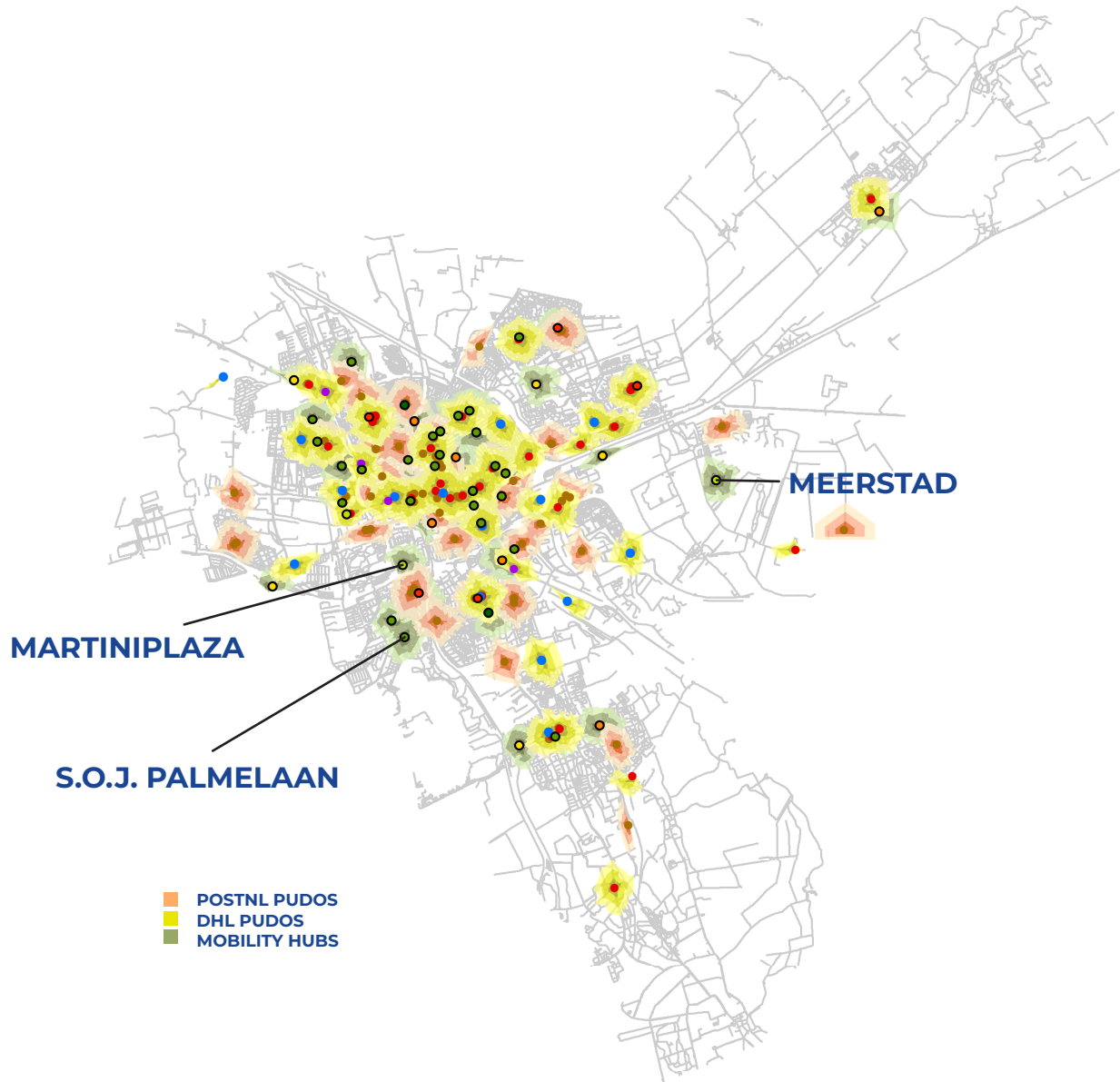*Figure 12: Area covered by mobility hubs at five minute intervals for pedestrians*

*Figure 13: Priority locations for parcel lockers
to complement the existing private offer*

CONCLUSIONS

The various layers for spatial analysis offer valuable insights to the City of Groningen on where to locate parcel lockers for increased user accessibility. Mapping the city's context helps to determine where most people live, potential hotspots for delivery demand, frequently used pedestrian and cycle routes, and how this all connects with the city's pre-planned mobility hubs. In this way, Groningen can make sure that mobility hubs are multifunctional and can serve both mobility and logistics in an integrated way.

Then, the models developed aid in optimising the distribution of parcel lockers across the city. We have highlighted ten locations with high potential to enhance the accessibility of the city's most populated areas. This can be particularly useful if a new brand is interested in creating an alternative network.

Finally, our analysis of the current distribution of parcel lockers and other pick-up and drop-off points highlights the existing gaps and underserved areas. While some of the largest LSPs have well developed networks accessible for cyclists, they are harder to reach by pedestrians. For this reason, our recommendations focus on prioritising three areas, to ensure that customers choose to walk or cycle, instead of drive, to pick up their parcels.

While our recommendations primarily target local authority planners and policy makers, they are equally relevant for practitioners and logistics service providers. Taking account of what different contexts require can help providers better shape their offers and increase acceptance and uptake. Although engagement takes considerable time and resources, we are confident that public authorities and parcel locker providers can collaborate to strike a balance between good quality, widespread and accessible logistics services, and overall increased quality of life.

Cities interested in developing a network of parcel lockers in public areas, or influencing the location selections of logistics service providers, can replicate a similar exercise. Such studies can support providers in understanding where their services might be most needed. However, the analysis is not limited to parcel lockers, and can be adapted for any other service of interest.

| CONTACT

Lorena Axinte
l.axinte@baxcompany.com

Víctor Ferran
v.ferran@baxcompany.com

Concept and benchmarking
Lorena Axinte
Bax & Company

Spatial analysis
Víctor Ferran
Bax & Company

Editing
Amy McCready
Bax & Company

Design
Mathis Fay
Bax & Company

Contributions from:
Paul Buijs & Klaas Schurer
University of Groningen

Sjouke van der Vlugt
Jacky van Geffen
Jim Klooster
City of Groningen