

# Infrastructural opportunities and barriers for last-mile delivery by small electric distribution vehicles in historical city centres in the Netherlands



Stef van Oosterhout  
S3734501

## Colophon

<b>Title:</b>	Infrastructural opportunities and barriers for last-mile delivery by small electric distribution vehicles in historical city centres in the Netherlands
<b>Author:</b>	Stef Arthur van Oosterhout
<b>Contact:</b>	s.a.van.oosterhout@student.rug.nl
<b>Student Number:</b>	S3734501
<b>Study Program:</b>	Bsc. Spatial Planning and Design
<b>University:</b>	University of Groningen, Faculty of Spatial Sciences
<b>Version:</b>	Final version
<b>Date:</b>	28-01-2022
<b>Supervisor:</b>	Dr. W.S. Rauws
<b>Cover page:</b>	Author, 2022

## Summary

Logistical movements in cities have increased over time and will continue to grow. These movements bring negative side effects to the urban environment such as congestion and pollution. Hence, cities are seeking more sustainable ways to supply their cities and The Green Deal Zero Emissie Stadslogistiek is a catalysator for local sustainable urban logistics plans. The small electric distribution vehicle could be a solution to cover the last mile and therefore, this research aims to identify how urban infrastructure in historical city centres enables and hampers last-mile delivery by such vehicles. This was done via a literature review, document review, interviews, and drive-along participative observation. The main findings show that municipalities are generally concerned about the speed of small electric distribution vehicles as well as the capacity of the charging network. Nevertheless, the infrastructure of historical city centres generally enables last-mile delivery using small electric distribution vehicles, especially when the speed of a small electric distribution vehicle will be considered in design and regulations.

**Keywords:** Last-mile delivery, zero-emission zone, small electric distribution vehicle, historical city centres, infrastructural characteristics

## Table of contents

COLOPHON.....	2
SUMMARY.....	3
1. INTRODUCTION.....	6
1.1 SOCIETAL AND ACADEMIC RELEVANCE.....	6
1.2 RESEARCH AIM.....	7
1.3 READING GUIDE.....	8
2. THEORETICAL FRAMEWORK.....	9
2.1 MAIN TRENDS IN SULP PLANS.....	9
2.2 LAST-MILE DELIVERY (LMD).....	9
2.3 SMALL ELECTRIC DISTRIBUTION VEHICLE.....	10
2.4 INFRASTRUCTURAL CHARACTERISATION OF A HISTORICAL CITY CENTRE.....	10
2.5 URBAN DESIGN PRINCIPLES.....	11
2.6 ASSESSMENT FRAMEWORK.....	13
2.7 EXPECTATIONS.....	14
3. METHODOLOGY.....	15
3.1 RESEARCH APPROACH.....	15
3.2 RESEARCH AREAS.....	15
3.3 DATA COLLECTION.....	16
3.4 DATA ANALYSIS.....	18
3.3.1 Analysis of document review.....	18
3.3.2 Analysis of semi structured interviews.....	19
3.3.3 Analysis of participative observation.....	19
3.3.4 Research ethics.....	19
4. RESULTS.....	20
4.1 MAIN TRENDS IN LOCAL SULP PLANS AND THE CONTRIBUTION OF SEDV.....	20
4.2 VIEWS OF POLICYMAKERS AND COURIER COMPANIES ON THE USE OF THE SEDV.....	21
4.3 EXPERIENCES OF DRIVING A SEDV IN HISTORICAL CITY CENTRES.....	22
5. CONCLUSION.....	26
5.1 CONCLUSION.....	26
5.2 REFLECTIONS ON ASSESSMENT FRAMEWORK.....	27
5.3 LIMITATIONS.....	27
5.4 LESSONS FOR PRACTICE & FUTURE RESEARCH.....	27
REFERENCES.....	28
APPENDIX A: METHODOLOGICAL APPROACH OVERVIEW.....	31
APPENDIX B: INTERVIEW GUIDE INTERVIEW 1.....	32
APPENDIX C: INTERVIEW GUIDE INTERVIEW 2.....	35
APPENDIX D: DOCUMENT REVIEW TABLE.....	38
APPENDIX E: PARTICIPATIVE OBSERVATION CHECKLIST.....	43
APPENDIX F: CODE TREE INTERVIEW 1.....	45
APPENDIX G: CODE TREE INTERVIEW 2.....	46
APPENDIX H: TIMETABLE.....	47

## List of figures and tables

Figure 1: Example of a SEDV .....	6
Figure 2: Example of a Goupil G4 from Picnic in Zwolle .....	10
Figure 3: Example of a Closed Cargo from PostNL in Groningen.....	10
Figure 4: The assesment framework.....	14
Figure 5: The historical city centre of Leiden.....	15
Figure 6: The historical city centre of Groningen.....	15
Figure 7: The historical city centre of Leeuwarden.....	16
Figure 8: The historical city centre of Zwolle .....	16
Figure 9: Map of Leiden with driven route.....	24
Figure 10: (Un)loading situation in Leiden.....	24
Figure 11: (Un)loading situation in Leiden.....	24
Figure 12: Map of Groningen with driven routes.....	24
Figure 13: (Un)loading situation in Groningen.....	24
Figure 14: Map of Zwolle with driven route.....	25
Figure 15: (Un)loading situation in Zwolle .....	25
Figure 16: (Un)loading situation in Zwolle.....	25
Figure 17: Map of Leeuwarden with driven route.....	25
Table 1: "Stedelijke verkeersniveaus" as described by "Verkeer in de stad" .....	11
Table 2: General principles from "Verkeer in de stad" .....	13
Table 3: Overview of policy documents on Sulp plans.....	16
Table 4: Overview of interviewees.....	17
Table 5: Information about location and date for participative observation .....	18
Table 6: Themes connected to information out of the policy documents.....	18
Table 7: Deductive code scheme.....	19
Table 8: Overview of existence of local Sulp plans, implementation date of the zero-emission zones, main trends and the SEDV concreteness.....	20

## Abbreviations

<b>SEDV</b>	Small Electric Distribution Vehicle
<b>Sulp</b>	Sustainable Urban Logistic Plans
<b>LMD</b>	Last Mile delivery
<b>GDZES</b>	Green Deal Zero Emissie Stadslogisitiek
<b>GIS</b>	Geographic Information System
<b>LEFV</b>	Light Electronic Freight Vehicle
<b>ANPR</b>	Automatic Number Plate Recognition

## 1. Introduction

Every day, people in cities consume and use products like food, clothes, furniture, books, and computers. The transport of these goods enables people to use these at any place at any time (Behrends et al., 2019). Between 2016 and 2020 these logistic movements, especially in terms of parcel delivery, have increased by 111,5% in the Netherlands (ACM, 2021). The final stage of delivery to end customers in the supply chain is referred to as last-mile delivery (LMD) (Brown & Guiffrida, 2015). A great downside of this ever-growing LMD is that it contributes to environmental issues and congestion in the urban environment (Behrends et al., 2019).

Consequently, a great number of European cities presented certain Sustainable Urban Logistic Plans (SULP) which can help accelerate freight transport into something more sustainable (Björngen et al., 2019). The *“Green Deal Zero Emissie Stadslogistiek”* (GDZES) states that the supply of city centres in the Netherlands should be without emissions by 2025. This GDZES led to many local SULP plans, for example the *“Covenant Stedelijke Distributie 071”* and *“Ruimte voor zero emissie stadslogistiek”* where municipalities try to achieve sustainability in logistics (Gemeente Leiden, 2020; Gemeente Groningen, 2021).

One possible solution which is increasing in popularity is to deliver this last mile using a small electric distribution vehicle (SEDV) (Rieck et al., 2019). A SEDV, as visible in figure 1, is sometimes allowed on bike lanes and can be parked closer to delivery addresses instead of parking places (Balm et al., 2018).

However, policies mentioning the future use of this vehicle or policies that promote the use of these concepts are presented without infrastructural measures. Possible challenges could be on the designated place on the road, general safety measures, (un)loading places and, the charging infrastructure.



Figure 1: Example of a SEDV (Emerce.nl, 2021)

### 1.1 Societal and academic relevance

Different pilots are being conducted and already multiple companies make use of or are going to make use of different types of SEDVs to cover the last mile of the logistical process. One example is the company of Picnic, which operates with already more than 1000 vehicles in 120 cities (Picnic, 2021). Additionally, PostNL started a pilot with SEDV in the centre of Groningen and is planning to expand its fleet with 5 more SEDVs (L. Aandewiel, personal communication, December 3, 2021). This rapidly increased use of SEDVs might be the reason news sites write about their safety. The news site AD writes: *“Delivery vehicle of Picnic falls on its side (and that’s not the first time)”* (AD, 2019). Furthermore, it is argued that it could be the case that the current infrastructure is not suitable for the increased use of electrical vehicles (Noordhollands Dagblad, 2021). The usage of SEDVs is still in its infancy but it is rapidly growing, and this use faces many challenges. Hence, there is more research needed regarding the requirements and opportunities of urban infrastructure.

According to the article from Walraad. (2019) an electric vehicle is as heavy as a regular car but has less stability and does not have a front that is 'crashworthy'. Furthermore, they sometimes drive on the bike path and stop on sidewalks to deliver goods (Ploos van Amstel et al., 2018). This can all result in, for example, unsafe situations, accidents, decrease in liveability and, possible problems on the charging network.

An overview of the use of SEDVs on the infrastructure of historical cities is missing in academic literature. Moreover, most studies don't focus on this specific type of vehicle or kind of area. To make sure municipalities can use this mode of transport to cover the last mile, it is relevant to conduct an in-depth study of the possible enabling and hampering factors on the use of SEDVs in historical city centres.

### *1.2 Research aim*

This research aims to explore the kind of infrastructural challenges and opportunities which arise when the SEDVs are used in historical city centres in the Netherlands. The historical city centres of Groningen, Zwolle, Leeuwarden, and Leiden will be examined to take lessons from. These lessons can help to implement different or adapted strategies in these, or other cities regarding the infrastructure and the use of SEDVs. To answer this, the main research question is formulated:

### **How does the urban infrastructure of historical city centres in the Netherlands enable and hamper last-mile delivery by small electric distribution vehicles?**

To support this central research question, several sub-questions are formulated:

- What are main trends in Sulp plans and what is the envisioned contribution of SEDVs?
- What are typical characteristics of transportation infrastructure in historical city centres in the Netherlands and how do they affect urban traffic?
- What can be learnt from views of policymakers and courier companies in the Netherlands towards the use of SEDV regarding infrastructural barriers and opportunities?
- What are experiences of driving a SEDV in historical city centres in the Netherlands regarding infrastructural barriers and opportunities?
- Which differences and similarities can be determined between the historical city centres of the Netherlands and what lessons can be learned for the integration of infrastructure and logistics policies?

### *1.3 Reading guide*

This thesis started with an introduction to the SEDV, background information, and the statement of the research problem connected to the research questions. Chapter two, the theoretical framework, can be seen as the basis of this research. Concepts and theories connected to the SEDV will be discussed, and the assessment framework will be presented in this section. Chapter three is about the different research methods which are used to answer the main research question and the connected sub-questions. Subsequently, chapter four discusses the research results connected to the assessment framework presented in chapter two. The final chapter contains the main conclusion and discusses the assessment framework, results, and presents lessons for practice and future research. At the end of the report references and appendices can be found.



## 2. Theoretical framework

In this section, the central concepts of this study will be defined, discussed, and linked. Doing so, two sub-questions will be answered: *“What are main trends in Sulp plans and what is the envisioned contribution of SEDVs?”* and the second research question: *“What are typical characteristics of transportation infrastructure in historical city centres in the Netherlands and how do they affect urban traffic?”*

### 2.1 Main trends in Sulp plans

Many policymakers around the world are focusing on the liveability of their growing cities, where city logistics play a great role (ALICE/ERTRAC, 2015). Downsides for the urban environment such as congestion and environmental issues are connected to this (Behrends et al., 2019). Sustainable urban logistic policies (Sulp) can help reduce the downsides mentioned before (Björger et al., 2019). To do so, accessibility should be ensured, air pollution should be reduced, efficiency in terms of energy and costs should be improved, and the quality of the urban environment should be enhanced (Behrends et al., 2019). Main trends presented to tackle these specific problems include according to Aifandopoulou & Xenou (2019):

- improve the effectiveness of city logistics;
- develop a long-term vision and a clear implementation plan;
- develop transport modes in an integrated manner;
- cross-institutional cooperation;
- involvement of all actors;
- monitoring;
- assuring quality.

SEDVs are part of trend number two as they are an innovative city logistics solution part of the implementation plan.

### 2.2 Last-mile delivery (LMD)

As explained, SEDVs have a great potential to be used for Last-mile Delivery (LMD). Boysen (2020) defines LMD as *“all logistics activities related to the delivery of shipments to private customer households in urban areas”*. To add, Brown & Guiffrida (2014), state that LMD *“involves the final leg of delivering to end customers in the supply chain”*. Finally, Lin et al. (2020) define the concept of LMD as: *“the final stage, i.e., delivering the parcels (goods) to the doorstep of the customer”*. Noticeable is that there is a difference when it comes to the location of this last mile. Boysen (2020) mentions *“urban areas”* but Lin et al., (2020) and Brown & Guiffrida (2014) mention something similar. To add, only Boysen (2020) uses the term *“private customers”*. This research focuses on all logistic movements of SEDVs inside of the historical city centres in the Netherlands, not considering what kind of customers. Therefore, a combination of Boysen (2020), Brown & Guiffrida (2014), and Lin et al., (2020) is most relevant to be used as guidance for the concept of LMD. Thus, LMD in this research is referred to as: *“All logistic activities related to the delivery of parcels in the final leg in the supply chain”*.

### 2.3 Small electric distribution vehicle

Current literature shows some ambiguity regarding the definition of electric freight vehicles (Ploos van Amstel et al., 2018; Ministerie van I&W, 2021). This research focuses on the vehicles used by for example Picnic and PostNL. They can be found under the umbrella term of the Light Electronic Freight Vehicles (LEFV), which consists of the cargo bike, the electric cargo moped, and the small electric distribution vehicle (Ploos van Amstel et al., 2018). Legislation in the Netherlands does not mention freight vehicles in their Light Electronic Vehicle policy document (Ministerie van I&W, 2020). Additionally, the new "LEV Kader" does not mention these vehicles either (Ministerie van I&W, 2021).

To make a fair comparison between different companies and their vehicles, a customized concept of a SEDV was made (Picnic, 2021; Aandewiel, 2021; RDW, 2021): 'a small electric distribution vehicle (SEDV) is a minivan with a payload up to 980 kg, a maximum weight of 2100 kg and a maximum technical speed of 50 km/h, suitable for last-mile delivery. It is less manoeuvrable than both the cargo bike and moped, but in comparison with a van, better suited for use in crowded areas and easier to park and manoeuvre'. This was realised with the help of number plates and corresponding data, visualised in table 1 and derived from Ploos van Amstel et al. (2018).

Car manufacturer	Companies	Type of car	Max weight (kg)	Payload (kg)	Length (m)	Width (m)	Max speed (km/h)
Blitterswijk ECO Mobiliteit / Goupil	Picnic	Goupil G4	2100	930~980	4,11	1,37	50
CARGOLEV	Post NL	Closed Cargo	1800	686	3,95	1,34	35

Table 1: Overview of different companies using different types of SEDVs (RDW, 2021)

Goupil G4



Figure 2: Example of a Goupil G4 from Picnic in Zwolle (Author, 2021).

Closed Cargo



Figure 3: Example of a Closed Cargo from PostNL in Groningen (Author, 2022).

## 2.4 Infrastructural characterisation of a historical city centre

In the Middle Ages, the first urban settlements could be found in Western Europe which were not formed using specific urban plans. Mainly natural factors lead to the formation of these cities which could be described as ‘spontaneous or organic’ (Meyer et al., 2020). Moreover, city walls were built around lots of cities and cities were only able to grow inside these walls, which resulted in small characteristic roads and high-density building (Kostof et al., 1992; Morris, 1979). As these cities were formed in times when the car did not exist yet, elements of the infrastructure have nothing to do with the use of the car. Moreover, canals were mainly used for transport instead of roads (Meyer et al., 2020).

Therefore, historical city centres consist of several different road types with many different functions. This part aims to make characterisations on the infrastructure of historical city centres. This characterization is derived from the “*stedelijke verkeersniveaus*” as described in “*Verkeer in de stad*” (ANWB, 2020). This is a classification based on four different speed regimes (10, 20, 30, and 50 km/h) connected to different vehicle “*families*”. The SEDV, as vehicle family D “*auto-achtigen*” by its mass, is not allowed within the pedestrian areas. However, several cities have window times in which these vehicles are allowed to deliver parcels (Regterschot, 2010). Table 3 visualizes the different types. For every different type, the author made a list of possible other different road types based on real-life experiences and visiting the cities in real life, to connect potential enabling and hampering factors for the use of the SEDV to specific road characteristics in city centres.





A	B	C	D
			
St. Jans Brug, Leiden	Brugstraat, Groningen	Nieuwstraat, Zwolle	Oosterkade, Leeuwarden
Pedestrian area, focus on residing	Slow traffic, can be combined with residing	Mixed urban zones	Dominant traffic function
<ul style="list-style-type: none"> <li>▪ Main shopping streets</li> <li>▪ Streets with terraces</li> <li>▪ Squares/parks</li> <li>▪ Often one shared space</li> <li>▪ Bridges</li> </ul>	<ul style="list-style-type: none"> <li>▪ Canal streets</li> <li>▪ Streets with terraces</li> <li>▪ Often one shared space</li> <li>▪ Roads with bike lanes</li> <li>▪ Bridges</li> </ul>	<ul style="list-style-type: none"> <li>▪ Narrow streets</li> <li>▪ Canal streets</li> <li>▪ Streets with terraces</li> <li>▪ Residential streets</li> <li>▪ Mixed road</li> <li>▪ One-way streets</li> <li>▪ Bridges</li> </ul>	<ul style="list-style-type: none"> <li>▪ Canal streets</li> <li>▪ Main routes/bus routes</li> <li>▪ Sorted road (separated bike lanes)</li> <li>▪ Mixed road</li> <li>▪ Bridges</li> </ul>

Table 1: “*Stedelijke verkeersniveaus*” as described by “*Verkeer in de stad*” (ANWB, 2020; Google Maps, 2021; Author, 2021).

## 2.5 Urban design principles

ANWB (2020) developed “*Verkeer in de stad*” with principles connected to urban infrastructure design and road safety. ANWB (2020) states that a shift can be seen in the use of compact delivery vehicles and cargo bikes instead of trucks which makes it highly suitable to use as a guideline for this research. Main principles found are:

- traffic safety
- liveability
- accessibility
- road design

According to Archer & Vogel (2000), traffic safety is connected to the “unacceptable numbers of road accidents involving fatality and injury” resulting from the increased number of vehicles on our roads. Moreover, in the Netherlands, a safe traffic system ensures that crashes are prevented as much as possible, and severe injury chances are reduced to almost zero (Weijermans & Wegman, 2011). In terms of ensuring this safety, which is of great concern, the mass of vehicles and speed differences between different types of vehicles should be limited (ANWB, 2020). This is supported by Shaffer et al. (2021) who state that electric vehicles should be made lighter to maximize safety benefits. Moreover, next to trucks, delivery vans are 2 to 3 times more involved in accidents in the city centre compared to regular cars (Ploos van Amstel, 2017). Regarding speed differences, Dijkstra & Petegem (2019) state that cyclists and pedestrians should never be in situations where other vehicles drive faster than 30 km/h.

A liveable city is a city that respects, on the one hand the needs and wants of the population and, on the other hand, the physical and biological characteristics of the city (Ruth & Franklin, 2014). To add, liveability is about achieving a satisfying level of quality of life through several opportunities (Appleyard et al., 2014). According to the report of ANWB (2020) mobility, in this case, delivery by SEDVs, should not result in a decrease of liveability by the nuisance of (too many) vehicles. On the city level, window times can be deployed to regulate overloaded centres and tackle logistical issues (Groothedde et al., 2003). Conversely, when window times are too narrow, they can result in even more traffic and thus influence the liveability of a city (Regterschot, 2010). One positive aspect to mention is that SEDVs are silent and can help prevent noise nuisance (Beella et al., 2009).

When SEDVs will be used for city logistics, several accessibility factors should be considered. To start, accessibility is about how easily activities can be reached from a specific location using certain transport (Morris et al., 1979). Overall, accessibility is influenced by road networks and the accessibility of parking places (ANWB, 2020). Furthermore, it often is a complicated case to designate parking places in shopping areas as the physical infrastructure is designed for pedestrians (Regterschot, 2010). Logistic suppliers are also confronted with restrictions regarding the designated route to drive in the city centre (Groothedde et al., 2003). Accessibility can not only be found in road networks or parking places since charging facilities play an important role as well. Questions arise whether the capacity of the network can cope with future charging needs (Tol & Otten., 2019). To add, knowledge on the effect of the GDZES on the current charging network is lacking (NAL, 2019).

Overall, coherent road design determines how the above aspects are implemented and balanced. Without proper road design traffic safety, accessibility and, liveability can be

influenced negatively (Cantarelle et al., 2006). Moreover, this road design should categorize its network and thus, separate specific vehicles to ensure safety (Weijermans & Wegman, 2011). This is supported in the report of ANWB (2020) as different vehicle types should be separated by different roads based on speed and vehicle family. However, often this will not fit in most urban areas (ANWB, 2020).

Table 4 shows the main aspects per principle and connected literature, figure 4 summarizes this chapter in a specific assessment framework for this research.

General principles for deployment of SEDVs	Main aspects for SEDVs in historical city centres in the Netherlands	From
Traffic safety	<ul style="list-style-type: none"> <li>- Speed differences</li> <li>- Mass</li> </ul>	(Archer & Vogel, 2000), (SWOV, 2019), (Ploos van Amstel, 2017), (Shaffer et al., 2021), (RDW, 2021) (ANWB, 2020), (Dijkstra & Petegem, 2019)
Liveability	<ul style="list-style-type: none"> <li>- Nuisance</li> <li>- Window times</li> </ul>	(Ruth & Franklin, 2014), (Appleyard et al., 2014), (Beella et al., 2009), (ANWB, 2020), (Groothedde et al., 2003), (Rechterschot, 2010).
Accessibility	<ul style="list-style-type: none"> <li>- Place of (un)loading/ parking</li> <li>- Charging infrastructure</li> </ul>	(Morris et al., 1979), (NAL, 2019), (Regterschot, 2010), (Tol & Otten., 2019) (Groothedde et al., 2003), (ANWB, 2020).
Road design	<ul style="list-style-type: none"> <li>- Speed of road users</li> <li>- Separation of functions</li> </ul>	(Cantarelle et al., 2006), (Weijermans & Wegman, 2011), (ANWB, 2020)

Table 2: General principles from “Verkeer in de stad” (ANWB, 2020).

## 2.6 Assessment framework

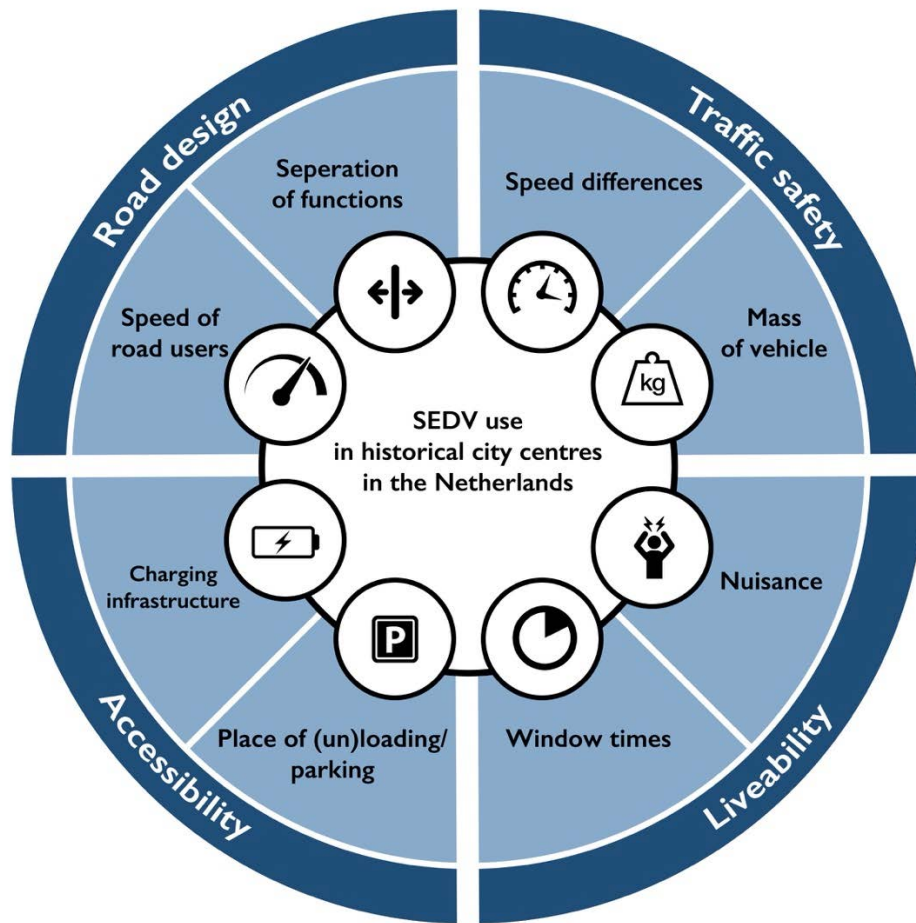


Figure 4: Assessment framework (Author, 2022)

The assessment framework model, as visualised in figure 4, shows the main principles of this thesis with their connected factors based on chapter 2.5. The framework will help to assess the deployment of the SEDV in practice based on these principles and connected aspects.

## 2.7 Expectations

This research aims to identify how urban infrastructure in historical city centres in the Netherlands enables and hampers LMD using small electric distribution vehicles. The expectations were that current road infrastructure generally enables last-mile delivery by SEDVs as the SEDV is smaller than a van or a truck so infrastructure should not be adapted to the use of the SEDV. Additionally, the expectation was that hampering factors could arise with specific characteristics which are hard to change as small roads and the designation of parking places in a busy city centre.

### 3. Methodology

#### 3.1 Research approach

To answer the central question of this research, a qualitative research approach was chosen. A qualitative analysis helps to understand the complexity and richness of human experience and processes (Delyser, 2010). The main research question and sub-questions were answered via document research, a literature review, semi-structured interviews, and drive-along participative observation. These multiple methods allowed the author research in an explorative, qualitative, and comparative way which, according to Clifford et al. (2016), help the researcher to strengthen the validity of research outcomes. This validity was strengthened as the author gained insight into all the relevant dimensions of the deployment of the SEDV in historical city centres in the Netherlands, such as the vision of the municipality and the experience of driving along.

#### 3.2 Research areas

The central question of this research states *“historical city centres in the Netherlands”*. Therefore, it is crucial to set boundaries to this and explain what is meant by the historical city centres of Leiden, Leeuwarden, Zwolle, and Groningen. On the one hand, all cities use a tailor-made strategy and have differences between their ambitions and on the other hand, all cities have the same infrastructural characteristics of such as narrow streets and challenging form. Therefore, it will be of high value to take lessons from the use of SEDVs. As most activity takes place inside the system of the canals, the historical city centres are bound to the physical separation of these canals. Figures 5, 6, 7, and 8 below, show the four main study areas of this research.

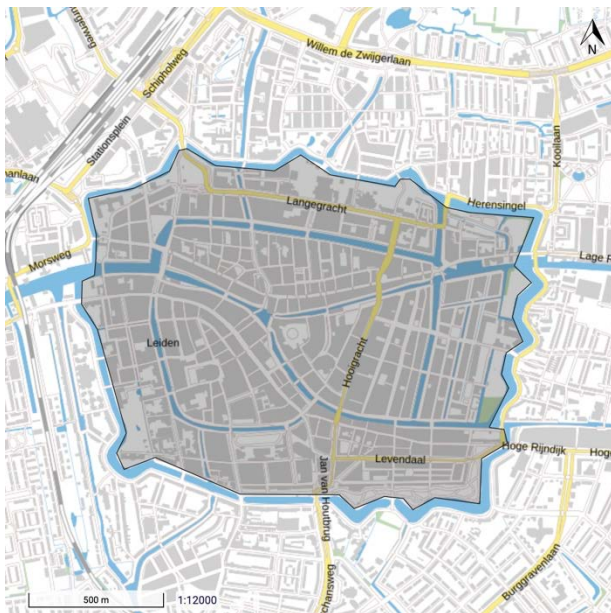


Figure 13: The historical city centre of Leiden (PDOK Viewer, 2021); (Author, 2021).

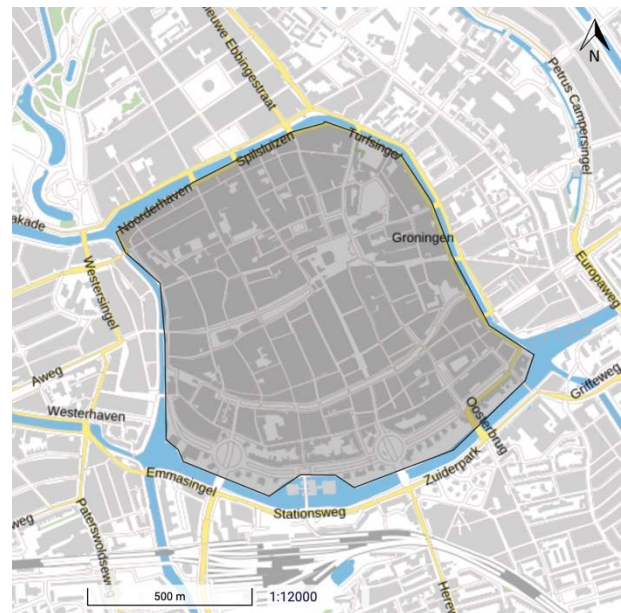


Figure 25: The historical city centre of Groningen (PDOK Viewer, 2021); (Author, 2021).

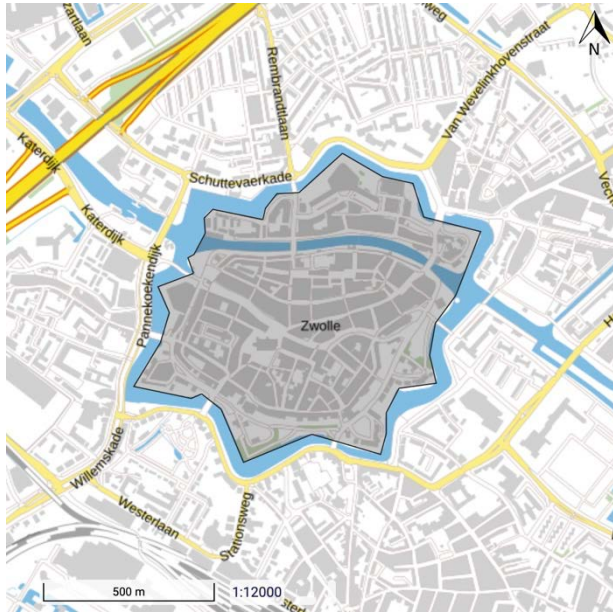


Figure 7: The historical city centre of Zwolle (PDOK Viewer, 2021); (Author, 2021).

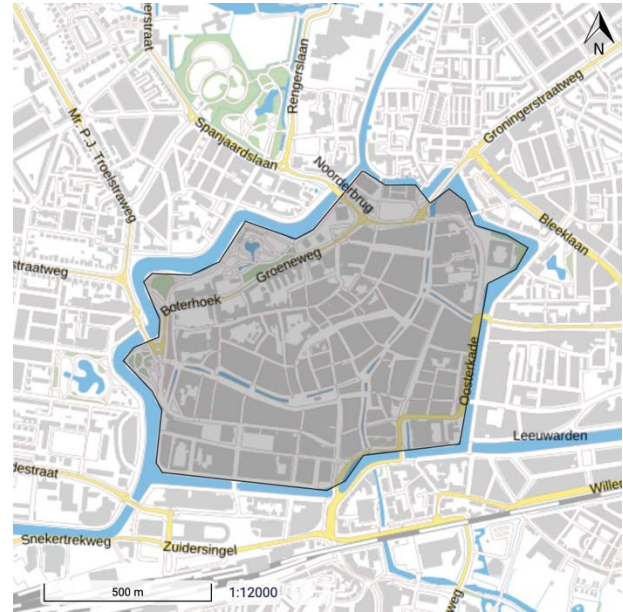


Figure 8: The historical city centre of Leeuwarden (PDOK Viewer, 2021); (Author, 2021).

### 3.3 Data collection

In the following section, there will be an explanation of the used method per sub-question.

#### 1. What are main trends in SULP plans and what is the envisioned contribution of SEDVs?

This research question was answered via literature research on the one hand and document research on the other hand. One part on main trends in SULP plans was already answered with the help of literature research and can be found in chapter 2.4. Next to the “Topic Guide” by Aifandopoulou & Xenou (2019), which was used as guidance, relevant articles were found via search engine ‘SmartCat’ with the help of keywords such as: ‘sustainable urban logistic policies’, ‘sustainable urban logistic planning’ and ‘urban logistics’.

Regarding the empirical part of this research question, a document review was conducted based on policy documents and is visualised in table 3. This document review provides background and context to other data sources (Bowen, 2009).

Title document	Author	Date of publication
<i>Convenant Stedelijke Distributie 071</i>	Municipality of Leiden	November 2021
<i>Ruimte voor zero-emissie stadslogistiek</i>	Municipality of Groningen	April 2021
<i>Zero-Emissie stadslogistiek</i>	Municipality of Zwolle	November 2020
<i>Mobiliteit 2019-2050</i>	Municipality of Leeuwarden	Maart 2020

Table 3: Overview of policy documents on SULP plans

#### 2. What are typical characteristics of transportation infrastructure in Dutch historical city centres and how do they affect urban traffic?

For this question, which was answered in chapter 2.5, literature research was conducted to find typical characteristics of Dutch historical cities and the possible effects of these on urban traffic. Relevant articles were searched for via ‘SmartCat’ with keywords such as ‘urban design history’, ‘city logistics’, ‘infrastructural factors’, ‘traffic safety’, ‘urban liveability’, ‘accessibility’, and ‘road design’ to filter the literature. To add, several non-reviewed Dutch research reports and policy advice reports were used as well such as ANWB (2020) and Regterschot (2010).



### 3. What can be learnt from views of policymakers and courier companies in the Netherlands towards the use of SEDV regarding infrastructural barriers and opportunities?

To answer this sub-question, semi-structured interviews were held with policymakers from municipalities, employees of delivery companies and one safety expert. Semi-structured interviews are useful to investigate complex opinions and experiences (Clifford et al., 2016). Interviews gained insight into the view and experience of both policymakers and courier companies towards barriers and opportunities regarding the infrastructure of historical city centres. The gained knowledge from the interview with the safety expert was used to compare to views of policymakers. The criteria for the safety expert were: knowledge of mobility and that the expert operated independently from organizations. Two interviews were used: interview 1 for policymakers (appendix B) and interview 2 for courier companies (appendix C).

In table 2 an overview on the interviewees from all organizations can be found.

Name interviewee in thesis	Organization	Main function	Interview date	Online or real life	Duration
Policymaker1	Municipality of Leiden	<i>Opgavemanager duurzame mobiliteit</i>	2021-11-17	Online, Google Teams	45 min
Policymaker2	Municipality of Groningen	<i>Senior Beleidsmedewerker Stadsontwikkeling</i>	2021-11-25	Online, Google Teams	45 min
Policymaker3	Municipality of Zwolle	<i>Adviseur mobiliteit</i>	2021-12-14	Online, Google Teams	45 min
Policymaker4	Municipality of Leeuwarden	<i>Adviseur mobiliteit &amp; ruimte</i>	2021-12-10	Online, Google Teams	45 min
Courier1	Walraad Verkeersadvisering BV	<i>Consultant verkeersveiligheid</i>	2021-12-17	Phone call	30 min
Courier2	Picnic	<i>Data analyst vehicle fleet</i>	2021-11-30	Online, Google Teams	45 min
Expert1	PostNL	<i>Project manager afdeling duurzaamheid</i>	2021-12-03	Online, Google Teams	45 min

Table 4: Overview of interviewees for interview 1

In terms of recruitment of policymakers, websites of the municipalities were visited, and standardised emails were sent to spokesmen or directly to employees who are concerned with mobility or city logistics. The interviewees of interview 2 were recruited via LinkedIn by sending them or colleagues a direct message.

### 4. What are experiences of driving a SEDV in historical city centres in the Netherlands regarding infrastructural barriers and opportunities?

With aim of understanding the enabling and hampering infrastructural features of historical centres for SEDVs, this study also mapped the experiences of drivers by driving along in the SEDV in all four different cities. This participative observation is used since it may help to create a better understanding of the context and can help to increase validity (Kawulich, 2005). To take notes in a strategically, an observation form will be used (see appendix E) where several situations can be explained based on the assessment framework (figure 4). To add, when

specific situations were noteworthy, elaborating questions were asked. A GPS application named ‘GPS Tracker’ was used to track the driven route. Drivers were recruited via the companies. An overview of the different cities, companies, and dates is visible in table 6.

City	Driver	Company	Date	Time
Leiden	D1	Picnic	2021-12-13	14:40-16:30
Groningen	D2	PostNL	2022-01-12	11:00-11:40
Groningen	D3	PostNL	2022-01-12	11:45-12:30
Zwolle	D4	Picnic	2021-12-10	14:30-15:30
Leeuwarden	D5	Picnic	2021-12-04	19:04-21:00

Table 5: Information about location and date for participative observation

5. Which differences and similarities can be determined between the historical city centres of the Netherlands and what lessons can be learned for the integration of infrastructure and logistics policies?

By using different insights on policies, views from companies, views from municipalities, and real driving experiences this question is answered. This was done with the help of table 9 and appendix B which visualised differences and similarities.

### 3.4 Data analysis

#### 3.3.1 Analysis of document review

The analysis of the policy documents in table 7 was conducted via an analysis table visible in appendix D. Documents were first skimmed, later thoroughly examined, and then interpreted (Bowen, 2009). In terms of thoroughly examining the documents, two main questions were kept in mind:

1. What steps do municipalities want to take to make city logistics more sustainable?
2. What will be the role of SEDVs in this according to the municipalities?

Important quotations were connected to the main message translated by the author. This information was categorized into themes, based on the assessment framework, to help recognize different patterns as visible in table 7 (Bowen, 2009). Later relevant themes, not connected to the assessment framework, were added.

Principle's assessment framework	Themes
Traffic safety	Car-free
Liveability	Window times, ANPR camera's, Exemption, nuisance
Accessibility	(Un)loading places, charging infrastructure
Road design	Car-free
(Added themes)	Hub, city growth, sustainable concepts, LEV

Table 6: Themes connected to information out of the policy documents

### 3.3.2 Analysis of semi-structured interviews

The interviews were all recorded with Apple's "Dictafon" application. The mp3. file was later saved in a secured Dropbox map. The recordings were transcribed in Word and analyzed using the software Atlas.ti. Both inductive and deductive coding was used to analyze the interviews (Fereday & Muir Cochrane, 2006). First, deductive coding was used to focus on the important principles from the assessment framework in figure 4. Consequently, inductive coding was used which helped to capture the diversity and complexity of the data. This order ensured structure from the beginning of the analysis and still enabled a more inductive approach in a later stadium (Linneberg & Korsgaard, 2019). An overview of the used deductive codes can be found in table 7 and the inductive codes in appendices F and H.

Theme	Code
Traffic safety	Speed difference
	Mass
Liveability	Nuisance
	Window times
Accesibility	Place of (un)loading/ parking
	Charging infrastructure
Road design	Speed of road users
	Separation of functions

Table 7: Deductive code scheme

### 3.3.3 Analysis of participative observation

The participative observation was documented in two ways. First, specific situations were written down, and second, the route was tracked via a GPS application called "GPS Tracker". Situations were organized via the use of the same deductive codes as used for analyzing the interview (table 7), in this case, the pillars for the observation, and all digitalized in Word. The GPS data was exported to a KML. file and was imported into QGIS. Important locations were highlighted on the exported maps based on situations from the participative observation form. This was done using Google Maps and Adobe Photoshop.

### 3.3.4 Research ethics

This research considered specific factors regarding privacy. To start, interviewees were always informed about their rights prior to the interview. Interviewees were informed that the interview was voluntary with the option to stop at any time, without providing the author with a reason. Secondly, it was communicated that the names of the interviewees were anonymized and only the supervisor could have insight into the names. All interviewees agreed on these rights. The interview data was safely stored in a secured Dropbox map for two years in case of complaints. In advance of the participative observation, the same rights were communicated and agreed on by the drivers.

## 4. Results

### 4.1 Main trends in local Sulp plans and the contribution of SEDV

This section presents results regarding the empirical part of sub-question 1: “What are main trends in Sulp plans and what is the envisioned contribution of SEDVs?”

Three of the four municipalities have a specific policy on sustainable city logistics. Leeuwarden does not have such a specific policy document, as it focuses more on future mobility where sustainable city logistics is part of. To add, all municipalities have the ambition to implement a zero-emission zone just as the GDZES focuses on.

Lots of new plans, revised old plans, and ambitions are described to make city logistics more sustainable. The two most mentioned plans were the use of window times and the (combined) use of certain exemptions. For example, Zwolle, Leiden, and Groningen want to give certain vehicles exemptions for specific window times. Furthermore, the municipalities of Leiden and Leeuwarden seem to be aware of the possible problems which can arise in the charging infrastructure which is confirmed by Tol & Otten (2019). As zero-emission zones will be designated, most municipalities are going to use ANPR cameras to enforce these. Overall, there are lots of policy efforts to reduce the impact of logistics on the city its liveability.

The SEDVs contribution in Sulp plans is connected to specific exemptions to deliver in city centres. Groningen and Leiden are frontrunners in the way they mention the specific contribution of the SEDVs in their Sulp plans, as both municipalities mention the use of SEDVs connected to specific exemptions deliver in the city centre. In contrast to this, Leeuwarden and Zwolle only mention electric vehicles and/or certain sustainable concepts which they want to stimulate to deliver in the city centre. This shows an indirect contribution of the SEDV in these Sulp plans as the SEDV could be found under these vehicles and concepts. An overview of the main trends can be found in table 9.

City	Leiden	Groningen	Zwolle	Leeuwarden
Specific policy on sustainable city logistics	✓	✓	✓	X
Implementation date zero-emission zone	2025	2025	2025	2030
Trends	<ul style="list-style-type: none"> <li>- Promote sustainable concepts</li> <li>- Car-free city</li> <li>- Enforcement by ANPR cameras</li> <li>- Exemptions</li> <li>- Research on charging infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>- Window times</li> <li>- Exemptions</li> <li>- Enforcement by ANPR cameras</li> <li>- Research on (un)loading places</li> </ul>	<ul style="list-style-type: none"> <li>- Promote sustainable concepts</li> <li>- Monitoring by ANPR cameras</li> <li>- Exemptions</li> <li>- Window times</li> </ul>	<ul style="list-style-type: none"> <li>- Promote sustainable concepts</li> <li>- Research on charging infrastructure</li> <li>- Use of mobility hub</li> </ul>
SEDV concreteness	- Exemptions for SEDVs	- Exemptions for SEDVs		

Table 8: Overview of existence of local Sulp plans, implementation date of the zero-emission zones, main trends and the SEDV concreteness.

## 4.2 Views of policymakers and courier companies on the use of the SEDV

This section presents the results connected to sub-question 3: *“What can be learnt from views of policymakers and courier companies in the Netherlands towards the use of SEDV regarding infrastructural barriers and opportunities?”*

Traffic safety is of great concern to all interviewees especially when it comes to the speed of the vehicle. Policymaker2, policymaker3, and policymaker4 mention the speed of the SEDV as a great concern or disadvantage. Policymaker4 talks about the concerns of the speed limits in the city since delivery drivers often ignore those. This has something to do with the behaviour of the delivery driver, as confirmed by courier1 who is only familiar with one unsafe event which resulted out behaviour. Overall, no policymakers have experience with unsafe events or accidents with SEDVs. In contrast with courier2, who talks about small accidents where cyclists were sometimes cut off. The “infrastructure which asks for driving fast” is a possible reason for this according to courier2. This could be supported by the theory of Dijkstra & Petegem (2019), who states that cyclists should never mix with vehicles that drive faster than 30 km/h.

According to the interviewees, the mass of SEDVs does not play a direct role in terms of traffic safety. No respondents have mentioned this regarding potential unsafe situations. This is in contrast with research from Shaffer et al. (2021), who states that the mass of electric vehicles should be decreased for safety benefits. One important remark from policymaker4 was about the fact that the vehicle is silent which could lead to unsafe situations. According to courier2 the company he works for already equipped some vehicles with speakers who emit a constant noise.

The liveability of the city centre is a serious issue for all respondents from the municipalities and the SEDV is welcome to contribute to this liveability. Only indirect measures on the infrastructure are taken as the implementation of window times. These window times are in line with research from Groothedde et al. (2003), who state that window times can regulate overloaded city centres. Moreover, these indirect measures continue as policymaker1 states that they want to debate with the inhabitants whether the SEDV can be used in their city.

Charging facilities should be placed outside the city centre and problems will arise in terms of capacity on the network. policymaker2, policymaker3, and policymaker4 prefer charging connections to be placed outside the city centre. To add, it is made clear by policymaker1 and policymaker2 that certain problems could arise in terms of charging capacity. Moreover, according to policymaker4, it is challenging to get new connections to the charging network. This is supported by research from Tol & Otten. (2019), who found that future charging capacity could be limited.

The designation of (un)loading places is still under investigation since it is unclear whether specific places should be designated for the SEDV. Policymaker2 explained that their municipality has limited unloading places and delivery vehicles are free to stop at any place. Conversely, policymaker1 questions if the (un)loading should take place in front of someone’s door.

Respondents from the municipalities do not consider specific infrastructural changes before the implementation of SEDVs in terms of road design. Indirectly, certain measures are taken for a car-free city centre according to policymaker1 and policymaker2. The separation of different traffic flows is one key safety aspect described by ANWB (2020). This is not in line with policymaker2, who wants every road user at the same level, policymaker3 who wants to permit the SEDV to enter the shopping areas, and policymaker1 who prefers to mix traffic as much as possible. Policymaker2, policymaker3, and policymaker4 talk about their preference to reduce the speed of the SEDV, as 30 km/h is sometimes still too fast. This is supported by expert1 who highlights the fact that speed is not of great importance for the courier company in the city centre: *“Je hoeft niet zo hard het is in de stad meer dan genoeg. Beter een tikkeltje te veilig dan”*. Furthermore, expert1 confirms this by saying that walking pace is the best option in the denser part of the city centre. Surprisingly, courier2 explained the decision to sometimes not deliver in a certain area when it is too complicated to deliver because of exemptions and hampering infrastructural factors, such as high bridges or streets with a small turning radius.

### 4.3 Experiences of driving a SEDV in historical city centres

This section presents the results connected to sub-question 4: *“What are experiences of driving a SEDV in historical city centres in the Netherlands regarding infrastructural barriers and opportunities?”*

The author drove along with 5 specific routes with 4 to 16 stops inside all city centres. In Leeuwarden a different vehicle (Goupil G6) was used and in Groningen 2 different routes were driven. Examples are connected to different road categories from table 1 and locations (L) visible in figures 9, 12, 14, and 17.

No unsafe events, connected to the speed and mass of the vehicle, were reported driving along with the drivers. D1 experienced a situation where two pedestrians could not hear the vehicle approaching (A). The silent operation of the vehicle is highlighted by D3 and D1, who state that this is the biggest safety issue. Additionally, D5 had to stop at a narrow street (B) and blocked the whole street (L5, figure 17) resulting in two cyclists who almost have collided. Furthermore, the G force alarm went off at two speedbumps. Elaborating questions showed that D1, D2 D3, D4, and D5 never experienced an accident or noteworthy unsafe event before. Overall, the silent operation, which is preferable in terms of liveability, seems the most unsafe factor in this case.

Liveability plays a small role in the use of the SEDV. D4 experienced some issues connected to the window times as we were not allowed to deliver at a certain address at that time of the day. Overall, no direct nuisance and effect on the liveability of a city were experienced driving along with a SEDV.

(Un)loading places were always found close to the delivery address and except high sidewalks, no hampering factors were experienced. (Un)loading happened on the sidewalk or street in front of the address and, sometimes at a parking place (visible in figures 10, 11, 13, 15, and 16). In figure 10 & 11 a canal street (B) is visible where cars are parked, pedestrians had to walk on the road to pass (L1). To add, figure 13 shows an example of (un)loading in a pedestrian area (L3) where enough space is left for other traffic to pass. Moreover, figures 15 & 16 show a parked vehicle on the road where enough space was left as well (L6). To add, D4 highlighted that she felt uncomfortable with parking the vehicle on the higher sidewalks. This was confirmed by D3.

Road design seems important in terms of speed differences with other traffic. D1 drove on a category D road and got overtaken by a faster car (L2). To add, D2 drove on the bus lane (L5) with a serious speed difference with a bus. This might ask for the separation of the SEDV with faster vehicles. Conversely, D2 and D3 drove in pedestrian areas (L3 & L4) where there was no separation and speed was reduced.

Pedestrians showed a positive attitude towards the use of the SEDV. D2 and D3 experienced people waving and giving compliments about the small size and the looks of the SEDV. These reactions seem to illustrate the success of the SEDV within city centres.

Experiences of driving along with a SEDV ask for possible changes on the current infrastructure and thus complement local Sulp plans, as only hampering factors of the mentioned window times were experienced. Traffic safety, in terms of speed, is of great concern for both policymakers and courier companies, but experiences show that only its silent operation can lead to unsafe events. To add, liveability is a factor that is not experienced negatively and thus confirms the views of policymakers and courier companies. Furthermore, (un)loading places were always found driving along with SEDVs which nuances views of both policymakers in their doubts of designating specific places. Finally, policymakers and courier companies do not consider specific changes on road infrastructure for the use of SEDVs. This contradicts the experience on main roads as speed differences between SEDVs and other vehicles were experienced. In summary, views of policymakers and courier companies towards the use of the SEDV are generally confirmed by the drive-along participative observation.

The expectations of this research were confirmed as current road infrastructure generally enables last-mile delivery by SEDVs. Additionally, the expectation on hampering factors that are difficult to change is disconfirmed by the high sidewalks which possibly could be adapted to the use of the SEDV.

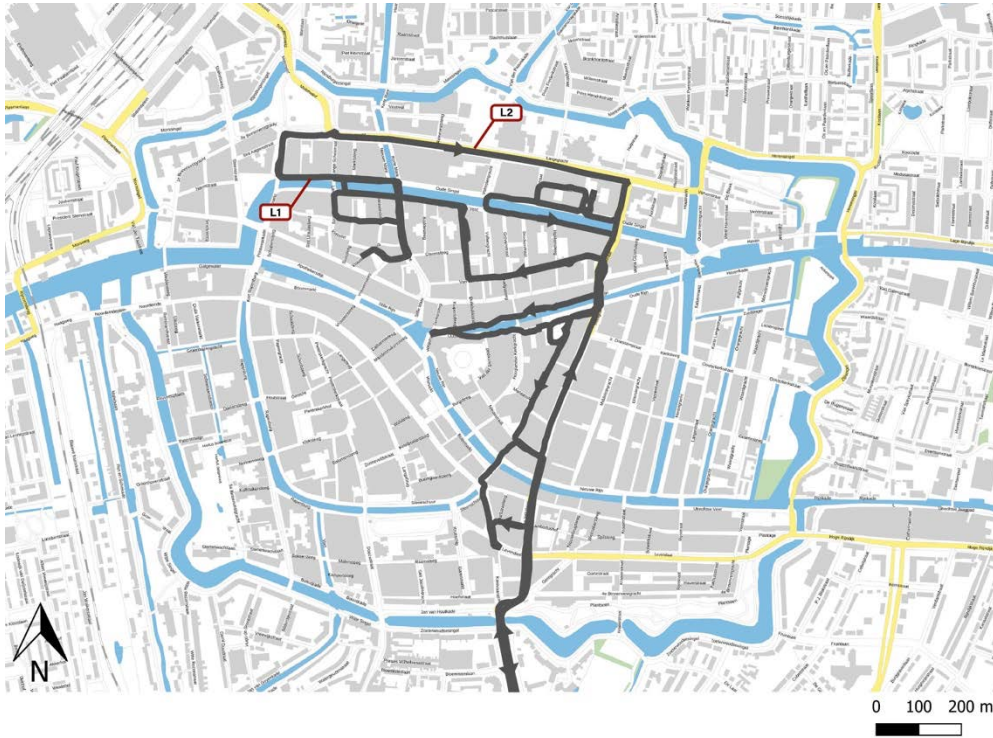


Figure 9: Map of Leiden with driven route (Author, 2022)



Figure 10: (Un)loading situation in Leiden (Author, 2021)



Figure 11: (Un)loading situation in Leiden (Author, 2021)

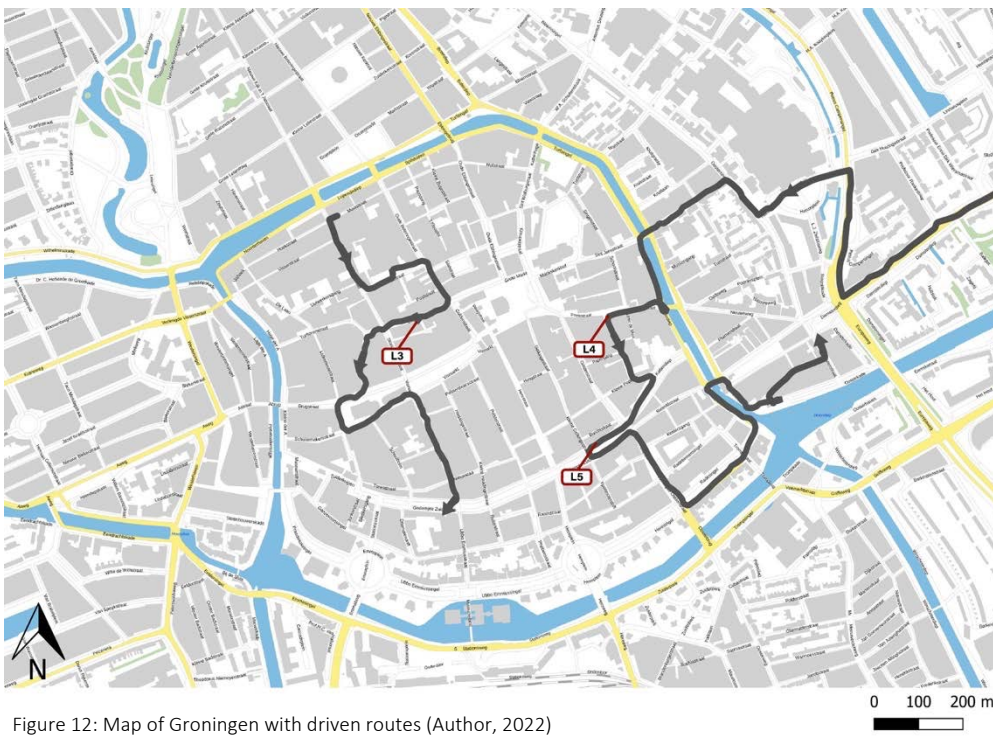


Figure 12: Map of Groningen with driven routes (Author, 2022)



Figure 13: (Un)loading situation in Groningen (Author, 2022)



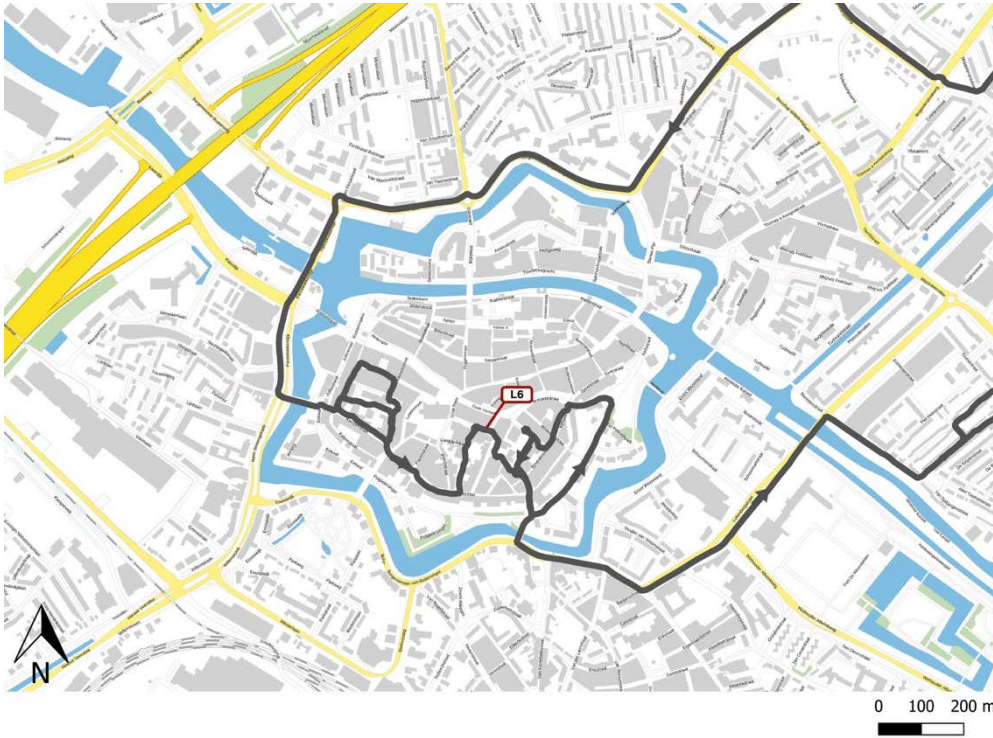


Figure 14: Map of Zwolle with driven route (Author, 2022)



Figure 15: (Un)loading place in Zwolle (Author, 2021)



Figure 16: (Un)loading place in Zwolle (Author, 2021)

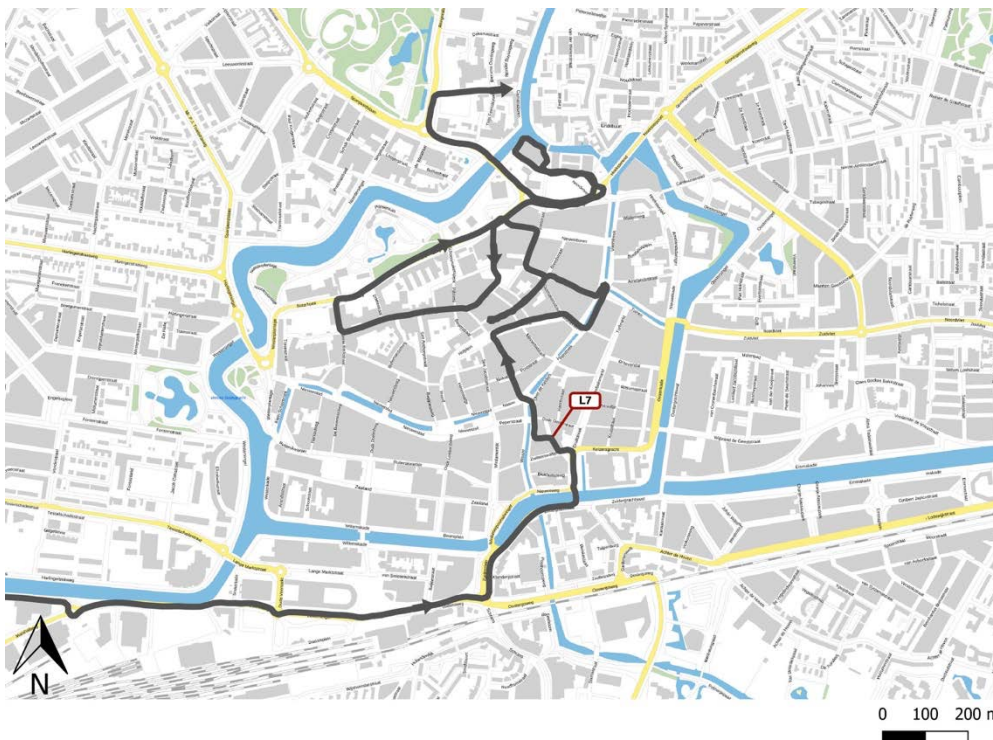


Figure 17: Map of Leeuwarden with driven route (Author, 2022)

## 5. Conclusion

### 5.1 Conclusion

This research identifies possible enabling and hampering factors of infrastructure in historical city centres in the Netherlands towards the use of the Small Electric Delivery Vehicles (SEDVs) for last-mile delivery. To identify these factors, qualitative research was conducted based on four main principles: traffic safety, liveability, accessibility, and road design.

Traffic safety is believed as something of great concern to policymakers and courier companies when the SEDV will be used in city centres, while this research shows that only a few factors influence traffic safety. These factors are not directly connected to infrastructure and are the silent operation of the vehicle and factors related to driving behaviour. These were both confirmed by courier companies and driving-along participative observation.

Liveability is generally respected when the SEDV is used in city centres and, municipalities welcome them. Window times are set to diminish nuisance and exemptions are made so SEDVs can almost always deliver close to the addresses. Reactions seem to illustrate the success of SEDV deployment in city centres as pedestrians waved and gave compliments.

Although, charging connections for SEDVs will be placed outside of city centres problems will arise on the current network due to low capacity. This is mentioned as a great problem in policy documents, by policymakers and courier companies and can hamper the future use of SEDVs. Concerning other accessibility factors, municipalities differ in view and research still needs to be performed to find the right spots. This research shows that (un)loading places do not have to be designated specifically as sidewalks, already existing parking places and roads offer plenty of possibilities.

Speed differences between the SEDV and other road users seem to result in unsafe and unpleasant situations. Experiences on driving on main roads and bus lanes with SEDV prove this. It seems logical that municipalities have not made plans regarding infrastructural changes as few factors as narrow streets, high sidewalks and speedbumps sometimes hamper the use of the SEDV. Moreover, municipalities are going to focus more on pedestrians and cyclists in their city centres with the help of specific infrastructural measures and lowering the maximum speed. This will result in fewer speed differences, and thus fewer unsafe events and improvements in terms of liveability. As municipalities plan to give exemptions to the SEDV, this will eventually enable delivery by SEDVs especially when factors such as high speedbumps and sidewalks are taken away.

This study shows that only a few factors hamper last-mile delivery by SEDVs, and most of them do not directly result out of the infrastructure in historical city centres. Moreover, pedestrians have a positive view towards the use of the SEDV. Overall, this research shows that the infrastructure of historical city centres generally enables last-mile delivery using SEDV, especially when the speed of a SEDV will be considered in design and regulations.

## *5.2 Reflections on assessment framework*

The assessment framework was suitable for this research as lots of factors were experienced and were highlighted by the interviewees. Conversely, some factors could have been added later as some parts of the framework focused on indirect infrastructural factors. Therefore, specific infrastructural factors on road design could have been added to add more value, like high sidewalks, speedbumps, and pedestrian areas.

## *5.3 Limitations*

This research has some limitations which should be mentioned. To start, the vehicle driven in Leeuwarden differed from the vehicles driven in the other cities (Goupil G6), which could have resulted in misleading situations regarding infrastructural measures. Additionally, it could be the case that unsafe events were not reported because of less crowded areas inside of the city centre due to the, during the research, closed essential stores. Lastly, some observations in Groningen could be distorted by the fact that the author was not able to drive along in the vehicle and examined it by following the vehicle on a bike.

## *5.4 Lessons for practice & future research*

In terms of lessons for practice, some suggestions could be made for policymakers and courier companies. To start, it appears that high sidewalks and speedbumps can hamper the use of the SEDV. Therefore, the policymakers can combine their infrastructural measures for the focus on pedestrians and cyclists with removing such characteristics to enhance the use of SEDV. Moreover, as the silent operation of SEDVs is of great concern, courier companies should equip their vehicles with additional noises.

As this research shows possible future problems on charging network capacity, more research is needed to investigate whether this will influence the deployment of electric vehicles such as the SEDV for city logistics. Moreover, as driving behaviour might play a role in certain measures, future research should take this into account as well.

## References

- Aandewiel, L. (2021). De nieuwe stadsvriendelijke voertuigen van PostNL rijden vanaf deze week in het centrum van Arnhem en Groningen! LinkedIn. Retrieved on December 26, 2021 from [https://www.linkedin.com/posts/aandewiel\\_zeroemissions-leefbaarheid-postnl-activity-6861608227000344576-hdOw](https://www.linkedin.com/posts/aandewiel_zeroemissions-leefbaarheid-postnl-activity-6861608227000344576-hdOw)
- AD. (2019). Bezorgwagentje Picnic valt om (en dat is niet voor het eerst). AD. Retrieved on October 4, 2021 from <https://www.ad.nl/rotterdam/bezorgwagentje-picnic-valt-om-en-dat-is-niet-voor-het-eerst~abb955ca/>
- Aifandopoulou, G & Xenou, E (2019). Sustainable Urban Logistic Planning. Topic Guide. European Commission. Retrieved on December 14, 2021 from [https://www.eltis.org/sites/default/files/sustainable\\_urban\\_logistics\\_planning\\_0.pdf](https://www.eltis.org/sites/default/files/sustainable_urban_logistics_planning_0.pdf)
- Albert Heijn (2021). Albert Heijn gaat boodschappen bezorgen met elektrische minibusjes. Albert Heijn. Retrieved on October 4, 2021 from <https://nieuws.ah.nl/albert-heijn-gaat-boodschappen-bezorgen-met-elektrische-minibusjes/>
- ALICE/ERTRAC (2015). Urban Freight research roadmap. Retrieved on December 12, 2021 from [https://www.ertrac.org/uploads/documentsearch/id36/ERTRAC\\_Alice\\_Urban\\_Freight.pdf](https://www.ertrac.org/uploads/documentsearch/id36/ERTRAC_Alice_Urban_Freight.pdf)
- ANWB (2020). Verkeer in de stad. Een nieuwe ontwerpaanpak voor verkeer in de openbare ruimte.
- Appleyard, B., Ferrell, C. E., Carroll, M. A., & Taecker, M. (2014). Toward Livability Ethics: A Framework to Guide Planning, Design, and Engineering Decisions. *Transportation Research Record*. 2403(1). 62–71.
- Archer, J., & Vogel, K. (2000). Traffic safety problems in urban areas.
- Autoriteit Consument & Markt (ACM) (2021). Post- en Pakkettenmonitor 2020. Retrieved on December 10, 2021 from <https://www.acm.nl/sites/default/files/documents/post-en-pakkettenmonitor-2020.pdf>
- Balm, S., Moolenburgh, E., Ploos van Amstel, W. & Anand, N. (2018). Chapter 15: The Potential of Light Electric Vehicles for Specific Freight Flows: Insights from the Netherlands.
- Balsas, C. (2004). Measuring the livability of an urban centre: An exploratory study of key performance indicators. *Planning. Practice & Research*. 101-110.
- Beella, S., Silvester, S., & Brezet, H. (2009). Electric vehicles are here to stay!. 8-10.
- Behrends, S., Lindholm, M., & Woxenius, J. (2008). The impact of urban freight transport: A definition of sustainability from an actor's perspective. *Transportation Planning and Technology*, 31(6), 693–713
- Björger, A., Seter, H., Kristensen, T., Pitera, K. (2019). The potential for coordinated logistics planning at the local level: A Norwegian in-depth study of public and private stakeholders. *Journal of Transport Geography*, 76, 34-41.
- Bowen, G. (2009). Document Analysis as a Qualitative Research Method. *Qualitative Research Journal*. 9. 27-40.
- Brown, J. & Guiffrida, A. (2014). Carbon emissions comparison of last mile delivery versus customer pickup. *International Journal of Logistics*. 17(6).
- Cantarella, G.E., Pavone, G., & Vitetta, A. (2006). Heuristics for urban road network design: Lane layout and signal settings. *Eur. J. Oper. Res.* 175. 1682-1695.

- Clifford, N., Cope, M., Gillespie, T. & French, S. (2016). *Key methods in geography (Third ed.)*. London: SAGE.
- Delyser, D. (2010). *The SAGE handbook of qualitative geography*. Los Angeles: SAGE.
- Dijkstra, A. & Petegem, J. van. (2019). Naar een algemene snelheidslimiet van 30km/h binnen de bebouwde kom? SWOV.
- Emerce.nl. (2021). Retrieved on December 2, 2021 from <https://www.emerce.nl/content/uploads/2017/10/Picnic-1.jpg>
- Gemeente Groningen (2021). Ruimte voor zero-emissie stadslogistiek. Visie op de toekomst van vracht- en bestelauto's in de binnenstad van Groningen. Retrieved on December 5, 2021 from <https://gemeente.groningen.nl/sites/default/files/Ruimte-Voor-Jou-visiedocument-2021-aanpassing-27-oktober.pdf>
- Gemeente Leeuwarden (2019). Mobiliteit 2019-2050.
- Gemeente Leiden. (2020). Covenant Stedelijke Distributie 071.
- Gemeente Zwolle (2020). Zero-emissie stadslogistiek. Retrieved on December 10, 2021 from <https://www.evofenedex.nl/sites/default/files/2020-12/Zero-emissie%20stadslogistiek%20Zwolle.pdf>
- Google Maps. (2022). Google Maps. Retrieved on January 1, 2022 from <https://www.google.maps.nl>
- Green Deal. (2014). C-173 Green Deal Zero Emission Stadslogistiek. Retrieved on October 16, 2021 from <https://www.greendeals.nl/sites/default/files/downloads/GD173-Zero-Emission-Stadslogistiek.pdf>
- Groothedde, B., Rustenburg, M., & Uil, K. (2003). De invloed van venstertijden en voertuigbeperkingen op de distributiekosten in de Nederlandse detailhandel. TNO Inro
- Kawulich, B. B. (2005). Participant Observation as a Data Collection Method. *Forum Qualitative Sozialforschung*
- Kostof, S., Castillo, G., & Tobias, R. (1992). *The city assembled: the elements of urban form through history*. London: Thames and Hudson.
- Meyer, H., Hoekstra, M.J. & Westrik, J. (2020). *Stedenbouw: Kern en perspectieven*. Amsterdam: Boom
- Ministerie van I&W (2020). Toelatingskader Lichte elektrische voertuigen Kwalitatief publieksonderzoek naar het sentiment onder verkeersdeelnemers in Nederland. Retrieved on December 20, 2021 from <https://open.overheid.nl/repository/ronl-dab25e95-e4a2-4305-be6c-beae32d53140/1/pdf/bijlage-4-kwalitatief-publieksonderzoek-tbv-toelatingskader-lichte-elektrische-voertuigen-mei-2020.pdf>
- Ministerie van I&W (2021). LICHT E ELEKTRISCHE VOERTUIGEN (LEV) DOOR DE OGEN VAN DE WEGBEHEERDER. Retrieved on December 8, 2021 from <https://www.rijksoverheid.nl/documenten/rapporten/2021/07/13/bijlage-2-notitie-lev-door-de-ogen-van-de-wegbeheerder>
- Morris, A.E.J. (1979), *History of Urban Form: Before the Industrial Revolution*. London: Routledge.
- Morris J. M., Dumble P. L., & Wigan M. R., (1979). Accessibility indicators in transport planning. *Transportation Research* 13 91 - 109

NAL (2019). Nationale Agenda Laadinfrastructuur. Retrieved on December 30, 2021 from <https://www.agendalaadinfrastructuur.nl/ondersteuning+gemeenten/documenten+en+links/documenten+in+biobliotheek/handlerdownloadfiles.ashx?idnv=1773453>

Noordhollands Dagblad (2021). Minstens drie incidenten met e-cars in Waterland: zijn de elektrische voertuigen nou zo onveilig? 'Te groot voor het fietspad, te klein voor de rijbaan'. Retrieved on October 10, 2021 from [https://www.noordhollandsdagblad.nl/cnt/dmf20210504\\_66008731](https://www.noordhollandsdagblad.nl/cnt/dmf20210504_66008731)

PDOK (2021). PDOK Viewer. Retrieved on October 14, 2021 from <https://www.pdok.nl/viewer/>

Picnic (2021). Over Picnic. Picnic. Retrieved on October 4, 2021 from <https://picnic.app/nl/over-picnic/>

Ploos van Amstel, W. (2017). Verkeersveiligheid stadslogistiek: tijd om aan de rem te trekken. *Logistiek.nl*. Retrieved on November 12, 2021 from <http://www.logistiek.nl/distributie/blog/2017/11/verkeersveiligheid-stadslogistiek-tijd-om-aan-de-rem-te-trekken-101159959>

Ploos van Amstel, W., Balm, S., Warmerdam, J., Boerema, M., Altenburg, M., Rieck, F., & Peters, T. (2018). City logistics: light and electric: LEFV-LOGIC: research on light electric freight vehicles.

RDW (2021). RDW Kentekencheck. Retrieved on October 24, 2021 from <https://ovi.rdw.nl>

Regterschot, E. (2010). Een integrale stedelijke distributieaanpak, een hogere stedelijke kwaliteit. Retrieved on december 14, 2021 from <https://www.crow.nl/downloads/documents/kpvm-kennisdocumenten/een-integrale-stedelijke-distributieaanpak-een-hog>

Rieck, F., Balm, S., Staal, C., & Hogt, R. (2019) Will automatic driving Light Electric Freight Vehicles be the future solution for urban Transport as a Service?

Shaffer, B., Auffhammer, M., & Samaras, C. (2021). Make electric vehicles lighter to maximize climate and safety benefits. *Nature*, 598(7880), 254–256.

Tol, E., & Otten, O. (2019). Laadinfrastructuur voor elektrische voertuigen in stadslogistiek. *Topsector Logistiek*.

Tolentino-Zondervan, F., Bogers, E., van de Sande, L. A. (2021). Managerial and Behavioral Approach in Aligning Stakeholder Goals in Sustainable Last Mile Logistics: A Case Study in the Netherlands. *Sustainability* 2021, 13, 4434.

Walraad, A. (2019). Prachtig fietsachtig. Mobiliteitsplatform. Retrieved on October 4, 2021 from <https://www.mobiliteitsplatform.nl/blog/prachtig-fietsachtig>

Weijermars, W. and Wegman, F. (2011). Ten Years of Sustainable Safety in the Netherlands: An Assessment. *Transportation Research Record*, 2213(1), 1–8.

Zeng, Y., Tong, Y. & Chen, L. (2019). Last-mile delivery made practical. *Proceedings of the VLDB Endowment*, 13(3), 320–333.

## Appendices

### Appendix A: Methodological approach overview

Research question	Information to gather	Moment of collection	Data collection	Data documentation	Data analysis
Main: "How does the urban infrastructure of historical city centres in the Netherlands enable and hamper last-mile delivery by small electric distribution vehicles?"	Information from policy advisors, company owners and delivery drivers towards the (potential) use of SEDVs and the driving experience. This combined with existing literature and framework on historical cities and how the current infrastructure influences the use of the SEDV.	During data collection period: week 42-46	The main research question will be answered with help from the 4 sub-questions.	Combination of four sub-questions	Based on the analysis of the four sub-questions.
Sub-question 1: "What are main trends in Sulp plans and what is the envisioned contribution of SEDVs?"	Definition of Sulp. Different Sulp plans from EU level to national and local. Seek for contribution (or not) of SEDV in these Sulp plans.	During data collection week 42-45	Scanning policy documents on the use of SEDVs or other comparable modes of transport.	In the theoretical framework. Data will be stored in an excel sheet in Google Drive and later translated to a table in the thesis.	The overview table will be analysed and described
Sub-question 2: "What are typical characteristics of transportation infrastructure in historical city centres in the Netherlands and how do they affect urban traffic?"	Characteristics of Dutch historical city centres, characteristics of historical centres regarding (transportation) infrastructure and effect of infrastructure on urban traffic.	During data collection week 42-45	Literature review using one main book and comparing that with several articles.	In the theoretical framework of the thesis.	Read literature and compare different findings.
Sub-question 3: "What can be learnt from views of policymakers and courier companies in the Netherlands towards the use of SEDV regarding infrastructural barriers and opportunities?"	Insights from policymakers and company owners on the use of SEDVs for LMD, focusing on infrastructural barriers and opportunities. Insights from a traffic safety expert to compare these specific answers with.	During data collection week 42-46	Insights from policymakers by semi structured interviews Insights from owners of courier companies by semi structured interviews	Transcripts and recordings will be saved in a secured Dropbox file. Files will be deleted after research is finished.	Analysis using coding systems in ATLAS.ti
Sub-question 4: "What are experiences of driving a SEDV in historical city centres in the Netherlands regarding infrastructural barriers and opportunities?"	Insights from the author regarding infrastructural barriers and opportunities riding a SEDV.	During data collection week 42-46	Insight from author towards driving with a SEDV (participatory observation) with a checklist/scheme.	Written forms will be digitalized, and routes will be tracked via GPS software.	Analysis of checklist/scheme.
Sub-question 5: "Which differences and similarities can be determined between the historical city centres of the Netherlands and what lessons can be learned for the integration of infrastructure and logistics policies?"	Differences and similarities between municipalities on several different topics regarding sustainable logistics.	During the end of the data collection process	Insights from different and similar views of municipalities.	In the result section of the thesis.	Compare findings

## Appendix B: Interview guide interview 1

Introduction text: Bedankt dat u wilt bijdragen aan dit onderzoek!

[Voorstellen]

Dit onderzoek focust zich op het gebruik van kleine elektrische vrachtvoertuigen. Ik onderzoek hoe een historische binnenstad, zoals die van Leiden en van Utrecht, invloed heeft op het gebruik van deze vervoersmiddelen. Hierbij kijk ik naar de veiligheid maar ook naar bijvoorbeeld het comfort. Dit doe ik aan de hand van interviews met beleidsmakers, bedrijfseigenaren en ook bezorgers. De titel van het onderzoek is: "Infrastructural opportunities and barriers for last mile delivery by small electric distribution vehicles in historical city centres in the Netherlands"

Ik zou u vooraf graag uw rechten willen noemen zodat u weet waar u aan toe bent.

Vrijwillig

- Dit onderzoek is vrijwillig, u bent te allen tijde vrij om te stoppen zonder daar een verklaring voor te geven

Privacy

- In het onderzoek zal uw naam geanonimiseerd worden
- De gegevens worden gedeeld met mijn supervisor
- De geanonimiseerde data zal in dit onderzoek gebruikt worden
- De data zal maximaal 3 maanden worden bewaard

Gaat u hier mee akkoord?

Heeft u verder nog vragen?

Questions

Theme	Question	Probing question	Link to theoretical framework / aim to identify	References
Introduction	Wat is/zijn uw functie(s) binnen de gemeente?	- Kunt u me hier iets meer over vertellen?	This question aims to get to know the interviewee and understand the role within the municipality.	
Policy	Aan de hand van de Green Deal Zero Emission Stadslogistiek heeft uw gemeente een beleid geschreven, wat heeft u hieraan bijgedragen?	- Hoe is dit beleid tot stand gekomen?	This question aims to get to know the contribution of the policy advisor on the current policy documents.	(Green Deal, 2014); (Gemeente Leiden 2020; Gemeente Groningen, 2021; Gemeente Zwolle, 2020; Gemeente Leeuwarden, 2019).
	Welke duurzame vervoersmiddelen bedoeld voor bezorging komen aan bod in het beleid?	- In welke mate komen kleine elektrische vrachtvoertuigen voor in jullie beleid?		



Infrastructural implications	Wanneer een small electric distribution vehicle ingezet wordt in de binnenstad, moet de infrastructuur dan aan bepaalde eisen voldoen?	<ul style="list-style-type: none"> <li>- Zo ja, wat voor eisen zijn dit precies?</li> <li>- Zo nee, wat maakt het dat er geen eisen worden gesteld?</li> </ul>	This question aims to understand to what extent the policy advisors believes that the current infrastructure is suitable for the use of the SEDV	(ANWB, 2020)
SEDV use in general	Wat zijn de voordelen van de inzet van een small electric distribution vehicle ten opzichte van andere duurzame bezorgvoertuigen in het stadscentrum kijkend naar de infrastructuur?		This question aims to understand the view of the policymaker to the use of SEDVs in the historical inner city.	
	Wat zijn de nadelen van de inzet van een small electric distribution vehicle ten opzichte van andere duurzame bezorgvoertuigen in het stadscentrum kijkend naar de infrastructuur?		This question aims to understand the view of the policymaker to the use of SEDVs in the historical inner city.	
	Hoe is de infrastructuur van de binnenstad aangepast op small electric distribution vehicles?	<ul style="list-style-type: none"> <li>- Indien geen aanpassingen: Waarom zijn er geen aanpassingen gemaakt?</li> <li>- Worden er nog aanpassingen verwacht?</li> </ul>	The answer to these questions helps to understand the focus of the municipality regarding the implementation of SEDVs and if and how the infrastructure is considered.	
Safety	Hoe zou de infrastructuur van de binnenstad kunnen bijdragen aan de algemene veiligheid (bestuurder en andere weggebruikers) van een small electric distribution vehicle?	- Zijn er bij u onveilige situaties ongelukken bekend en hoe zijn die dan ontstaan?	This question aims to understand the thoughts behind the implementation of the SEDVs and the connected road safety.	(Dijkstra & Petegem, 2019) (Ploos van Amstel, 2017), (Shaffer et al., 2021), (RDW, 2021)
Liveability	In hoeverre heeft de leefbaarheid van de stad invloed op de inzet van small electric distribution vehicles?		This question tries to identify several aspects that enable and hamper delivery because of the liveability measures of the municipality.	(ANWB, 2020), (Groothedde et al., 2003), (Rechterschot, 2010).
Accessibility	In hoeverre zijn belangrijke faciliteiten (laad -en los plekken, laadinfrastructuur en parkeerplaatsen) toegankelijk	<ul style="list-style-type: none"> <li>- Waar laden en lossen small electric distribution vehicles?</li> <li>- Waar laden small electric distribution vehicles de batterij op?</li> </ul>	This question aims to get information about the location of specific facilities and how things are	(NAL, 2019), (Regterschot, 2010), (Tol & Otten., 2019) (Groothedde et

	voor small electric distribution vehicles?	- Wat zou een toename in het gebruik van small electric distribution vehicles betekenen voor de toegankelijkheid van deze faciliteiten?	organized in terms of accesibility.	al., 2003), (ANWB, 2020).
Coherent design	Hoe kan de binnenstedelijke infrastructuur bijdragen aan een duidelijke 'plek in het verkeer' van een small electric distribution vehicle?	- Waar rijdt een small electric distribution vehicle? - Hoe hard rijdt een small electric distribution vehicle? - Verschilt dit in delen van de stad?	These questions aim to understand the specific measures and thoughts regarding the coherent design.	(ANWB, 2020); (Dijkstra & Petegem, 2019)
Future?	Hoe ziet u de stad voor na 2025 kijkend naar het gebruik van small electric distribution vehicles?		This question tries to summarize the interview in a creative way.	

Bedankt voor de bijdrage aan mijn onderzoek! Is er verder nog iets wat u kwijt wilt wat niet aan bod is gekomen of heeft u nog een vraag?

De onderzoeksresultaten zullen in de eindfase in januari met u gedeeld worden mocht u geïnteresseerd zijn.

## Appendix C: Interview guide interview 2

Introduction text: Bedankt dat u wilt bijdragen aan dit onderzoek!

[Voorstellen]

Dit onderzoek focust zich op het gebruik van kleine elektrische vrachtvoertuigen. Ik onderzoek hoe een historische binnenstad, zoals die van Leiden en van Utrecht, invloed heeft op het gebruik van deze vervoersmiddelen. Hierbij kijk ik naar de veiligheid maar ook naar bijvoorbeeld het comfort. Dit doe ik aan de hand van interviews met beleidsmakers, bedrijfseigenaren en ook bezorgers. De titel van het onderzoek is: *“Infrastructural opportunities and barriers for last mile delivery by small electric distribution vehicles in historical city centres in the Netherlands”*

Ik zou u vooraf graag uw rechten willen noemen zodat u weet waar u aan toe bent.

Vrijwillig

- Dit onderzoek is vrijwillig, u bent te allen tijde vrij om te stoppen zonder daar een verklaring voor te geven

Privacy

- In het onderzoek zal uw naam geanonimiseerd worden
- De gegevens worden gedeeld met mijn supervisor
- De geanonimiseerde data zal in dit onderzoek gebruikt worden
- De data zal maximaal 3 maanden worden bewaard

Gaat u hier mee akkoord?

Heeft u verder nog vragen?

Theme	Question	Probing question	Link to theoretical framework / aim to identify	References
Introduction	Wat is/zijn uw functie(s) binnen het bedrijf?	- Kunt u me hier iets meer over vertellen?	This question aims to get to know the interviewee and understand the role within the municipality.	
Policy / vehicles	Welke duurzame vervoersmiddelen bedoeld voor bezorging gebruiken jullie?	- Welke type voertuigen zijn dit? - Wat is de motivatie achter het gebruik van deze voertuigen? - Welke voertuigen willen jullie nog meer gaan gebruiken in de toekomst? - Welke voertuigen gebruiken jullie niet meer?	These questions try to get insight in the different vehicles used for delivery and the motivation for this.	
	De Green Deal Zero Emission Stadslogistiek heeft gezorgd voor bepaalde beleidsplannen voor stad/steden waarin jullie opereren, wat heeft dit betekent voor jullie als bedrijf?	- Hebben jullie als bedrijf iets moeten aanpassen aan de hand van dit bedrijf? - Is hier een intern beleid voor geschreven? - Worden er nog aanpassingen verwacht?	This question tries to identify several measures which could have been taken to deliver according the GDZES.	(Green Deal, 2014).

		<ul style="list-style-type: none"> <li>- Zijn er nog documenten/publicaties die relevant zijn in deze context?</li> </ul>		
Infrastructural implications	Wanneer een small electric distribution vehicle ingezet wordt in de binnenstad, moet de infrastructuur dan aan bepaalde eisen voldoen?	<ul style="list-style-type: none"> <li>- Zo ja, wat voor eisen zijn dit precies?</li> <li>- Mochten er bepaalde eisen gesteld worden, hebben jullie dit gecommuniceerd met de gemeente?</li> <li>- Zo nee, wat maakt het dat er geen eisen worden gesteld?</li> </ul>	This question aims to understand to what extent the policy advisors believes that the current infrastructure is suitable for the use of the SEDV	(ANWB, 2020)
SEDV use in general	Wat zijn de voordelen van de inzet van een small electric distribution vehicle ten opzichte van andere duurzame bezorgvoertuigen in het stadscentrum kijkend naar de infrastructuur?	<ul style="list-style-type: none"> <li>- Hoe verhoudt dit zich ten opzichte van andere duurzame bezorgvoertuigen?</li> </ul>	This question aims to understand the view of the policymaker to the use of SEDVs in the historical inner city.	
	Wat zijn de nadelen van de inzet van een small electric distribution vehicle ten opzichte van andere duurzame bezorgvoertuigen in het stadscentrum kijkend naar de infrastructuur?	<ul style="list-style-type: none"> <li>- Hoe verhoudt dit zich ten opzichte van andere duurzame bezorgvoertuigen?</li> </ul>	This question aims to understand the view of the policymaker to the use of SEDVs in the historical inner city.	
	Hoe is de infrastructuur van de binnenstad aangepast op small electric distribution vehicles?	<ul style="list-style-type: none"> <li>- Indien geen aanpassingen: Waarom zijn er geen aanpassingen gemaakt?</li> <li>- Indien vraag naar aanpassingen, is dit gecommuniceerd met de gemeente?</li> <li>- Worden er nog aanpassingen verwacht?</li> </ul>	The answer to these questions helps to understand the focus of the municipality regarding the implementation of SEDVs and if and how the infrastructure is considered.	
Safety	Hoe zou de infrastructuur van de binnenstad kunnen bijdragen aan de algemene veiligheid (bestuurder en andere weggebruikers) van een small electric distribution vehicle?	<ul style="list-style-type: none"> <li>- Zijn er bij u onveilige situaties/ ongelukken bekend en hoe zijn die dan ontstaan?</li> <li>- Hoe zouden deze onveilige situaties/ ongelukken voorkomen kunnen worden?</li> <li>-</li> </ul>	This question aims to understand the thoughts behind the implementation of the SEDVs and the connected road safety.	(ANWB, 2020), (SWOV, 2019), (Ploos van Amstel, 2017), (Shaffer et al., 2021), (RDW, 2021)
Liveability	In hoeverre heeft de leefbaarheid van de stad invloed op de inzet van small electric distribution vehicles?	<ul style="list-style-type: none"> <li>- Op wat voor manier houden jullie rekening met de leefbaarheid van een stad tijdens de bezorging?</li> </ul>	This question tries to identify several aspects that enable and hamper delivery because of	(ANWB, 2020), (Groothedde et al., 2003), (Rechterschot, 2010).

			the liveability measures of the municipality.	
Accessibility	In hoeverre zijn belangrijke faciliteiten (laad -en los plekken, laadinfrastructuur en parkeerplaatsen) toegankelijk voor small electric distribution vehicles?	<ul style="list-style-type: none"> <li>- Waar laden en lossen small electric distribution vehicles?</li> <li>- Waar laden small electric distribution vehicles de batterij op?</li> <li>- Waar parkeren small electric distribution vehicles?</li> <li>- Wat zou een toename in het gebruik van small electric distribution vehicles betekenen voor de toegankelijkheid van deze faciliteiten?</li> <li>- Wat heeft jullie voorkeur?</li> </ul>	This question aims to get information about specific facilities used and whether which is preferred.	(NAL, 2019), (Regterschot, 2010), (Tol & Otten., 2019) (Groothedde et al., 2003), (ANWB, 2020).
Coherent design	Hoe kan de binnenstedelijke infrastructuur bijdragen aan een duidelijke 'plek in het verkeer/ op de weg' van een small electric distribution vehicle?	<ul style="list-style-type: none"> <li>- Waar rijdt een small electric distribution vehicle?</li> <li>- Wat heeft jullie voorkeur?</li> <li>- Hoe hard rijdt een small electric distribution vehicle?</li> <li>- Wat heft jullie voorkeur?</li> <li>- Verschilt dit in delen van de stad?</li> </ul>	This question aims to understand the preferences and current measures of the company towards the coherent design.	(ANWB, 2020)

### Closing

Kent u nog iemand binnen uw bedrijf die betrokken is bij mijn onderwerp die mogelijk geïnteresseerd is om mij te woord te staan?

Is er verder nog iets wat u kwijt wilt wat niet aan bod is gekomen of heeft u nog een vraag?

---

Bedankt voor de bijdrage aan mijn onderzoek!

De onderzoeksresultaten zullen in de eindfase in januari met u gedeeld worden mocht u geïnteresseerd zijn.

Appendix D: Document review table

Document	Page	Text	Gathered information	Theme(s)
<b>Convenant Stedelijke Distributie 071.</b> (Gemeente Leiden, 2020)	2	“Leiden is een compacte historische stad, waar het steeds drukker wordt. Door de groei van het aantal woningen, banen en bezoekers neemt de druk op de binnenstad toe.”	Pressure is on the city centre because of its compactness and growing number of dwellings, jobs, and visitors.	City growth
	2	“De huidige economische groei vraagt om slimme en innovatieve oplossingen zodat Leiden ook in de toekomst aantrekkelijk, leefbaar en bereikbaar blijft”	To keep up with the current trend, Leiden should focus on smart and innovative solutions.	City growth
	2	“Grachten uit de Gouden Eeuw zijn niet ontworpen voor doorgaand autoverkeer, Middeleeuwse stegen rondom de Pieterskerk of de Hooglandse kerk ziet Leiden het liefst geheel autovrij.”	Infrastructure in the city centre is not suitable for loads of traffic so the municipality prefers a car-free zone.	Car-free, history
	2	“De binnenstad moet te bevoorraden zijn, maar anders (schoner, efficiënter en duurzaam) worden ingericht. Gemeente Leiden wil daarbij samen met ondernemers en leveranciers/vervoerders zoeken naar slimme en duurzame oplossingen, zoals het gebruik van elektrische wagens, bakfietsen, cargobikes, voertuigen of waterstof of boten.”	The city knows city logistics are important but wants to switch to sustainable options, this will be realized by working along with entrepreneurs to search for sustainable solutions.	Sustainable Solutions
	2	“Ook draagt het convenant bij aan een breder pakket van maatregelen om de leefbaarheid, bereikbaarheid en aantrekkelijkheid van de binnenstad te verbeteren.”	Except for sustainability, other principles as liveability, accessibility and attractiveness are important.	Liveability, accessibility, attractiveness
	5	“Nul-emissie bevoorrading van de binnenstad Leiden vanaf 1 januari 2025.”	The goal is to have zero-emission city logistics by 2025.	Date, zero-emission
	5	“Verbeteren van bereikbaarheid binnenstad voor distributie en publiek”	Improving the accessibility for logistics and visitors are the main principles.	Accessibility
	6	“Voertuigen. Nul-emissie wordt gedefinieerd als: - Voertuigen (bestelauto's en vrachtwagens) die elektrisch, op waterstof of met een brandstofcel rijden; ook 'light electric' voertuigen (LEVs), cargobikes, elektrische brom-/snorfietsen e.d. worden tot deze categorie gerekend.	Zero-emission vehicles consist out of several concepts including Light Electric Vehicles.	Vehicle, Zero-emission

	7	“Er wordt gestreefd naar handhaving van de zone met ANPR (kenteken) camera’s.”	Enforcement will be based on the use of ANPR camera’s	ANPR Camera’s
	8	“Voor nul-emissievoertuigen wordt onderzocht of de huidige venstertijden kunnen worden uitgebreid (ook in de avonduren).”	Delivery windows are under investigation whether they could be extended for example in the evening.	Delivery window
	8	“Ook wordt onderzocht of het mogelijk is om lichte elektrische vrachtoertuigen (LEV’s) toegang te verlenen tot afgesloten gebieden.”	Another option which is considered is the use of Light Electronic Vehicles in restricted areas.	Exemption
	9	“Vrijstelling wordt in kader van de harmonisatie regelgeving milieuzones grotendeels landelijk geregeld.”	Exemptions should be managed nationally in terms of harmonization laws on emission zones.	Exemption, harmonisation
	9-10	“Daarbij zal vooral ook de laadmogelijkheden voor het bestelverkeer worden onderzocht...”	Charging infrastructure is one important factor to implement the zero-emission zone. This is the reason that the municipality investigates the charging possibilities for delivery vans.	Charging infrastructure
<b>Ruimte voor zero-emissie stadslogistiek</b>  (Gemeente Groningen, 2021)	-	“We zien te vaak dat bestelbusjes voetpaden of zelfs straten blokkeren bij het laden en lossen. Of vrachtwagens in nauwe straten waardoor verkeersonveilige situaties voor voetgangers en fietsers ontstaan. En wat te denken van geluidsoverlast en vervuilende uitstoot in onze binnenstad? Dat kan schoner, slimmer en vooral ook met minder vracht- en bestelauto’s.”	The municipality knows vans and trucks that block sidewalks and streets could cause unsafe situations. To add, the municipality wants to tackle noise nuisance and emissions in several ways.	Nuisance
	2	“Een historische binnenstad die bovendien al zo’n 1000 jaar dezelfde omvang heeft”	Groningen knows they cannot do something with the density of the city.	City growth, history
	2	“Tegelijkertijd merken we dat er grenzen zitten aan die groei. Soms ook letterlijk. De historische binnenstad heeft nauwe straten. Die worden drukker, voller en er rijdt steeds meer verkeer. Niet alleen door de bevoorrading van horeca en winkels. Ook het gemak van online bestellen zorgt voor meer bezorg- én retourstromenverkeer. Auto’s, vracht- en bestelauto’s, pakketbezorgers, aannemers, fietsers en voethangers krioelen door elkaar. Kortom: er is een keerzijde aan het succes.	There are boundaries to the ever-growing city. The city has narrow streets and with more and more different traffic flows there will be a downside to the success.	City growth
	12	“Er zijn op dit moment geen laad- en losplekken in de binnenstad. In principe mag je nu overal in de	Delivery drivers are allowed to stop everywhere in the city centre to (un)load.	(Un)loading places

	binnenstad stoppen om te laden en/of te lossen.”		
13	“In Groningen kiezen we ervoor om de zero-emissie zone zo snel mogelijk in te voeren. Daarom maken we de begrenzing van de zone in 2021 bekend (zie kaartje op pagina 11) waarna de zone in 2025 wordt ingesteld.”	Since the municipality of Groningen wanted to give all affected sectors the possibility to prepare for the zero-emission zone, they communicated the implementation strategy in 2021. This gives the sectors 4 years to prepare when the whole zone will be set up in 2025.	Date, Zero-emission
14	“Uitgangspunten bevoorradingsvenster. Van 5:00-12:00. Uitgangspunt: bevoorrading in de ochtend en zoveel mogelijk vervoer per bakfiets of met Licht Elektronische Voertuigen (LEV).”	Window times do not change but the vehicles which are preferred to deliver within that time do. Groningen wants to use the cargo bike or light electric vehicle.	Window time
14	“Spoedleveringen mogen met een bakfiets of LEV”	Emergency deliveries, so deliveries that are not within the window times, are allowed with the use of cargo bikes and light electric vehicles.	Exemptions
17	“Ontheffingen. Het doel is om een strikt ontheffingenbeleid te hanteren onder het motto: nee, tenzij. Bovendien zijn er vaak uitstootvrije alternatieven voor als bezorging in de middag of avond echt nodig is. Dan kan dat met de vrachtfietsen en Lichte Elektronische Vrachtoertuigen (LEV).”	Strict exemptions will be made where the municipality prefers a “no”. When there are exemptions made, cargo bikes or LEVs should be the vehicles to deliver with.	Exemption
18	“Om de naleving van de venstertijden en later ook het gebruik van uitstootvrij bevoorradingsverkeer te controleren, plaatsen we vanaf 2022 camera’s bij de entrees van het venstertijdengebied en latere zero-emissiezone. De ANPR-camera’s lezen automatisch alle kentekens. Heb je geen ontheffing? Dan volgt er een boete.”	To control the window times and later the zero-emission zone, ANPR cameras will be installed starting from 2022.	ANPR Camera’s, exemptions
30	“In de gesprekken met de belangenorganisaties bleek grote behoefte aan enkele logische laad- en losplekken binnen het venstertijdengebied en de zero-emissiezones. Daar gaan we mee aan de slag. In 2021 gaan we onderzoeken wat de beste routes voor logistiek verkeer zijn, wat geschikte plekken zijn voor laden en lossen en op welke plekken we	Interest groups highlighted the need for (un)loading places inside the window time area and the zero-emission zone. The municipality is investigating this including the best route for logistical traffic.	(Un)loading places, accessibility



		laden en lossen juist onmogelijk willen maken.”		
<b>Zero-Emissie stadslogistiek</b> (Gemeente Zwolle, 2020)	1	“...vanaf 2025 is al het bestel- en vrachtverkeer in de Zwolse binnenstad duurzaam en geldt de binnenstad als emissievrije zone voor stadslogistiek. Het invoeren van een zero-emissiezone is een belangrijk onderdeel in de omslag naar slimme en schone stadslogistiek.”	By 2025 the zero-emission zone is set up and all logistical traffic is emission-free.	Date, Zero-emission
	1	“Minder (overlast van) logistieke voertuigbewegingen, en daardoor meer fysieke ruimte voor bezoekers van de binnenstad en een prettiger leefomgeving voor bewoners.”	One main goal is to reduce nuisance from delivery vehicles and bring more physical space for visitors and inhabitants. This will increase liveability.	Nuisance, liveability
	1	“Stimulans voor nieuwe, innovatieve concepten, waardoor koplopers weten dat Zwolle dé stad is om innovaties te lanceren.”	New concepts will be stimulated.	Sustainable concepts
	1	“Een helder, afgebakend gebied. Bezoekers krijgen voorrang boven logistieke voertuigen.”	When delivery vehicles still need to enter the city centre, visitors will always have priority.	Exemptions
	2	“Het voornemen te starten met monitoring logistiek verkeer op alle ingangen van de toekomstige zero-emissiezone is uniek in Nederland. Hiermee brengt Zwolle doelgericht in kaart wat nodig is om bedrijven te faciliteren in een soepele overgang naar zero emissie stadslogistiek.”	Zwolle started in 2021 with the monitoring of logistics traffic using cameras. This will help the municipality to predict future needs and thus help to implement the zero-emission zone in 2025.	ANPR camera’s, monitoring
	2	“Maatwerkoplossingen schone en slimme initiatieven. Idee van deze pilot is dat schone en slimme initiatieven in beperkte mate een ontheffing ontvangen voor bevoorrading buiten venstertijden.”	Zwolle started a pilot where sustainable concepts could get exemptions to deliver inside the city centre outside of the window times.	Sustainable solutions, exemptions, window times.
<b>Mobiliteit 2019-2050</b> (Gemeente Leeuwarden, 2019)	7	“Voorbeelden zijn het stimuleren van de (elektrische) fiets, het beperken van de maximumsnelheid, het weren van dieselauto’s in de binnensteden, het promoten van elektrisch rijden en het uitvoeren van stadsdistributie met elektrische voertuigen.”	Sustainable concepts are stimulated just as city logistics with electrical vehicles.	Sustainable concepts
	7	“Dat betekent bijvoorbeeld dat we goed moeten nadenken over laadvoorzieningen en welke rol je daar als overheid in wilt hebben.”	The goal to promote sustainable (electric) concepts will result in adaptations to the charging facilities. The municipality is aware of this.	Charging infrastructure

9	“Stadsdistributie. Minder hinder en verduurzaming zijn de redenen om in te zetten op fossielvrije stadsdistributie en minder bevoorradingsvoertuigen in de binnenstad.”	Zero-emission city logistics will help to become more sustainable and will result in fewer movements inside of the city centre.	Nuisance
14	“ Dat levert heel veel krasbewegingen op in onze stad met een flinke belasting voor onze wegen, ons milieu en onze openbare ruimte. Zeker in onze binnenstad kan dat conflicteren met belangen van een aantrekkelijke en gezonde binnenstad. Daarom investeren we in milieuvriendelijke stadsdistributie.”	Shops get more deliveries with fewer parcels resulting in more movements in the inner city. By investing in sustainable city logistics by for example the use of a city hub, everything will become more environmentally friendly.	Zero-emission
14	“ We zien mogelijkheden om bij Werpsterhoeke een multifunctionele mobiliteit hub te ontwikkelen. Deze hub is naast personenvervoer ook gericht op het distribueren van goederen. Pakketten die in de binnenstad moeten worden afgeleverd kunnen we daar verzamelen en op een milieuvriendelijke manier, bijvoorbeeld met elektrische voertuigen naar de stad brengen.”	The municipality of Leeuwarden is going to set up one main hub at the border of the city. This hub will help to deliver environmentally friendly inside of the city centre. This delivery can be done by for example electrical vehicles.	Hub, vehicles
14	“De gemeente Leeuwarden wil aanjager zijn en staat open voor experimenten en pilots met vernieuwende en/of geautomatiseerde vormen van goederen- en personenvervoer tussen de hub en de binnenstad van Leeuwarden.”	The municipality of Leeuwarden wants to be a driving force when it comes to experiments, pilots, and other initiatives to deliver from the hub at Werpsterhoeke.	Sustainable concepts
15	“Ons doel is om uiterlijk in 2030 de bevoorrading van onze binnenstad geheel met fossielvrije voertuigen te laten plaatsvinden.”	The municipality of Leeuwarden is a bit reticent when it comes to setting deadlines for the zero-emission zone. Instead of 2025, the municipality aims for 2030. Still, parts of the city centre will be delivered using zero-emission vehicles by 2025.	Date, Zero-emission

## Participative Observation Form

Introduction text: Bedankt dat je mij wilt helpen met mijn onderzoek! Dit onderzoek focust zich op het gebruik van kleine elektrische vrachtvoertuigen. Ik onderzoek hoe een historische binnenstad, zoals die van Zwolle, Leeuwarden of Groningen, invloed heeft op het gebruik van deze vervoersmiddelen. Hierbij kijk ik naar de veiligheid maar ook naar bijvoorbeeld het comfort. Ik zal je onderweg wat vragen stellen die ik later uitwerk in tekst, ik track de route doormiddel van gps-gegevens en ik noteer informatie over bepaalde situaties.

Ik zou vooraf graag uw rechten willen noemen zodat u weet waar u aan toe bent.

### Vrijwillig

- Dit onderzoek is vrijwillig, u bent te allen tijde vrij om te stoppen zonder daar een verklaring voor te geven

### Privacy

- In het onderzoek zal uw naam geanonimiseerd worden
- De gegevens worden gedeeld met mijn supervisor
- De geanonimiseerde data zal in dit onderzoek gebruikt worden
- De data zal maximaal 3 maanden worden bewaard

Gaat u hier mee akkoord?

Heeft u verder nog vragen?

---

The form first focuses on general facts about the day. After that, observation will be based on several pillars. When something is observed which is connected to a certain pillar, questions can be asked to elaborate on a certain situation. It is possible that a certain situation is not connected to a pillar, in that case the situation will be explained as well. The route information in terms of GPS data will be collected via a GPS application called 'GPS Tracker'.

### Pillars (derived from theoretical framework)

1. **Safety:** focus on unsafe events which can be connected to excessive braking, changing speed, honking, unsafe feelings of the driver, possible accidents speed differences.
2. **Liveability:** Check if the driver is blocking streets, if other people are affected by the way the car drives or parks in the area and is window times have a certain effect.
3. **Accessibility:** Focus on the city network, (un)loading places and possible charging infrastructure.
4. **Coherent design:** Focus on the place of the SEDV within the city, speed, and differences within the city.

For every explanation connected to a pillar the contribution (of the infrastructure) is noted as well, what contributed to this event (or not) and why? Some situations can exist out of more than one pillar, in that case this situation will be divided in multiple situations.

General		Notes:
Date:		
Time:		

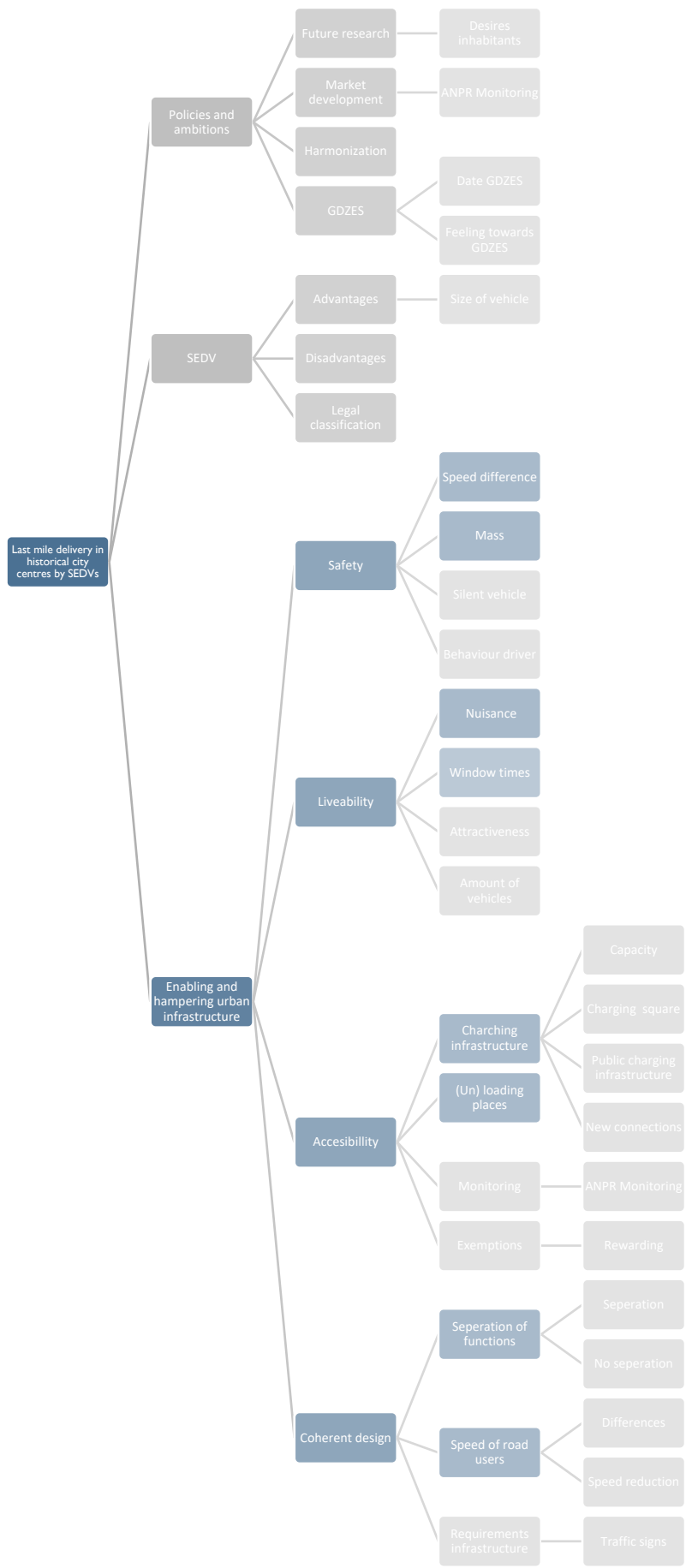
Weather conditions:			
Experience driver:			
Type of car (condition as well):			
Number of stops:			
Situation (brief description):	Pillar:	Notes (explanation whole situation and including possible questions):	
1:			

Heeft u nog vragen?

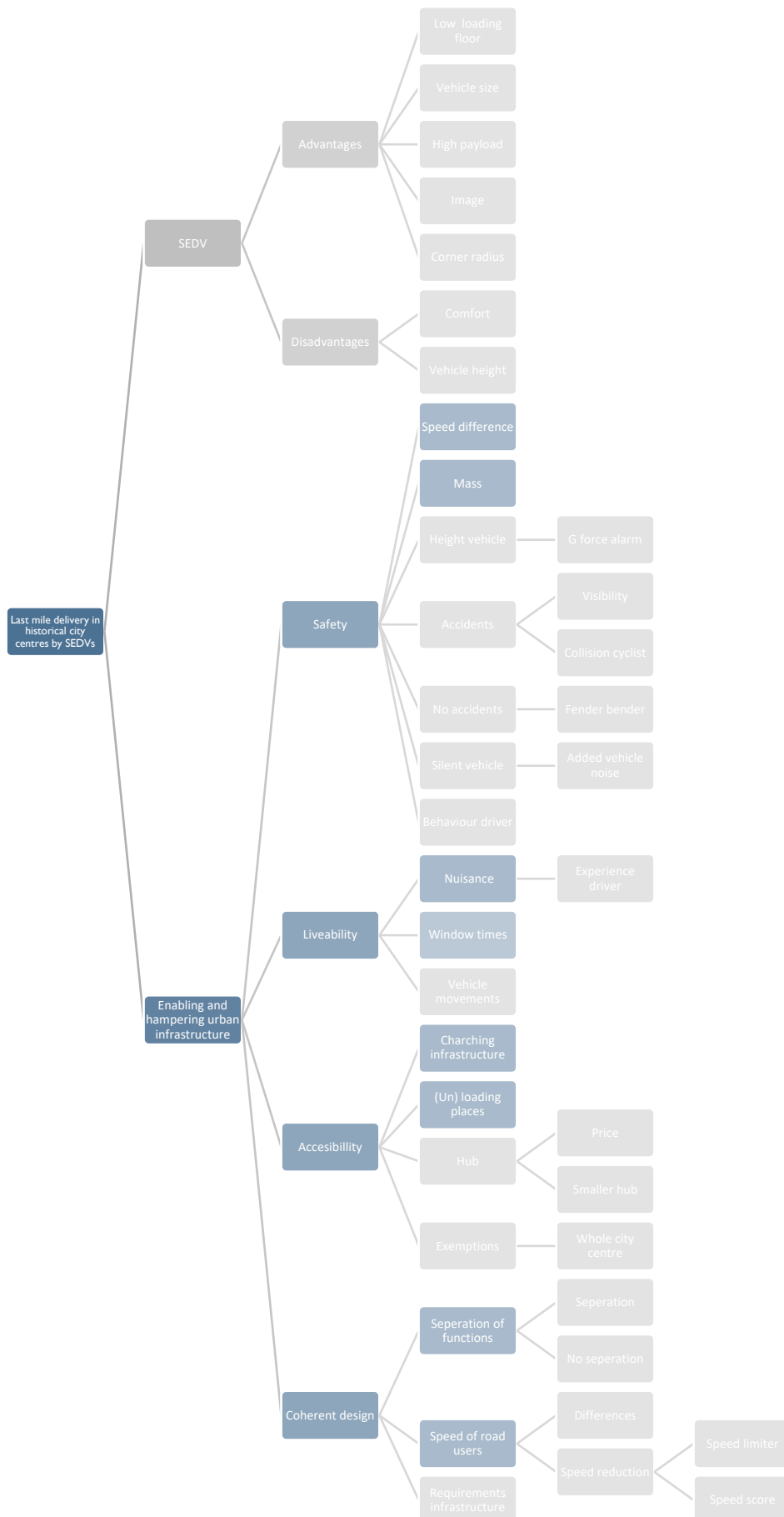
Bedankt voor de bijdrage aan mijn onderzoek!

De onderzoeksresultaten zullen in de eindfase in januari met u gedeeld worden mocht u geïnteresseerd zijn.

Appendix F: Code tree interview 1: In blue the deductive codes and in grey the inductive codes



Appendix G: Code tree interview 2 - In blue the deductive codes and in grey the inductive codes



## Appendix H: Timetable

Week	Tasks	Deadlines
Week 40	Work on research step 2 Get framework from CROW.	Group session 4  Deadline revision Research Step 2: Friday, October 8 <sup>th</sup> at 17:00
Week 41	Contacts companies and interviewees  Open office: qualitative research, GIS, and quantitative research  Prepare questions open office  October 14 <sup>th</sup> till 17: work	Deadline Research Step 3: Friday, October 15 <sup>th</sup> at 17:00  Personal deadline: Wednesday, October 13 <sup>th</sup>
Week 42	Personal goal: plan all interviews before the end of week 43.  Work on data collection	Group session 5
Week 43	Work on data collection	
Week 44	Exam week; 1 Exam: Friday November 5 <sup>th</sup>	
Week 45	Personal goal: finish data collection and start with preparing Research Step 4.	
Week 46	Personal goal: finish Research Step 4 (personal deadline) and start with Research Step 5.	Group session 6  Deadline Research Step 4: Friday, November 14 <sup>th</sup> at 17:00  Personal deadline: Wednesday, November 12 <sup>th</sup>
Week 47	November 23 <sup>rd</sup> till 28 <sup>th</sup> : work	
Week 48	Work on Research Step 5	
Week 49	Work on Research Step 5	
Week 50		Deadline Research Step 5: Friday, December 17 <sup>th</sup> at 17:00  Personal deadline: Monday, December 13 <sup>th</sup>
Week 51	Give feedback	Deadline Research Step 6: Friday, December 24 <sup>th</sup> at 17:00

	Receive feedback and start making changes	
Week 52	Christmas Break Make changes based on feedback	
Week 1	Christmas Break Finish research step 5 'Version 2'	Deadline Research Step 5 (Version 2): Friday, January 14 <sup>th</sup> at 17:00
Week 2	Work on final version	
Week 3	Individual sessions Work on final version	Personal deadline Research Step 7: Friday, January 21 <sup>st</sup>
Week 4	Exam week: no exam	Deadline Research Step 7: Friday, January 28 <sup>th</sup> at 17:00
Week 5	Exam week: no exam	
Week 6	Individual final interview	