

# FINDING THE RIGHT SPACE FOR URBAN LOGISTICS

**A FRAMEWORK FOR OPEN PARCEL LOCKER SYSTEMS**

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# I 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<sup>1</sup> 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.

<sup>1</sup> 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.

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 Web shop Returns (products) Returns (packaging) Locker / short term storage	Courier express parcel services Local businesses Other service providers Online shops / marketplaces Private individuals

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).

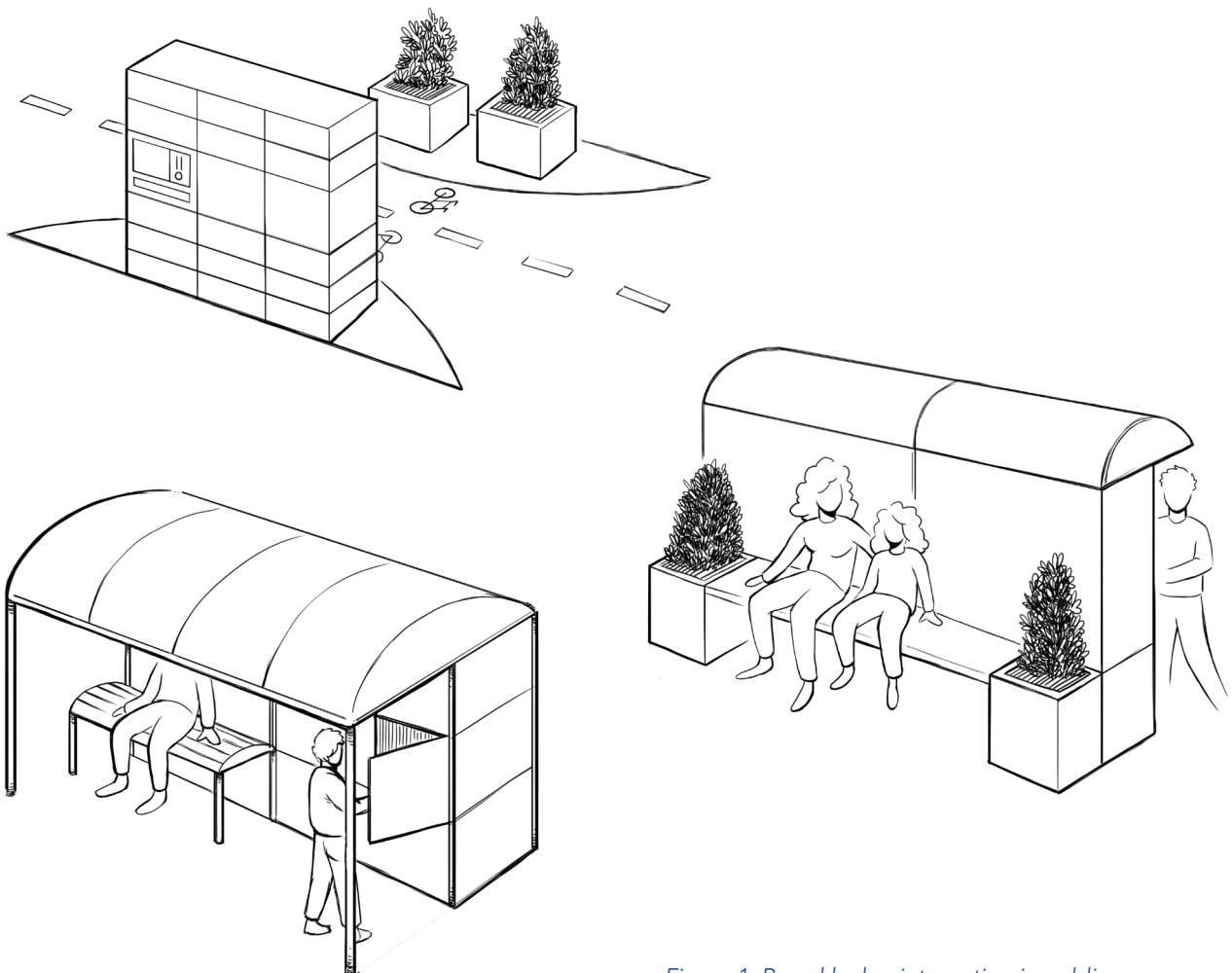


Figure 1: Parcel locker integration in public space (Visual inspired by Millie Mitchell / Centre for London)

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.

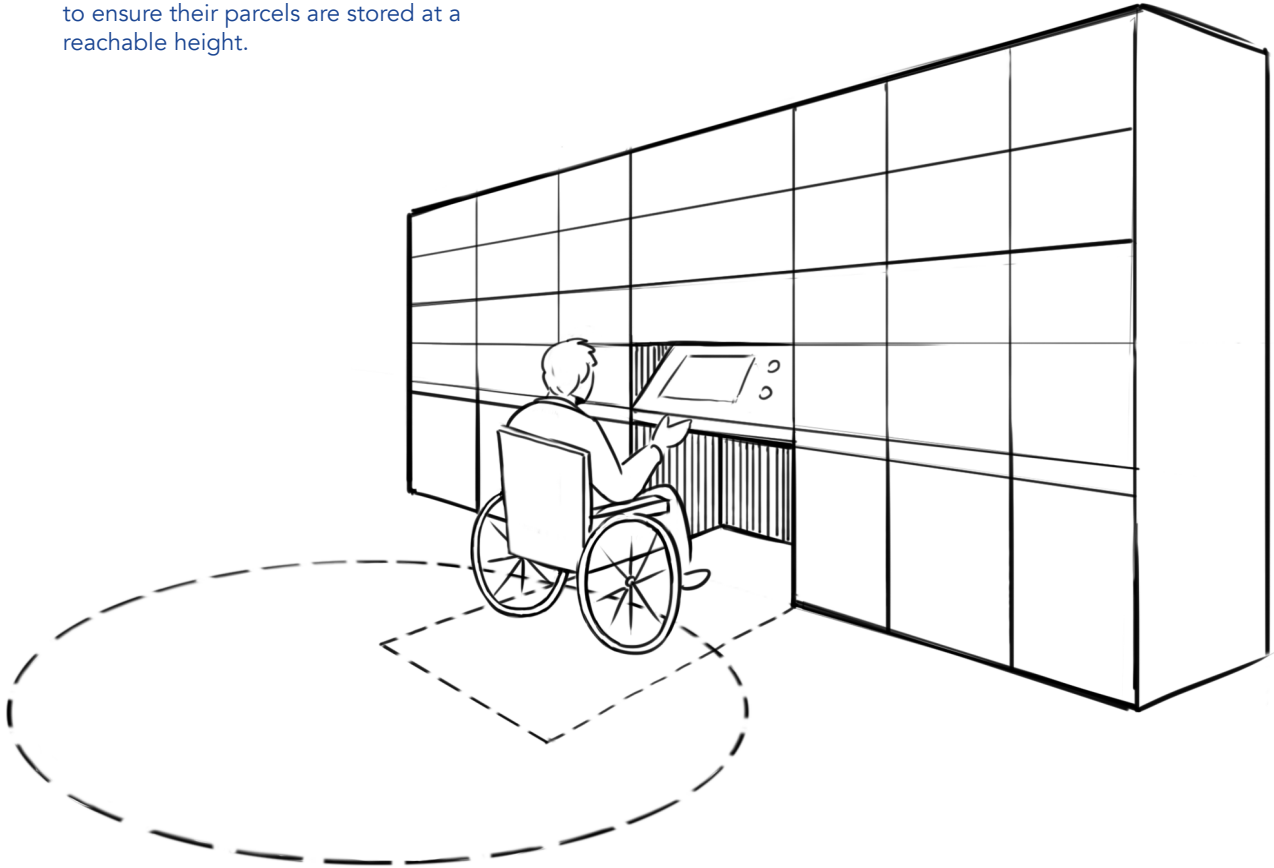


Figure 2: Barrier-free design of the installation site  
(Visual inspired by Bernhard Hrsuka / Architecture B4)

## RECOMMENDATIONS

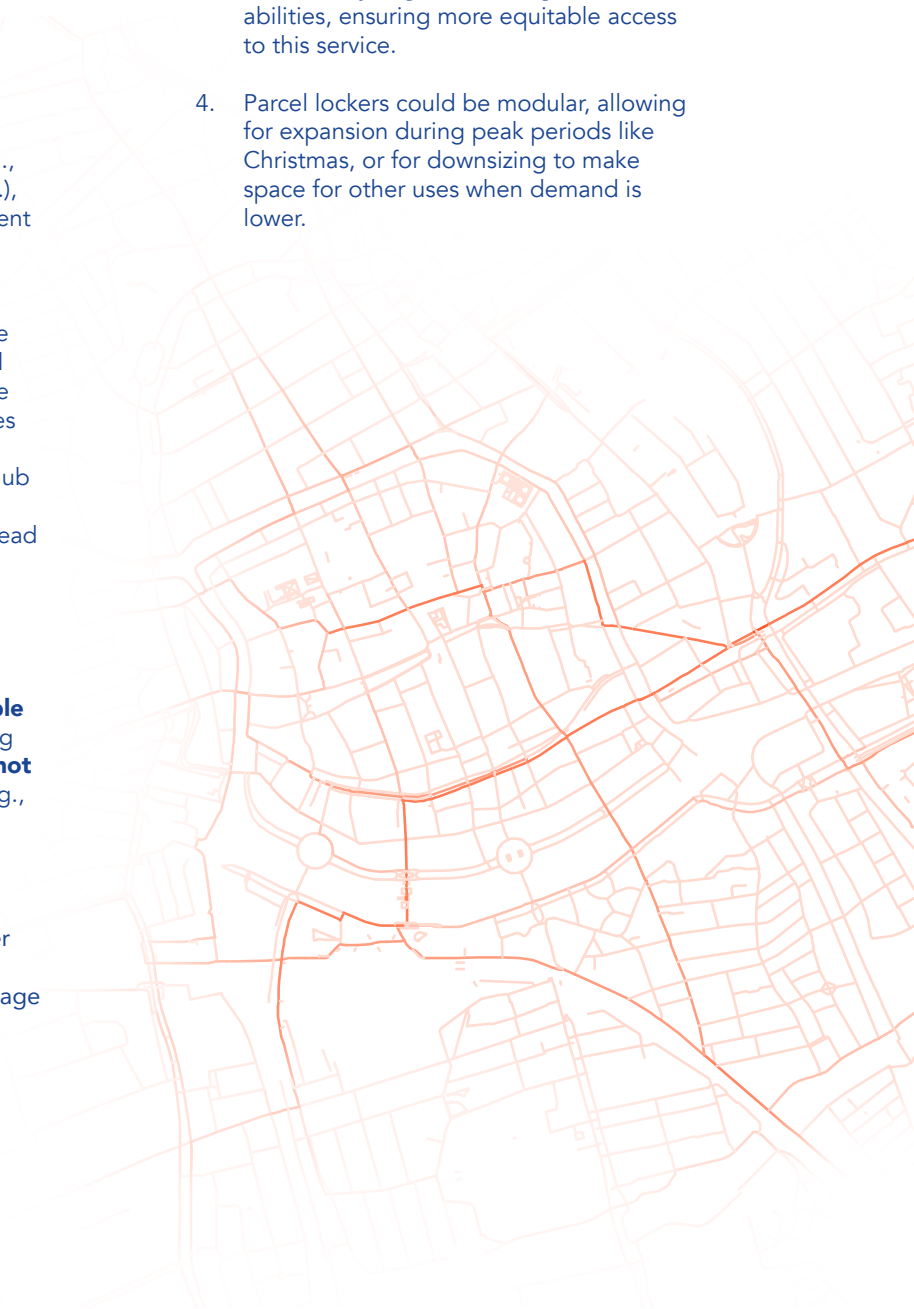
To simplify matters for public authorities, and Groningen in particular, the following recommendations are structured into *key* and *nice to have*. This should allow municipalities to determine priorities and reach a **common ground** during consultations and negotiations with logistics service providers.

### 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.

### 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

## 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.

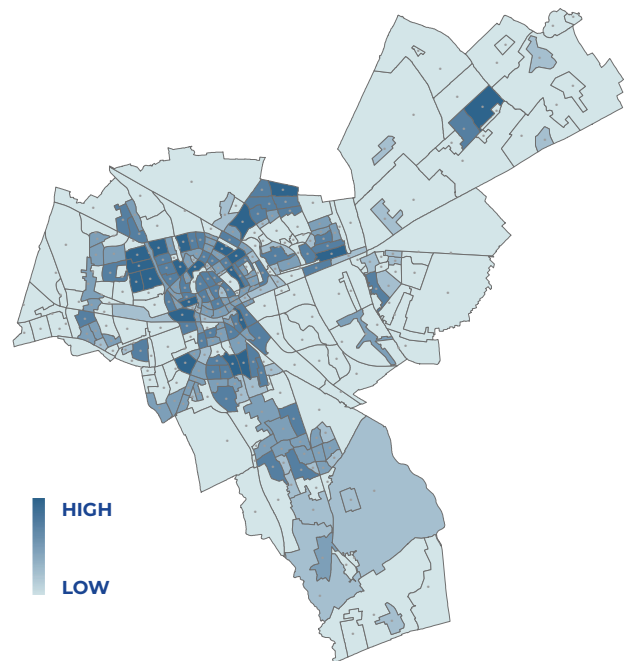


Figure 3: Neighbourhoods and population density in Groningen

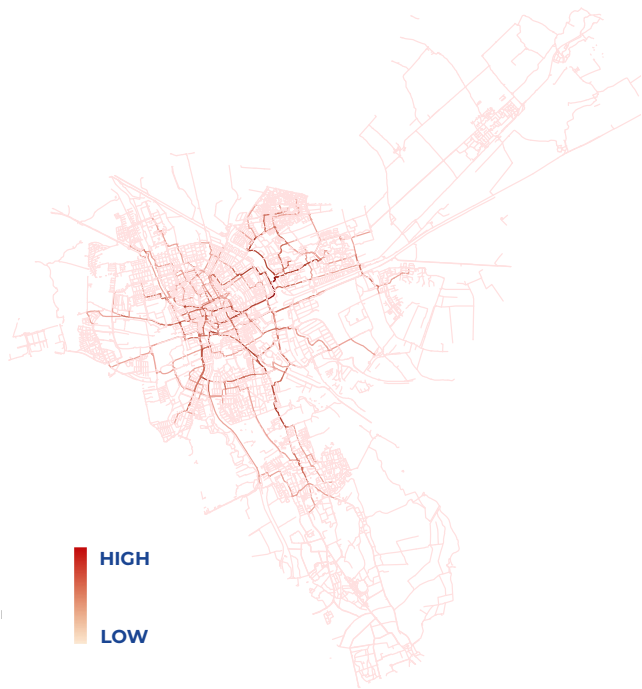


Figure 4: Streets most likely used by cyclists

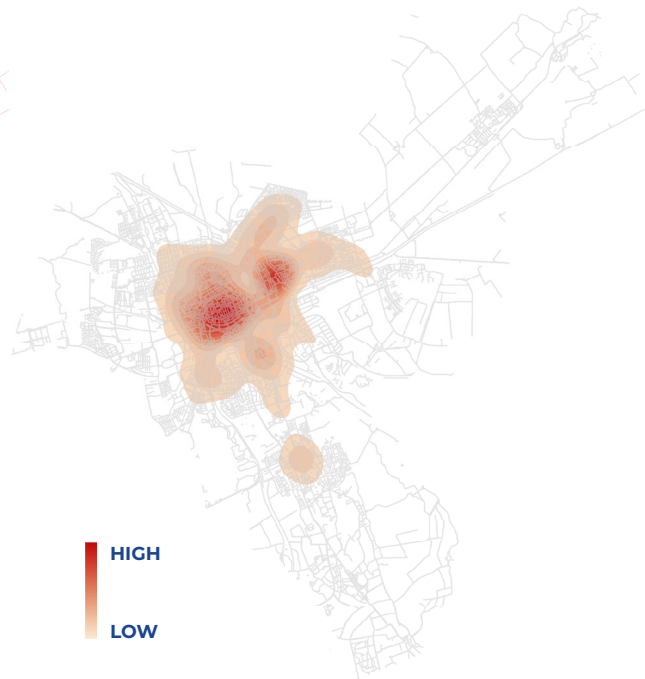


Figure 5: Density of streets most likely used by cyclists

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

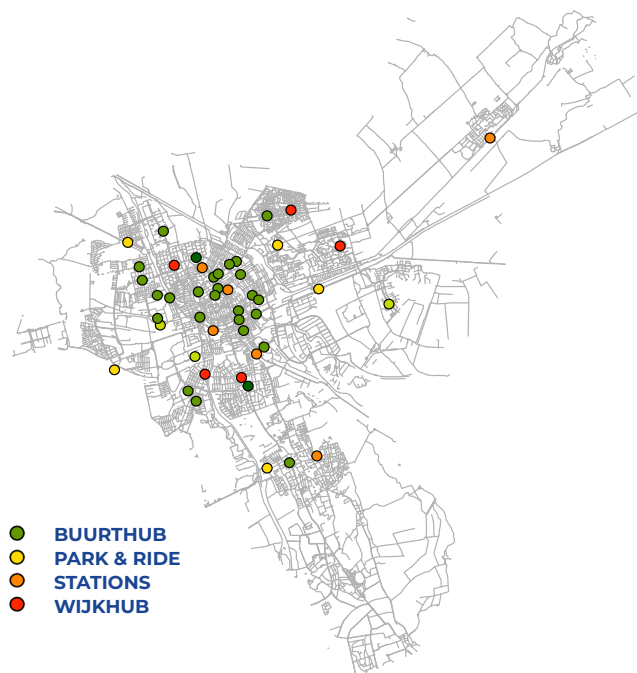


Figure 6: Types of mobility hubs developed by the city of Groningen



## 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)<sup>2</sup>.

<sup>2</sup>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).

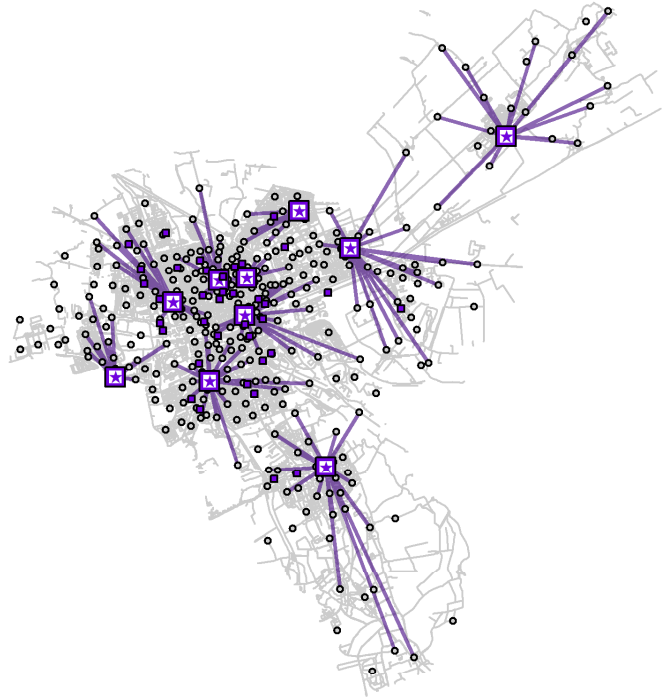


Figure 7: Optimal location of ten lockers in the city

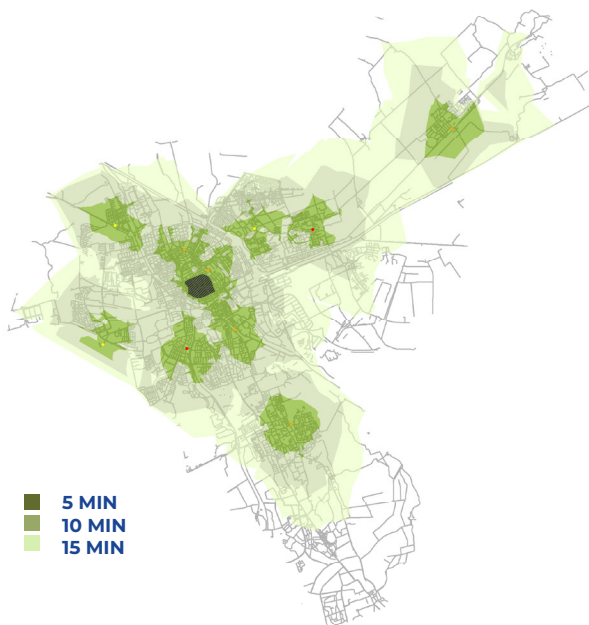


Figure 8: Area coverage for 10 optimally-located lockers at five minute intervals for cyclists

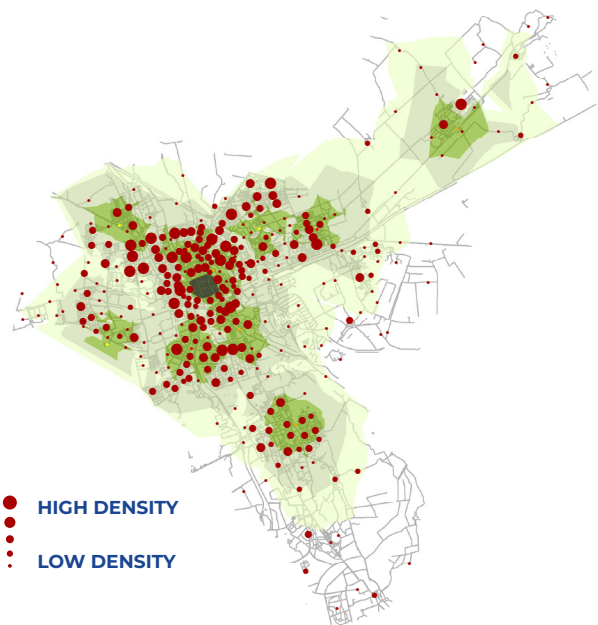


Figure 9: Area coverage for lockers at five minute intervals for cyclists and population density

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

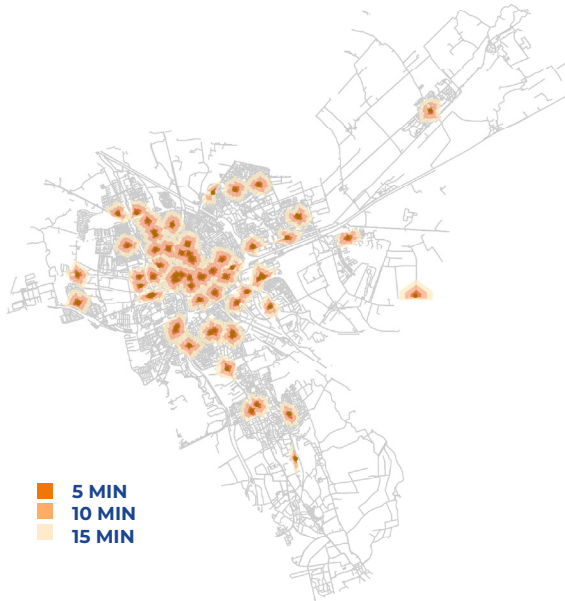


Figure 10: Area covered by PostNL lockers at five minute intervals for pedestrians

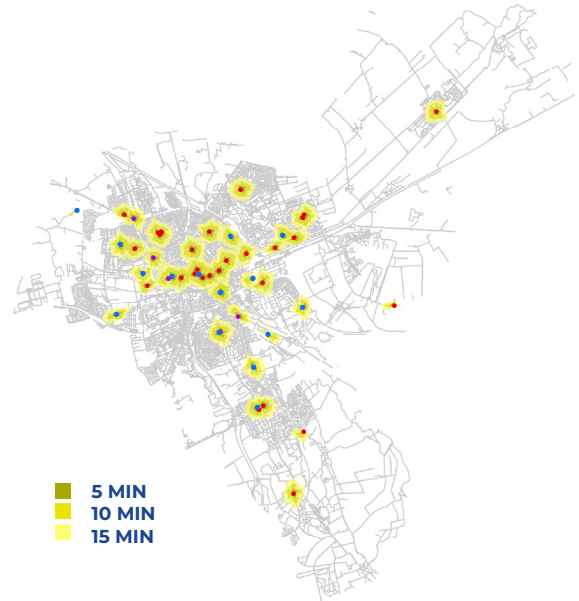


Figure 11: Area covered by DHL lockers at five minute intervals for pedestrians

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:

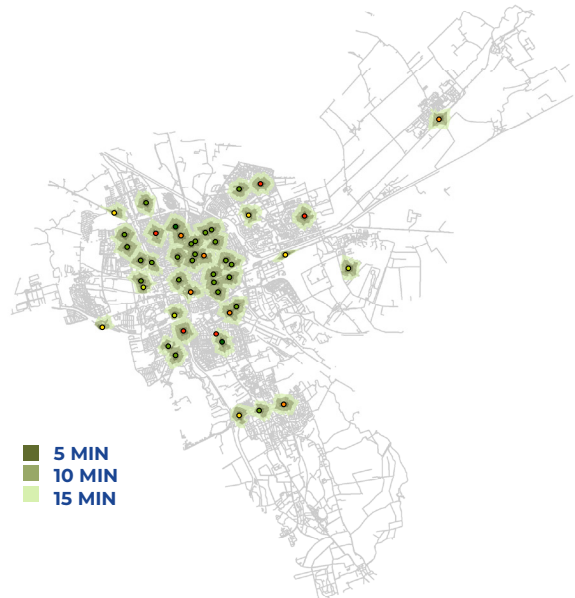


Figure 12: Area covered by mobility hubs at five minute intervals for pedestrians

- 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.

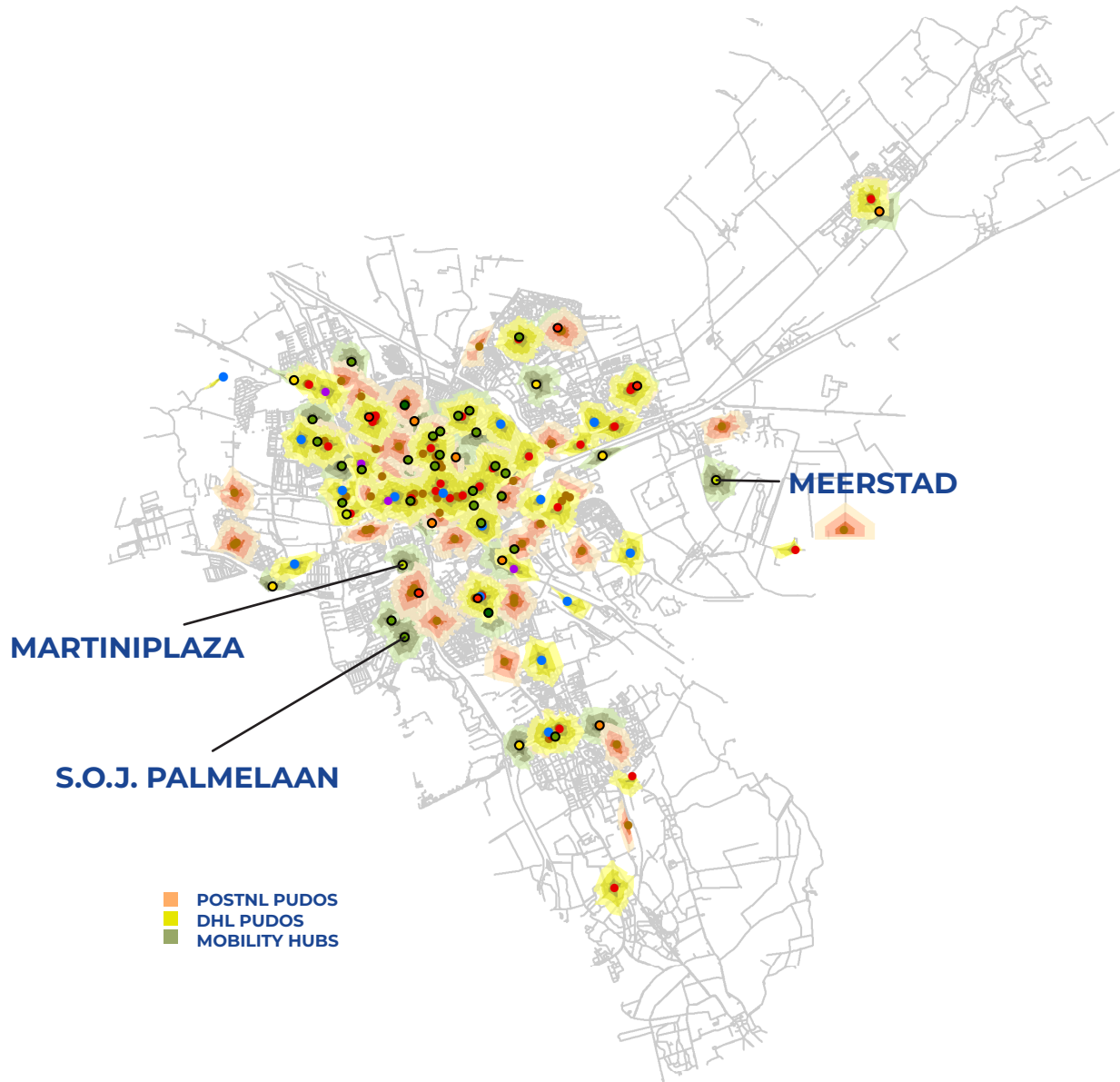


Figure 13: Priority locations for parcel lockers to complement the existing private offer

# I 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.

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