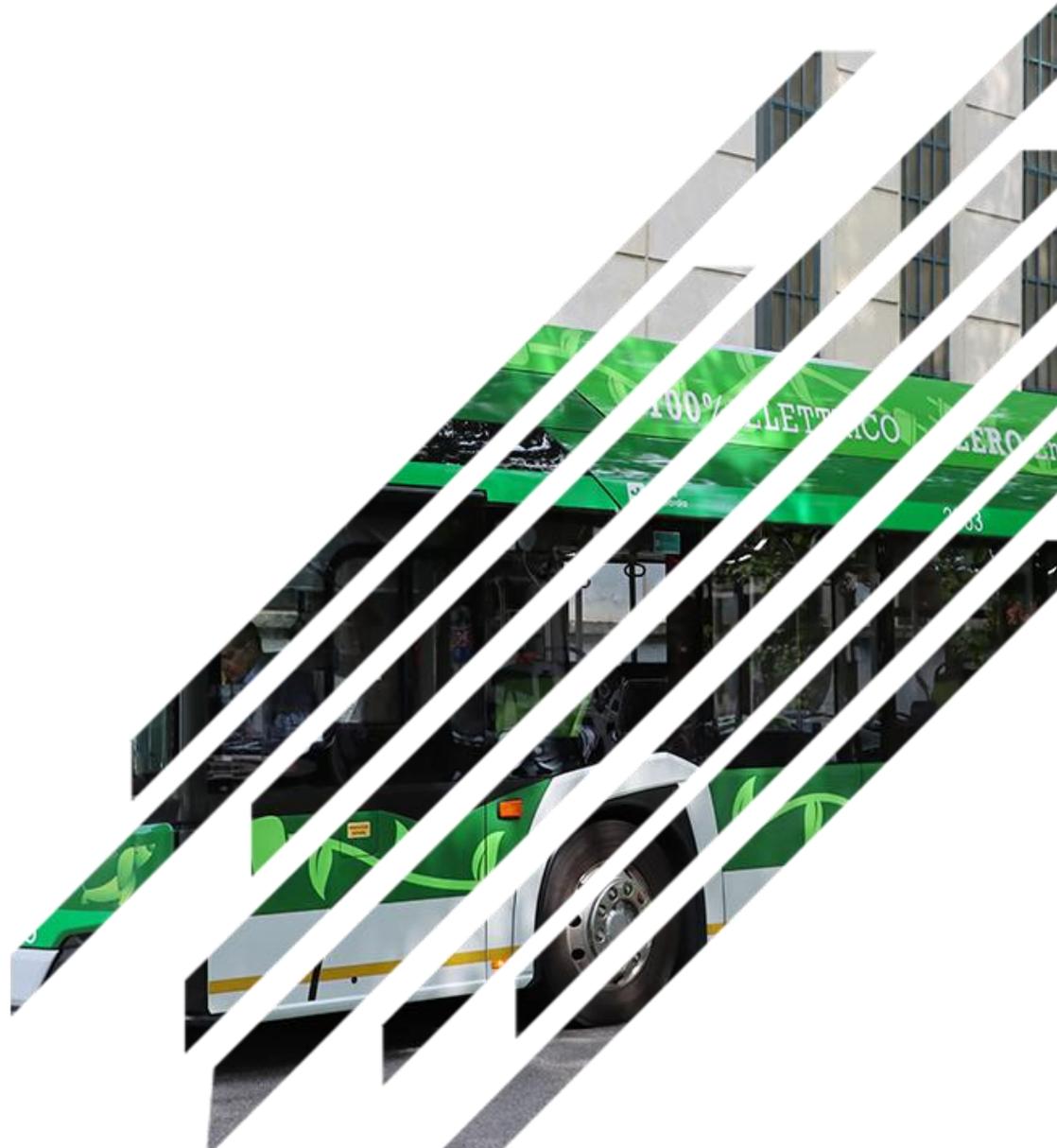


Smart Public transport Initiatives for climate  
Neutral cities in Europe

D2.3 Antwerp LL and Implementation  
Version 1





## Document Summary Information

Grant Agreement No	101096664	Acronym	SPINE
Full Title	Smart Public transport Initiatives for climate Neutral cities in Europe		
Start Date	01/01/2023	Duration	48 months
Project URL	<a href="https://www.spine-project.eu/">https://www.spine-project.eu/</a>		
Deliverable	D2.3 Antwerp LL and Implementation Version 1		
Work Package	WP2		
Contractual due date	30.06.2024	Actual submission date	30.06.2024
Nature	R – Document, report	Dissemination Level	PU - Public
Lead Beneficiary	Antwerp		
Responsible Author	Stijn Vernailen, Chris Van Maroey		
Contributions from	UA, YUNEX		

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## Revision history (including peer reviewing & quality control)

Version	Issue Date	% Complete <sup>1</sup>	Changes	Contributor(s)
v1.0	01/12/2023	10	Initial Deliverable Structure	Chris Van Maroey
V2.0	10/06/2024	90	First consolidated version for internal peer-review	Stijn Vernailen Chris Van Maroey
V3.0	21/21/2024	99	Peer Review	Sandra García García Floriea Di Ciommo
VF	25/06/2024	100%	Final consolidated version	Stijn Vernailen Chris Van Maroey

## Glossary of terms and abbreviations used

Abbreviation / Term	Description
AI	Area of Influence
API	Application Programming Interface
CO <sub>2</sub>	Carbon dioxide
De Lijn	Flemish Public Transport Operator
DLA	Data Licence Alliance
elkn screen	Electronic ink screen
FUA	Functional Urban Area
KPI	Key Performance Indicators
LEM	Local Evaluation Manager
LEZ	Low Emission Zone

<sup>1</sup> According to SPINE's Quality Assurance Process



LL	Living Lab
MaaS	Mobility as a Service
MMTIS	Multi Modal Travel Information Services
NMBS	Belgian National Railway Company
P&R	Park and Ride
PT	Public Transport
SUMP	Sustainable Urban Mobility plan
TEN-T	Trans-European Transport Network
UX	User Experience
VLCC	Antwerp Traffic Light Coordination Centre (Verkeerslichtencoördinatiecentrum)
VMP	Vehicles of Personal Mobility
WCAG	Web Content Accessibility Guidelines



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## 1 Executive Summary

Deliverable D2.3 is part of Work Package WP2 and focuses on the Antwerp LL, namely Task 2.2 of the SPINE GA. It describes the setup, operation and successful progress of the LLs developed in Antwerp as a SPINE lead city from March 2023 to May 2024 (M3-M18). The general objectives of WP2 includes successful LL establishment, design and development of physical and digital common spaces, LL daily functioning, and the implementation of LL-specific actions outlined in the subtasks described below. Actions are supported by the SPINE methodology, which involves the following steps: A1 – Empathize, A2 – Define, A3 – Co-create, and A4 – Prototype.

Task 2.2 includes four subtasks, associated to the following relevant contents of the deliverable:

- ST2.2.1 Operation of digital and physical LL spaces: D2.3 describes how actions are carried out for smooth operation, city-specific coordination of meetings, decision-making and co-creation process of solutions;
- ST2.2.2 City-specific digital enablers to the city-specific mobility solutions: D2.3 describes models and available data used, as well as stakeholders to be involved in the implementation for data sharing;
- ST2.2.3 Development and Implementation of SPINE mobility solutions: D2.3 outlines time plan of the actions, and highlights risks and mitigation measures;
- ST2.2.4 Physical Impact Assessment: D2.3 reports the work made around the definition of city and solution specific KPIs.

This deliverable describes in detail the actions taken, implementation, milestones, stakeholders and monitoring of the Antwerp LL, structured within these four Antwerp measures, namely:

**ANT\_MS1 Upgrade physical and digital design, wayfinding, of 5 existing multimodal hubs.**

**ANT\_MS2 Upgrade existing real-time information provision to promote the use of the hubs.**

**ANT\_MS3 Upgrade 'Smart Ways to Antwerp' intermodal multimodal journey planner, which integrates real-time information on different mobility services.**

**ANT\_MS4 Public Transport Green Wave Analyses.** In collaboration with the specific tasks of WP3, Spine technical partner YUNEX.



## 2 Introduction

For the development of this deliverable, the following SPINE documents were taken into consideration:

- Grant Agreement (GA), Reference number: 101096664, to ensure that the agreed activities and outputs are delivered in this deliverable.

### Mapping SPINE Outputs

The purpose of this section is to map SPINE's Grant Agreement commitments, both within the formal Deliverable and Task description, against the project's respective outputs and work performed.

Table 1: Adherence to SPINE's GA Deliverable & Tasks Descriptions

SPINE GA Component Title	SPINE GA Component Outline	Respective Document Chapter(s)	Justification
DELIVERABLE			
D2.3 Antwerp LL and Implementation Version 1	<i>Report including requirements and user stories, business model description,</i>	Chapter 2 & 3	<p><b>Chapter 2</b> The Antwerp SPINE LL is introduced within the Antwerp context, and user stories. Further subchapters illustrate a high-level timeline of the implemented solutions, the operational factors, stakeholders and decision-making process.</p> <p><b>Chapter 3</b> describes in detail the actions taken, implementation, milestones, stakeholders and monitoring of the Antwerp LL, structured within these four Antwerp measures, namely:</p>
	<i>Report including a detailed implementation plan that defines the operational zone, operational parameters and fleet characteristics.</i>	Chapter 3 (section 3.1, 3.2, 3.3 and 3.4)	<p><b>Chapter 3</b> describes in detail the actions taken, implementation plan, operational zones, stakeholders and monitoring of the Antwerp LL, structured within the four Antwerp measures.</p>
TASKS			
T2.2 Antwerp LL and implementation	<i>Performs the corresponding actions relevant to the Antwerp LL and implementation</i>		



ST2.2.1 Operation of digital and physical LL spaces	<i>Is related to the smooth operation of the digital and physical LL spaces</i>	Chapter 2	Section 2.1.2 addresses Antwerp SPINE LL use case(s) and requirements
	<i>and the city-specific coordination of meetings, decision-making and all relevant iterative processes.</i>	Chapter 2	Section 2.1.5.3 describes Antwerp LL decision making process
ST2.2.2 City-specific digital enablers	<i>Undertakes all city-specific digital enablers to the mobility solutions. In collaboration with the specific tasks of WP3, it supports the implementation of solutions via engaging the digital tools which will facilitate the implementation process.</i>	Chapter 3	ANT_MS4: Traffic Management & PT prioritization supported by technical partner YUNEX (as part of WP3)  All the other measures are supported by city specific digital enablers.
ST2.2.3 Development and Implementation of SPINE mobility solutions	<i>After receiving the input from the digital impact assessment tasks of WP3, this subtask will continue with the development and application of the mobility solutions in the city. This subtask will carry out the implementation of the qualified mobility solutions</i>	Chapter 3	Sections 3.1.3, 3.2.3, 3.3.3 & 3.4.3 describe detailed implementation plan for Antwerp LL solutions.
ST2.2.4 Physical Impact Assessment	<i>Registers and monitors all physical impact indicators during and after the successful implementation of the innovative solutions in the city. It reports feedback and indicators to T2.6 (LLs lessons learned and barriers' identification).</i>	Reference D2.1	Logbook of lessons learned is described in D2.1

## Deliverable Overview and Report Structure

**Chapter 1** consists of a general introduction to the document structure and an executive summary.

**Chapter 2** overviews Antwerp's overall context, broader city objectives and Mobility Plans.

The Antwerp SPINE Living Lab (LL) is introduced within the Antwerp context.



Further subchapters illustrate a high-level timeline of the implemented solutions, the operational factors, stakeholders and decision-making process.

The goal of the Antwerp SPINE Living Lab is to improve the user experience both on the physical layer at the mobility hubs as on the digital layer

**Chapter 3** describes in detail the actions taken, implementation, milestones, stakeholders and monitoring of the Antwerp LL, structured within these four Antwerp measures, namely:

ANT\_MS1 Upgrade physical and digital design, way finding, of 5 existing multimodal hubs

ANT\_MS2 Upgrade existing real-time information provision to promote the use of the hubs.

ANT\_MS3 Upgrade 'Smart Ways to Antwerp' intermodal multimodal journey planner which integrates real-time information on different mobility services

ANT\_MS4 Public Transport Green Wave Analyses. In collaboration with the specific tasks of WP3, Spine technical partner YUNEX.

**Chapter 4** summarizes the specific outputs of the deliverable. The challenges can be grouped into 3 main categories: **data, behavior, and governance**.



## 3 SPINE Living Lab CITY

### 3.1 Antwerp LL objectives

#### 3.1.1 City context

The city of Antwerp has been facing significant mobility challenges. As a key node in the TEN-T network and with the Port of Antwerp-Bruges next to the city, the mobility infrastructure has always been lagging behind demand. As an added challenge, the "ring road" around Antwerp is not actually a ring. This results in the main traffic flow going only around one side of the city (east side).

To address these traffic issues in and around Antwerp, the Flemish government drew up the [Masterplan 2020](#). The focus of the Masterplan is not limited to smoothen traffic but also to improve road safety and improve quality of life. For example, public transport will be expanded more strongly. Furthermore, new, safe cycling networks will be created, and the waterways will not be forgotten. The goal: half of all journeys in the Antwerp conurbation should be made by public transport, on foot or by bicycle.

With the [Routeplan 2030](#) the Mobility plan for the Antwerp region the Master Plan 2020 will be significantly expanded. In this way, Antwerp becomes a livable and easily accessible city region.

The best-known project in the Master Plan is undoubtedly [Noorderlijn](#), with the new square Operaplein and the renovated Opera- metro station as its showpiece. This project includes the tram extensions to the north of the city. Car traffic will pass under the square 'Operaplein' via the new tunnels for car traffic.

Another well-known project from this plan is the [Oosterweel connection](#). On the Left Bank of the river Scheldt, the works are in full swing. Now that the environmental permit for the works on the right bank has been approved, the first preparatory works have started. The Oosterweel connection completes the Ring Road and thus ensures better mobility. In this way, Antwerp and its port can continue to be an engine for the Flemish and European economies. After the construction of the Oosterweel connection, the future canopy of the Ring Road will send the cars underground. This frees up space above ground for the [Ring Parks](#) to live well, with plenty of greenery and cleaner air.

With the reconstruction of several roads and thanks to new connections (missing links) with cycle (high)ways cyclists are able to travel safely and smoothly in all directions connecting the city center with neighboring districts along the most logical cycling connections.

Transport by water is also part of the plan. The widening of the canal and the raising of the many bridges over the canal in order to attract more shipping is in full swing.

The implementation of the Masterplan 2020 was also the basis for the **SUMP** of the city of Antwerp, which was revised in 2015, and defines next to the aforementioned "hard measures", actions related to "soft measures" and "digital measures".

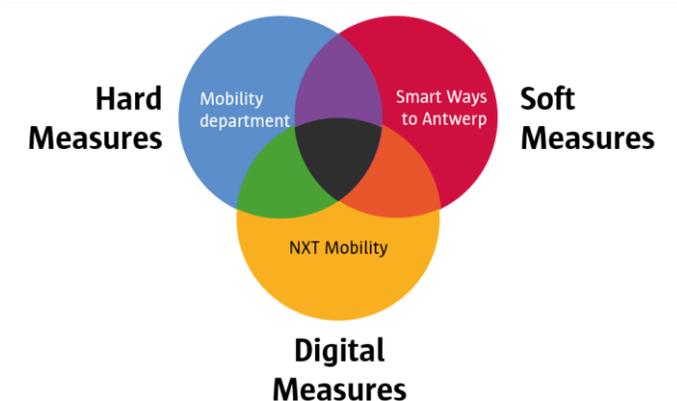


Figure 1: Integrated approach using hard, soft, and digital measures

### Soft measures: Smart Ways to Antwerp

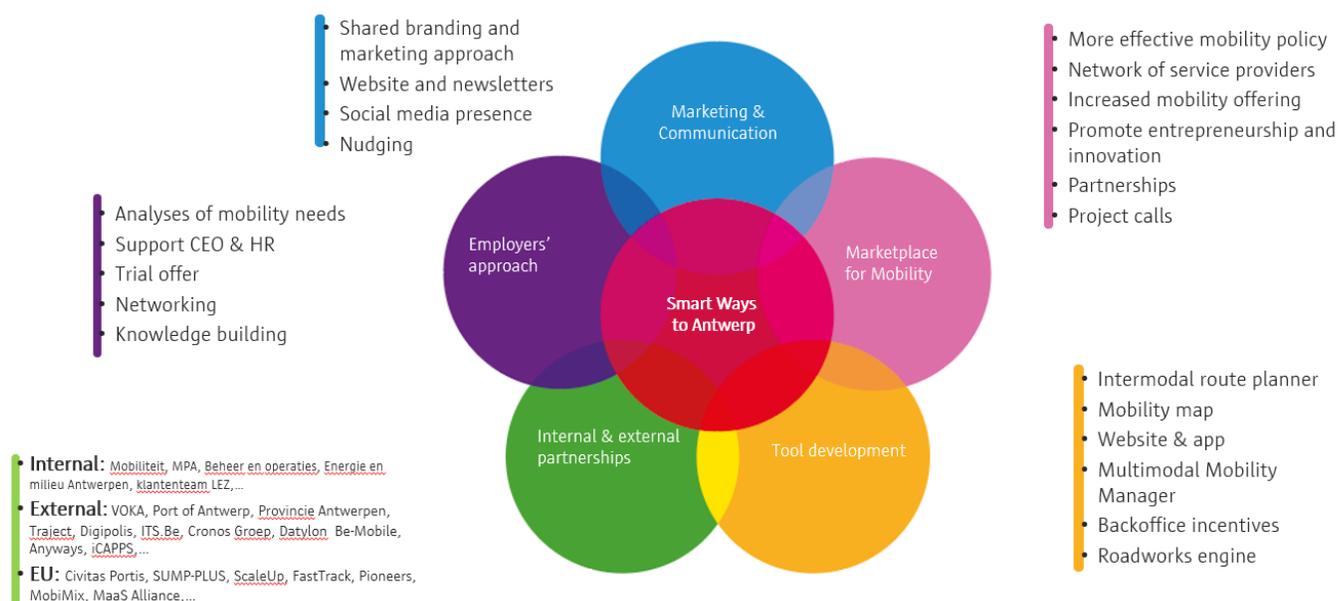


Figure 2: Activities and teams of Smart Ways to Antwerp

As part of the SUMP and the soft measures approach, **Slim naar Antwerpen (Smart Ways to Antwerp/SnA)** was created in 2016. The focus of the SnA is to work on a mind and modal shift for both citizens living in Antwerp, as well as commuters and visitors coming from outside the city. The program of SnA consists of multiple smaller teams, each working on a dedicated topic:

- The **B2C-team** is in charge of communicating towards end-users (both in passenger mobility as well as in logistics). This is done through media campaigns, events, active collaboration with event organizers, a dedicated website and a unique multimodal route planner and



navigation app. The B2C team also provides the necessary communication materials for the yearly mobility report.

- The **B2B-team** is dedicated to supporting employers in helping the employees make a modal shift. This is done through actively contacting big employers in and around Antwerp, providing CEOs and HR-managers with all the necessary information, creating a mobility scan to validate the potential for modal shift and providing employees access to a trial offer of mobility solutions.
- **The Marketplace for Mobility** actively works together with various solutions providers who can contribute to reaching the modal shift of 50/50 in the whole Antwerp transport region. Project calls are organized to attract new and innovative solutions and services for both passenger mobility and urban logistics. Solution providers can easily become partners of the marketplace by filling in a form. In return, communication about their offering is done through the various channels available to SnA.

The team of SnA also closely works together with other mobility teams within the city:

- **Team Modal Shift:** team of the mobility department that is responsible for the various mobility modes available in the city of Antwerp. Where the marketplace tries to attract the various mobility modes, it's up to the Modal Shift team to make sure the right regulations and agreements are in place to ensure that the activities of the mobility providers are in line with the various mobility goals. Team Modal Shift has been developing various dedicated mobility plans (e.g. a new cycling plan).
- **MPA (Mobility & Parking Antwerp):** the unit responsible for everything related to parking and parking management (both on- and off-street). SnA helps MPA to clearly communicate the various parking zone regulations and helps to develop options to guide users to off-street parkings and P&Rs.
- **Public infrastructure:** the team responsible for all street furniture in the city. Together with the team of public infrastructure, SnA developed wayfinding at the various mobility hubs (called "Smart Hubs").
- **NXTMobility:** a collaboration between the mobility department and SnA which focuses on collecting and improving mobility data for usage in various applications.

Under **the umbrella of NXTMobility** a wide variety of digital tools are developed, which support the various actions defined in the SUMP and help to monitor progress. The NXTMobility/data team consists of members of Smart Ways to Antwerp (soft measures) and Team Modal Shift. Together they collect the necessary data, improve and monitor the quality of the data and support both teams in implementing guidelines and regulations with the necessary data requirements.

The data team helps collect and process data for policy evaluation through various platforms:

- **Multimodal mobility manager:** a tool that analyses trip data and vehicle usage. The focus is on monitoring shared mobility providers and reporting on compliance with the shared mobility regulation in Antwerp.

Some of the other tools developed and used by the team are

- **Smart Ways to Antwerp Route Planner (web+app):** a unique multimodal route-planner available via web and app.



- **Traffic Event Management Tool:** tool to input roadworks for usage in the multimodal mobility route planner.
- **Werventool:** converts polygon data to network data. Used to convert roadworks data (polygon) to data that can be understood by route planners.

### 3.1.2 Antwerp SPINE LL use case(s) and requirements

The goal of the Antwerp SPINE Living Lab is to improve the user experience on the **physical layer** at the mobility hubs as on the **digital layer**.

On the digital layer, it became clear that combining the route planner and the mobility map in one application would improve the user experience and knowledge transfer towards users, resulting in a higher likelihood of users choosing the smartest/most sustainable route option. For the physical layer, it became clear that wayfinding on the mobility hubs was still lacking.

**As part of the SPINE project, wayfinding at hubs is being improved. Additionally, digital information is also added to the wayfinding to take away uncertainty for the user and improve the whole user experience.**

In order to achieve improvements on both digital and physical levels, it is also clear that data quality needed to be improved and new data sources needed to be onboarded. This is another measure within the SPINE project. **To improve information related to public transport, a new integration of the static, timetables, and real-time data needed to be developed.** Since the quality of the static and accessibility data of PT was too low, actions have been taken to improve the quality of this data and make the development future-proof.

Since only improving the digital and the physical layer does not necessarily improve the quality of the offer, **The flow at traffic lights is also taken into account within the SPINE project.** Analyses on the existing data is **performed by YUNEX** to see where optimizations on the flow of public transport can be made at key intersections.

By improving the pre-trip, on-trip, and post-trip user experience, the city of Antwerp expects an increase in multimodal trips and higher user satisfaction at mobility hubs.

### 3.1.3 City KPIs and mapping with SPINE objectives

In connection with WP1, and as reported in deliverables D1.1 and D1.2, a mapping of the maturity level of the city mobility context and ecosystem in relation to the initial basket of foreseen interventions was carried out to end up with a consolidated list of SPINE measures for Antwerp.

Through the discussion with WP1 leaders the main KPIs were identified for each of the measures in the LL, as well as baseline, target values, and means of verification. Selected KPIs align SPINE measures foreseen for Antwerp to the SUMP objectives, and specifically:

- Increase of PT share;
- Increase of user satisfaction;
- Reduction of polluting vehicles in the city area.
- Reduction of CO2 emissions;



- Reduction of private car use.

The collaboration between WP leader UAEGEAN and the lead cities is still going on, since SPINE project's main KPIs need to be aligned among SPINE cities and with KPIs identified by sister project UPPER, resulting in a further refinement process of KPIs for SPINE cities, including Antwerp.

A temporary list of Antwerp living lab KPI's, (detailed in D1..2) can be find in Annex A

### 3.1.4 High-level timeline of implemented solutions

Table 2 is a high-level timeline for the implementation of the various solutions for the Spine Living Lab in Antwerp. This is based on the SIAF-tracking method, developed by WP2 leader city of Antwerp. The SIAF management tool enables to monitor the progress of lead city activities and flags any potential delays (more detailed description in D2.1):

- Start
- Implementation
- Activation
- Finish

Table 2: Antwerp Measures Timeline

	ANTW_MS1	ANTW_MS2	ANTW_MS3	ANTW_MS4
	Multimodal hubs/info screens	Real-time information for passengers (for dev)	Multimodal journey planner app	Traffic Management / PT prioritization services
Jan-23	S: initiation of the design process for the multimodal hubs			S: Initiation of the measure with exchange of data. Slow progress due to internal changes at the city and YUNEX
Feb-23				
Mar-23				
Apr-23				
May-23				
Jun-23	I: Original planned start of implementation of the designs	S: start of the process to request updated and more qualitative date from the various mobility providers	S: start of the development process for the renewal of the multimodal journey planner	
Jul-23				
Aug-23				
Sep-23				
Oct-23				
Nov-23	IAF: Start of integration of new data sources and improvement to the data infrastructure, data onboarding. Continues process. Each data flow goes through its own SIAF flow.	I/1: actual start of development for the web component (/1)		
Dec-23				



Jan-24				
Feb-24				
Mar-24				
Apr-24	I: restart of the project due to changes and uncertainties			I: analysis of the first crossroad along a PT-corridor
May-24			A/1: Activation of the website (in ACC) for finetuning)	
Jun-24			F/1: Finalizing development and testing	
Jul-24			F/1: Release of first version of website	I: implementation needs to be further defined depending on the outcome of the analysis
			S/2: start of process to update app	
Aug-24			I/2: Implementation of the required design changes to the app. Activation depends on development challenges	
Sep-24				
Oct-24				
Nov-24	A: Planned first instalment.			
Dec-24				
Jan-25				
Jan-25				
Feb-25				
Mar-25				
Apr-25				
May-25				
Jun-25				
Jul-25	F		F	F
Aug-25				
Sep-25				

### 3.1.5 Operational plan (on city level)

#### 3.1.5.1 Operational factors

Not all measures can be rolled out over the same operational zone. The various operational zones have been defined based on external factors (other projects running, planned works...) and zones that would generate the highest impact with the highest learning factor.

For the digital measures, the focus has been on collecting data preferably at the level of Belgium and The Netherlands when applicable and feasible. This choice has been made because the target audience for the app and website is within this geographic area. However, due to the multilevel, multistakeholder nature of the mobility ecosystem, this has not always been possible within budget, scope, and timeline. For the various modes, the following geographical areas have been used:



- Bus & tram: main focus on Flanders (De Lijn) for detailed information on the map. Route planners' data for the whole of Belgium (BE) and The Netherlands (NL).
- Train: main focus on Belgium for detailed information on the map. Route planners' data for the whole of BE & NL. Some data needed to be added manually by the city of Antwerp. In this case, the focus has been on the close area around Antwerp
- Shared mobility: focus on Antwerp & FUA. Some providers have given the city access to all the data of BE & NL in one data flow. In these cases, the data has been onboarded at these levels and the mobility solutions are also shown in other cities.

For the physical infrastructure, the operational zone has been defined based on the characteristics of the planned mobility hub and the possibility for the city to implement measures without the need for approval of third parties like functional urban area or region of Flanders. The hubs chosen are Operaplein, Mediaplein, Bist, Centraal Station and Olympiade.

For the PT Green Wave, the selection of crossroads for analysis was done based on their connection with the chosen mobility hubs and whether the city has control over the traffic lights at those crossroads. Most of the crossroads on major arteries are under the control of the Flemish region, limiting the possibilities for testing and adjusting the scenarios.

### **3.1.5.2 Mapping of stakeholders**

For the development of the digital layer, Smart Ways to Antwerp already has dedicated partnerships ongoing. To make sure that developments done within the SPINE project can continue after the project, the city opted to work with those partners in the further development of some of the measures. The following stakeholders are involved:

- Digipolis: IT-department of the city of Antwerp
- Studio Hyperdrive: web development
- iCAPPS: app development
- BeMobile: multimodal route planner engine
- Anyways: walking & cycling route planner engine

For the physical components, existing framework contracts were used to ensure continuity after the project:

- o Q-Lite: display provider
- o TecnoArt: street furniture provider

### **3.1.5.3 Decision-making process**

The decision-making process related to the living lab depends on the measures and solutions which will be implemented within Antwerp's living lab. For the measures related to the route planner and digital improvements the core team involved in the challenge consists of 5 experts each with overlapping expertise. Most functional and design choices are made by them. For choices that are more sensitive, a limited number of alternatives are generated and presented to higher governance levels depending on the topic and sensitivity.



## 4 SPINE Antwerp Living Lab Measures

### 4.1 ANT\_MS1: Multimodal hubs/info screens



Figure 3 Wayfinding (non-digital) at Bist

#### 4.1.1 Description and experimentation area

The focus of **ANT\_MS1: Multimodal hubs/info screens** is to improve the user experience at key mobility hubs by improving the wayfinding at the hub and providing the user with improved information. This is done by putting signposts at key locations at the hub and equipping some of them with electronic ink screens carrying real-time information. Onboarding and improving the quality of the data is done in “ANT\_MS2: Realtime information for passengers”. Depending on the location of the signpost, different information will be shown. Next to real-time public transport information, information on available shared mobility solutions will also be shown.

As part of ANT\_MS1, design principles and other possible visualizations and applications are conceptually developed together with a possible broader set of features like notifications in case of events/calamities.

The city of Antwerp is also looking into renewing the parking guidance systems. Thanks to the work done on multimodal hubs and their info screens, there is an interest to see whether both the parking guidance system and the multimodal hubs screens can use the same design principles or even the same data management system.



#### 4.1.2 Actors and stakeholders

The city of Antwerp has existing framework agreements with providers of the various hardware components needed for the construction and installation of the signpost. Where possible, these contracts are used to enable faster and smoother roll-out.

Table 3: Actors & stakeholders info-screens

Name	Description	Internal/external	Role
<b>Team Smart Links</b>	The team within the city responsible for the physical design of the public domain and the defining the locations of the various hubs	Internal	Project lead
<b>Smart Ways to Antwerp</b>	Part of the communication and participation unit of the city of Antwerp responsible for communicating the various mobility solutions to the end-users and using soft measures to influence mobility behavior	Internal	Design lead
<b>Q-Lite</b>	Hardware provider responsible for screens in Antwerp	External	Technical partner
<b>TecnoArt</b>	Hardware provider of the street furniture in Antwerp	External	Technical partner
<b>De Lijn</b>	Public transport providers. They also have displays on the public domain and are a key data provider	External	Knowledge partner

#### 4.1.3 Detailed Implementation plan

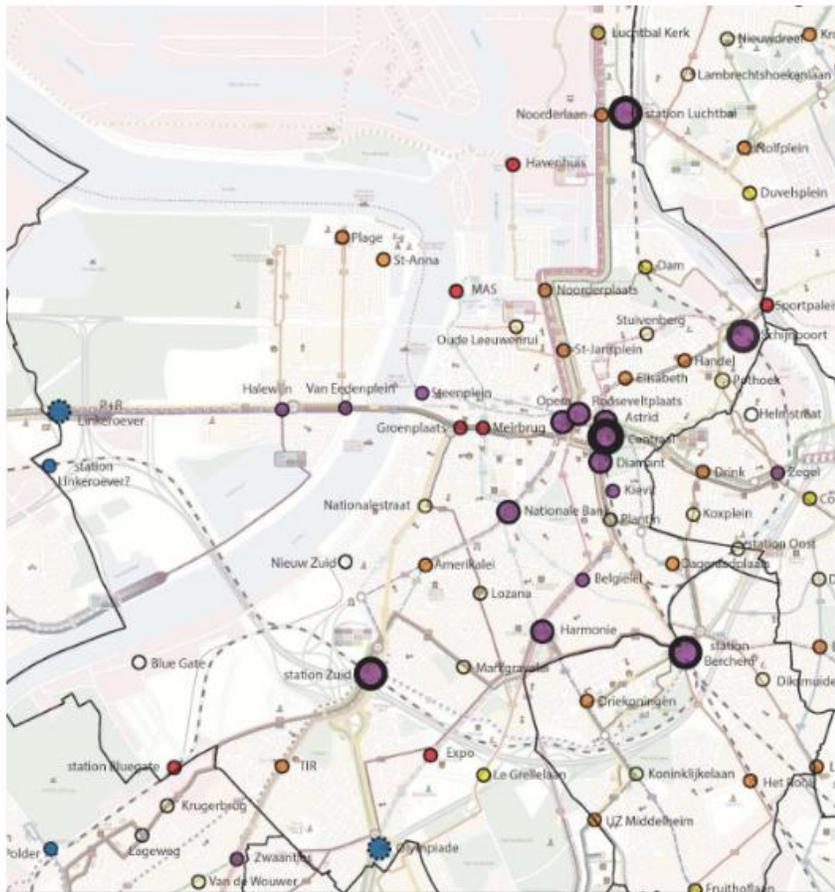
As an initial step, a selection of possible mobility hubs and their locations were chosen. Before the start of the project, a list of mobility hub locations was already defined together with the requirements of these hubs but the designs of most of the hubs were not done yet. In the first phase, a selection of the hubs with the most potential was made. Depending on the existing state and design of the location, some infrastructural changes needed to be made. In most cases, these changes were limited to moving bus stop locations or drop-off zones for shared mobility solutions. The selection of the hubs and the start of the redesign/planning process were done between April 2023 and August 2023.

Table 4: Implementation plan info-screens

Step	Time	Activity	Description	Objective
<b>A1: Empathise</b>	sep23	Knowledge exchange PTO De Lijn	A knowledge exchange workshop on design principles for displays in the public domain and design principles for wayfinding	Aligning the various efforts related to wayfinding in the public domain with all stakeholders and using the same design principles.
<b>A5: Test/technology</b>	Jun2023	Field test elnk screens	Field test of the elnk screen technology to validate the	Ensuring readability under most weather conditions.



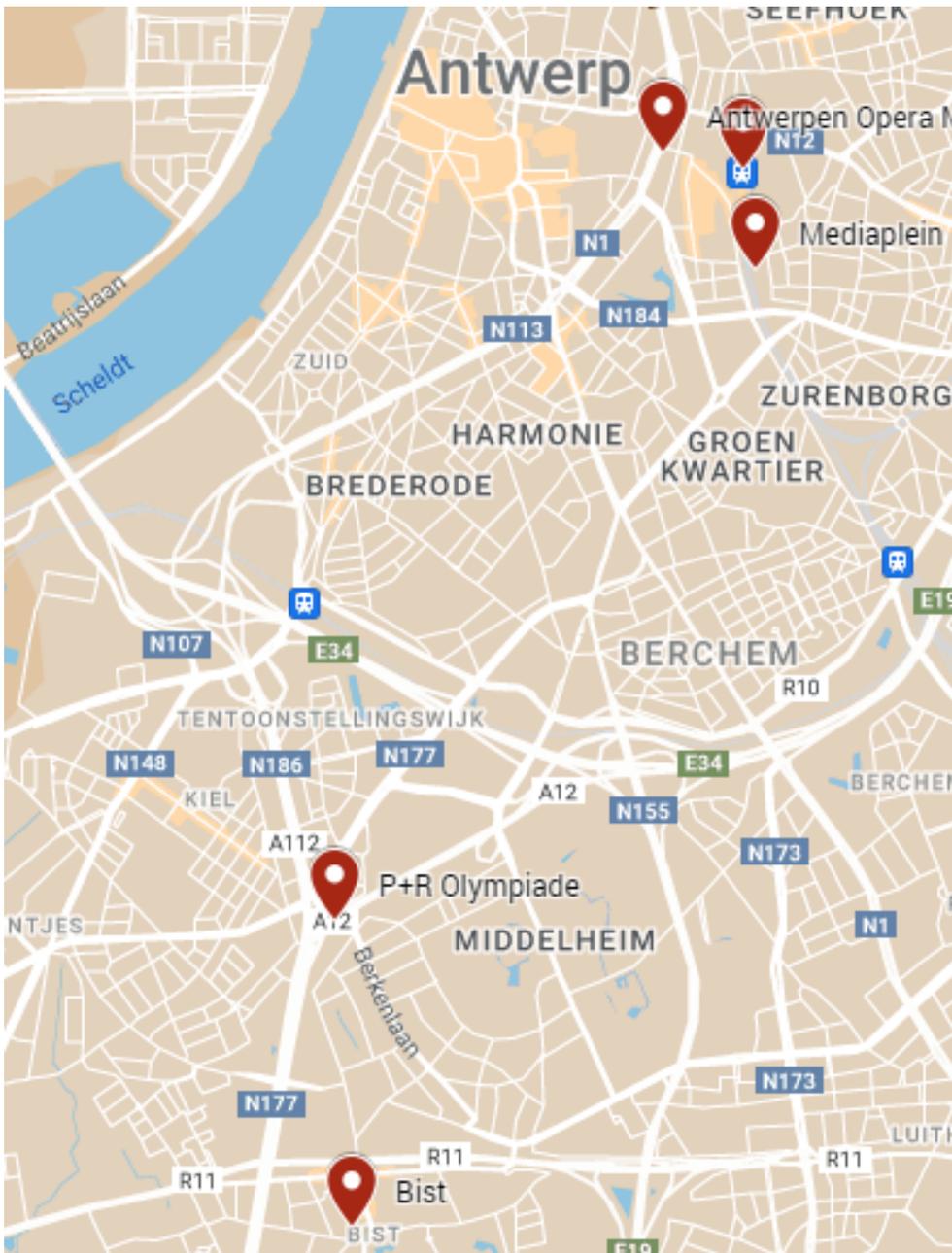
			technological choices made	
<b>A2/A3: Define &amp; Ideate</b>	Jun 23-Nov23 Apr24-Jul24 (continued)	Design of screens and public domain	Design of the various elements of the mobility hubs, wayfinding and displays.	
<b>A5: Test/readability</b>	Oct23	Icons & design validation inclusiveness	Validation of the redesigned icons and designs by the ATLAS team (inclusiveness panel)	Ensuring that icons are generally understood as intended.



- **Locations & categories** i.c.w. local councils, Transport Region, ...
- 125 hubs on Antwerp territory:
  - 5 ‘interregional’ (main stations)
  - 13 ‘regional’ (P&Rs + bus/tramhubs)
  - 70 ‘local’
  - 38 ‘neighbourhood’
- 5 subcategories/types
  - Residential areas
  - Residential + attraction areas
  - Attraction
  - Interchange + attraction area
  - Interchange

Figure 4: Overview of Smart Link/hub locations

After [selecting 5 locations](#) with the most potential and for which the redesign timeline would fit within the timeframe of the project, the development of the signpost was started. The selected locations are shown in Figure 5 to Figure 10.:



- Operaplein: a complex node where tram, metro and busses from the whole region come together. Different levels, multi-stakeholder, multi-location
- Mediaplein
- Antwerpen Centraal: main train station:
- P&R Olympiade
- Bist

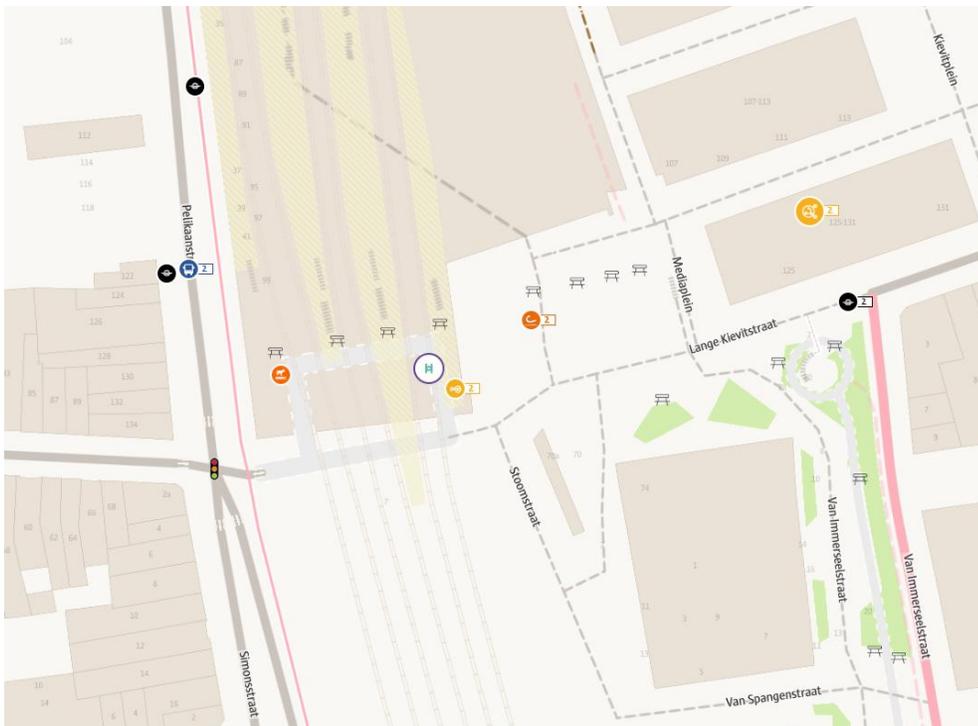
Figure 5: Location SPINE LL Mobility Hubs



**Operaplein:**

- Connects to main bus terminal Rooseveltplaats in the north
- Is located on the "Via Sinjoor", a key pedestrian boulevard going east to west
- Connects several trams en metros on multiple levels
- Includes parking garages (with car sharing solutions)
- Entrance to the main shopping street to the west.

Figure 6: Operaplein



**Mediaplein**

- Alternative exit for the main train station (Antwerpen Centraal)
- All shared modes, trains and parking

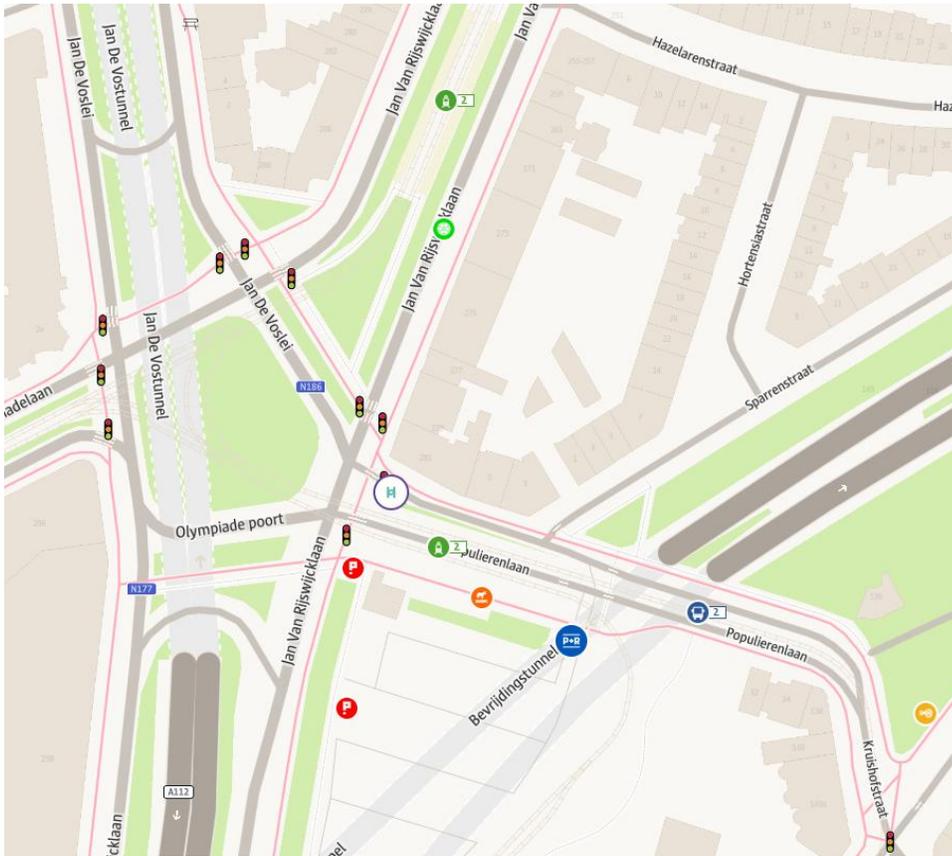
Figure 7: Mediaplein



### Antwerpen Centraal

- Main train station
- Multi-level, multi-location, multi-stakeholder
- Serves all modes
- Key international hub

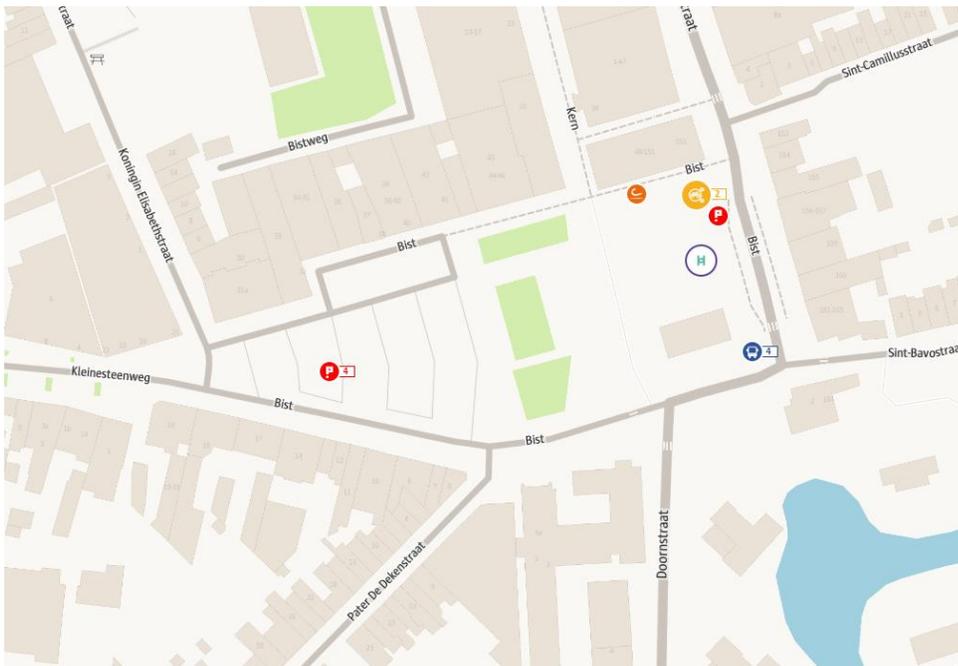
Figure 8: Train station ‘Antwerpen Centraal’



**P&R Olympiade**

- Important entry point for cars coming from the south of Antwerp.
- P&R with buses and trams to the city center
- All shared modes available

Figure 9: P&R Olympiade



**Bist**

- Local municipality hub with key bus connections to city center.
- Shared mobility and busses

Figure 10: Bist



After the selection of the test locations, the development process was started. This consisted of three design flows: physical design of the signpost, print design of the signpost and digital design of the screens on the signpost.

- **Physical design:** there is a catalogue of possible street furniture that can be used for the placement of signs in the public domain. After the design of the technical components of the screen that needed to be placed, it was clear that the existing product available was not deep enough to carry the screen. Therefore, new designs were made so that the technical components would fit within the frame.
- **Print design:** as part of the physical design, wayfinding was added to the signposts. A design system was created, and design choices were made. As part of the graphical design of the wayfinding, the icons were redesigned so that the icons used on the website of the city of Antwerp, on Smart Ways to Antwerp and on the wayfinding, would be inline. Other design choices are related to color choices, addition of a QR-code, and addition of basic information for the users. The designs were also validated with the inclusion group of the city. (Figure 11)
- **Digital design:** various visuals of for the elnk screens were made, and tests in various light conditions of the displays were performed. The visual designs have been validated and have been made ready for development. (Figure 12)

The three design processes have been running in parallel throughout September 2023 up to December 2023. Due to uncertainty of a requested change in spending from the purchase of screens, the development of software to manage the screens was put on hold. After clarification, it was decided to leave the management of the content of the screens in the hands of the provider of the screen technology. Development of the platform and implementation will start in September 2024.

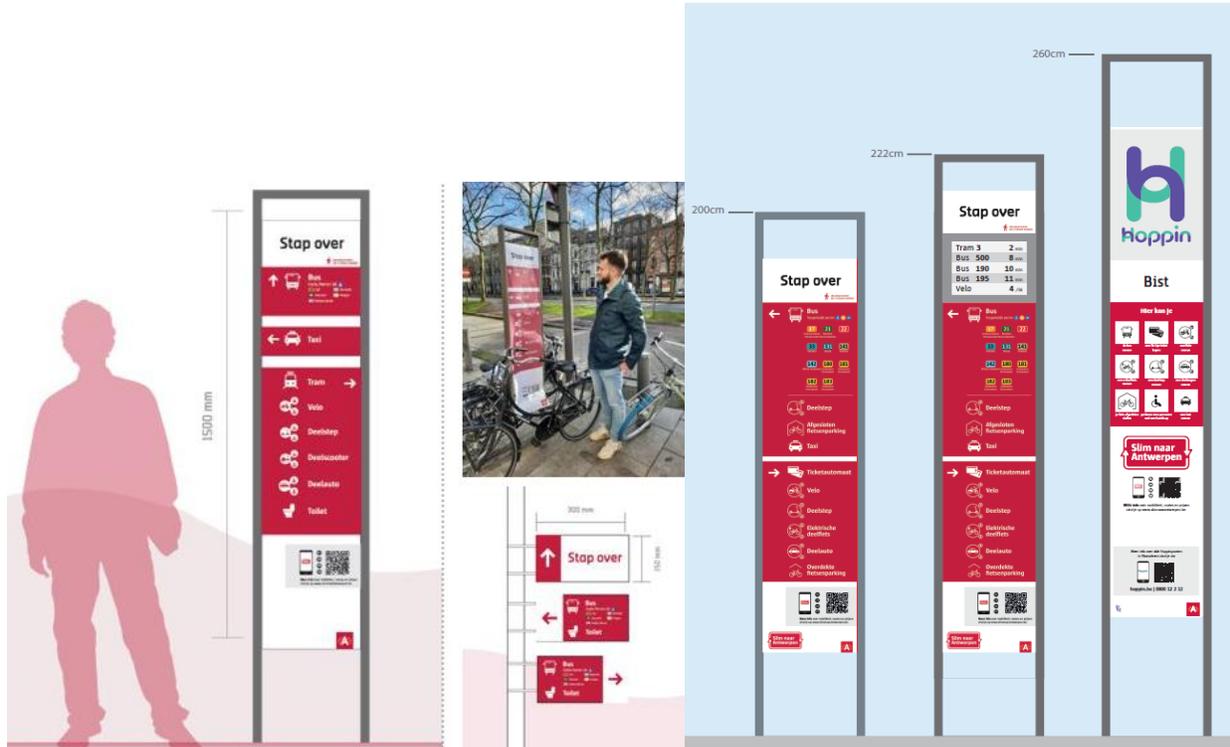


Figure 11: Concept design of current wayfinding at hubs and concept variations including digital display (middle) and combination with Hoppin brand Flanders

### Display principles

		<i>Titels</i>	
<i>Pictogram of lijnaanduiding</i>	3	<b>P+R Merksem</b> via Deurne	2 min
<i>Mededelingen</i>	650	<b>Regatta</b> Geen tracking info	2 min
	3	<b>Wijnegem</b> Rijdt niet	<del>10:15</del>
<b>Varianten volledig scherm</b>		<b>Deelsteps</b> 4 Poppy   2 Lime   2 Bird	8 stuks
<b>Lijnvarianten</b>		<b>Hinder door Antwerp 10 Miles</b>	
<b>&lt;= Kleurversie</b>			
			<i>Betrouwbaarheidsinformatie</i>
			<i>Tijd en beschikbaarheid</i>
			<i>Vrije tekst/notificaties</i>

Figure 12 Design principles for the elnk display



Since there is a delay in both the manufacturing of the screens as well as in the development needed to display the information on the screens, the first signposts have been installed without the technical components. As soon as the technical components are available, they will be installed on location and the printed signs will be replaced with one with cutouts for the screens.

#### 4.1.4 Actual and future Business model

The current business model for the signage at mobility hubs is through the default framework contracts of the city. By using these existing providers, it is assured that the developments performed during the SPINE projects can be continued at the end of the project. This ensures continuity for all parties involved.

There is currently no business model behind the signage at mobility hubs. Possible future business models will be explored later in the project.

#### 4.1.5 Monitoring Measure ANT-MS1

Since it is impossible to measure the impact on the user experience through sensor data or other quantitative data, the impact of the measure will be monitored based on regular surveys at the locations themselves.

Another source of feedback on the user experience at the hubs are at least two co-creation workshops that will be organized in Q4 of 2024. As part of the co-creation workshops, a 'mobility safari' will be organized in which various stakeholders, user groups, and experts are sent out to the 'urban jungle' to find their way and spot some of the mobility providers and solutions in the city. These mobility safaris have proven to be very valuable ways of getting input from various stakeholders through letting them really experience the solutions firsthand. After these validations, a re-assessment will be done of the wayfinding and improvements will be implemented where possible.

Table 5: Monitoring Measures ANT\_MS1

Monitoring Activity	Measurement approach	Measurement	KPI
Mobility survey	The survey is done every 2 years for the whole city area using a random sample. Data can be extrapolated to smaller areas.	Modal shift, mobility satisfaction.	PT ridership, PT user satisfaction
Qualitative interviews	On-location survey with random users.	User experiences and user satisfaction of solution	PT user satisfaction



## 4.2 ANT\_MS2: Realtime information for passengers

### 4.2.1 Description and experimentation area

Providing the right information at the right time in the right format is essential to inform travelers. Although real-time data from public transport was already available through some channels, as part of the SPINE project, the real-time information for travelers has been improved and extended. The developments done within this measure serve as an input for ANT\_MS1 displays at the hubs and ANT\_MS3 Redesign journey planner.

### 4.2.2 Actors and stakeholders

Key stakeholder for the real-time information for passengers is Smart Ways to Antwerp. Data will be included in the route planner and mobility map of Smart Ways to Antwerp in the first phase. Additionally, the team Modal Shift is a stakeholder since they are responsible for follow-up of the onboarding, and they also use real-time data for analysis.

A second key stakeholder is Digipolis, the IT-partner of the city of Antwerp. They are the technical provider for the onboarding of the data, providing the API-store and doing data conversions/improvements where needed.

Other actors within this measure are the various mobility providers ranging from PTOs to share mobility providers to parking garage operators. Some of these players are required to provide access to real-time data to the city through operating licenses. Others are not required to share information with the city and only do this if they see a business opportunity.

A fourth actor are the higher-level governments (Flemish region, Belgian Federal state) which all have key data which is also used by the various apps of Smart Ways to Antwerp.

Table 6: Actors & stakeholders real-time information

Name	Description	Internal/external	Role
<b>Team Smart Ways to Antwerp</b>	Team working on communication of mobility solutions using nudging techniques. Developers of the route planner and other communication materials.	Internal	Measure lead
<b>Digipolis</b>	IT-department/partner of the city of Antwerp responsible for onboarding data	Internal	Technical partner
<b>Mobility Providers</b>	All mobility providers active in Antwerp. They are the main data providers.	External	Data provider
<b>Flanders</b>	Various departments within the Flemish government have data that is useful for the various applications of Smart Ways to Antwerp and the Smart hubs.	External	Data provider



### 4.2.3 Detailed Implementation plan

In the first phase (September 2023), use cases were developed, which described the various possible information flows and user flows for the redesign of the multimodal journey planner. These use cases were then translated to a data need. Based on the data need, research was performed to find out which of the data was already available, in which format, for which purposes, and at which geographical scale.

In a parallel implementation phase, the onboarding of data sources was started. This consists of finding the right endpoint to onboard the data, getting permission to use the data, agreeing on a DLA, checking the quality of the data, etc. Depending on the data owner and the level of maturity of the IT-solution of the data owner, development levels varied.

The onboarding process is still ongoing but key data sources have been made ready for ANT\_MS1 and ANT\_MS3.

Table 7: Implementation plan real-time information

Step	Time	Activity	Description	Objective
<b>A3: Ideate</b>	Oct23-Feb24	Weekly ideation and design meetings	Regular meetings to discuss and define the various features, design layers, views, user flows, ...	A clear plan and concepts for the developers to work with to ensure efficient development
<b>A4: Prototype</b>	Oct23-Feb24	Biweekly sessions with UX designers	Regular meetings with the UX designers to validate the ideas, concepts of the weekly ideation and design meetings	Ensuring a consistent and streamlined user experience throughout the whole user flow

### 4.2.4 Actual and future Business model

There is currently no business model behind the integration of real-time data. Due to the architectural setup of the infrastructure of the city of Antwerp it is possible to provide third parties an access to the various data sources through an API-store. The platform is actually being reviewed for an update.

### 4.2.5 Monitoring ANT-MS2

For the onboarding of real-time data from the various mobility providers, the percentage of the number of mobility providers who deliver data in a correct and qualitative way is used.

### 4.2.6 Risks and mitigation measures

The main risks associated with real-time data are:



**Mobility providers are reluctant to give access to their data.** To mitigate this, much of the requested data falls under the MMTIS regulation, which mandates that mobility providers must grant access to certain data sources. Additionally, the system's functionality is designed to be easily toggled on or off to adapt to data availability.

The potential **reduction in the capacity** of Digipolis, Antwerp's IT-partner responsible for onboarding real-time data. To counter this, there are provisions to utilize external development resources if the internal capacity of Digipolis becomes insufficient.

## 4.3 ANT\_MS3: Multimodal journey planner app

### 4.3.1 Description and experimentation area

In the past five years, Smart Ways to Antwerp has been developing a multimodal route planner and a mobility map with all the necessary information for travelers as shown in Figure 13. The route planner is unique in the possible routing combinations it can make and the possibility for the city to define routing logic. The focus of the route planner is not only on the city of Antwerp or the functional urban area around Antwerp, but it also serves the whole region of Belgium and the Netherlands. It is also noteworthy to mention that the level of detail of most data sets used is highest in Antwerp.

Through the website, a mobility map is also available on which the user can visualize various data layers like parking zones, locations of shared vehicles, low emission zone, and public transport stops. However, in 2022, as part of continued user research and survey, it became clear that most users didn't find their way to the mobility map and didn't understand all of the functionality that was available on the mobility maps. The survey also showed that most users did find the information very useful once they found their way around it. A redesign of the mobility map and a user-friendly integration into the route planner was imminent.

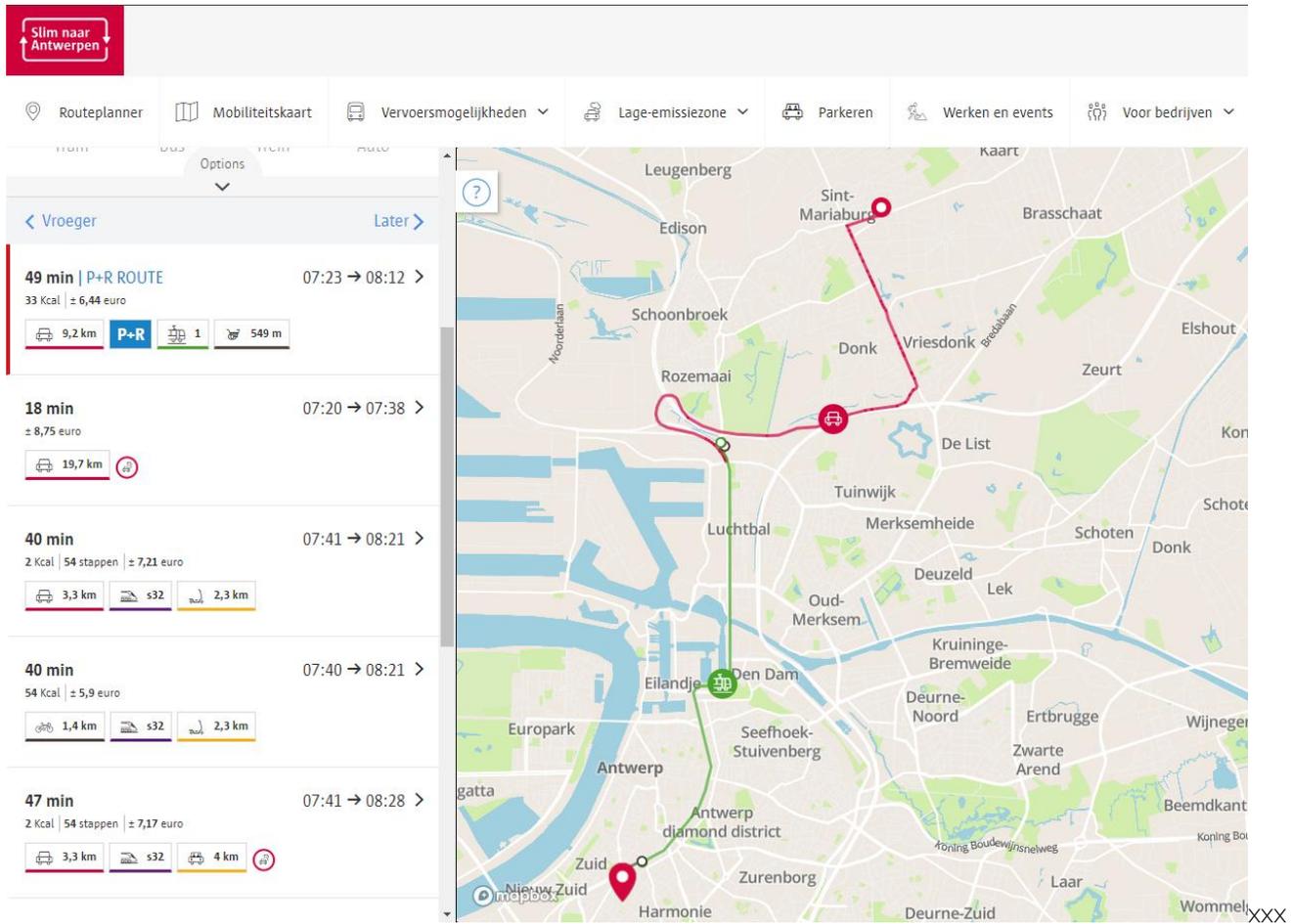


Figure 13: Old route planner interface and map

### 4.3.2 Actors and stakeholders

Table 8: Actors & stakeholders, multimodal journey planner

Name	Description	Internal/external
Smart Ways to Antwerp	The redesign of the multimodal journey planner app is initiated and managed by the Smart Ways to Antwerp team. They have the final decision on the features required and take most of the design decisions.	Internal
Data cell of Antwerp city Department for Urban Development	The data cell is in charge of the data that is used by the multimodal route planner and mobility map.	Internal
Digipolis	Digipolis is the IT-partner of the city of Antwerp. They provide technical support and infrastructure.	Internal
Studio Hyperdrive	Studio Hyperdrive, web-designer, is in charge of the redesign of the website of Smart Ways to Antwerp.	External



iCAPPS	iCAPPS, software-developer, is responsible for the redesign of the app of Smart Ways to Antwerp and for the integration of the redesigned route planner and mobility map in the app.	External
BeMobile	BeMobile has developed a multimodal routing engine. For the redesign of the website, no major developments on the routing engine have been planned	External
Anyways	Anyways provides the routing engine for walking & cycling. For the redesign of the route planner and mobility map, no major development of the routing engine has been planned.	External

### 4.3.3 Detailed Implementation plan

From September 2023 to March 2024 use cases were developed through weekly workshops and data requirements were defined, which were used as input for ANT\_MS2. Participants of the workshop depended on the topics handled. For most topics, experts in the specific mobility fields were consulted e.g. for inclusiveness related challenges, the ATLAS<sup>2</sup>-team made their test-team available. Based on the use cases, designs, and visualizations, priorities were defined. Multiple efforts were made to improve the data quality and increase the geographic scope of the data.

Once the use cases were clear, they were translated into technical requirements and development pathways by Studio Hyperdrive. Development and acceptance environments were set up starting January 2024 and development in these environments is still ongoing.

The launch date of the redesigned website is planned for June 25<sup>th</sup> .2024 with a press release on June 28<sup>th</sup>, 2024.

Table 9 shows the main blocks of the implementation plan for the multimodal journey planner.

Table 9: Implementation plan multimodal journey planner

Step	Time	Activity	Description	Objective
<b>A3: Ideate</b>	Oct23-Feb24	Weekly ideation and design meetings	Regular meetings to discuss and define the various features, design layers, views, user flows, ...	A clear plan and concepts for the developers to work with to ensure efficient development
<b>A4: Prototype</b>	Oct23-Feb24	Biweekly sessions with UX designers	Regular meetings with the UX designers to validate the ideas, concepts.. of the weekly	Ensuring a consistent and streamlined user experience throughout the whole user flow

<sup>2</sup> Atlas, integratie & inburgering Antwerpen offers information and support to non-Dutch-speaking newcomers and organisations from the city of Antwerp.



			ideation and design meetings	
<b>A5: Test</b>	Oct23-Feb24	WCAG check & validation	Throughout this period five workshops with targets groups were performed and analysis were made to ensure WCAG compliance of the web interface	Ensure WCAG compliance
<b>A2: Define</b>	Oct23-June24	Data collection, quality improvements, onboarding, ...	Continues actions related to defining the data requirements, hunting down the data, onboarding various data sources.	Improve information provided through the user interface
<b>A4: Prototype</b>	March24-June24	Configuring and validating design	Configuring the acceptance environment of the website, setting all the information and layers correct, validate the implementation, change assumptions and bug fixes	Ensuring a validated product before product launch

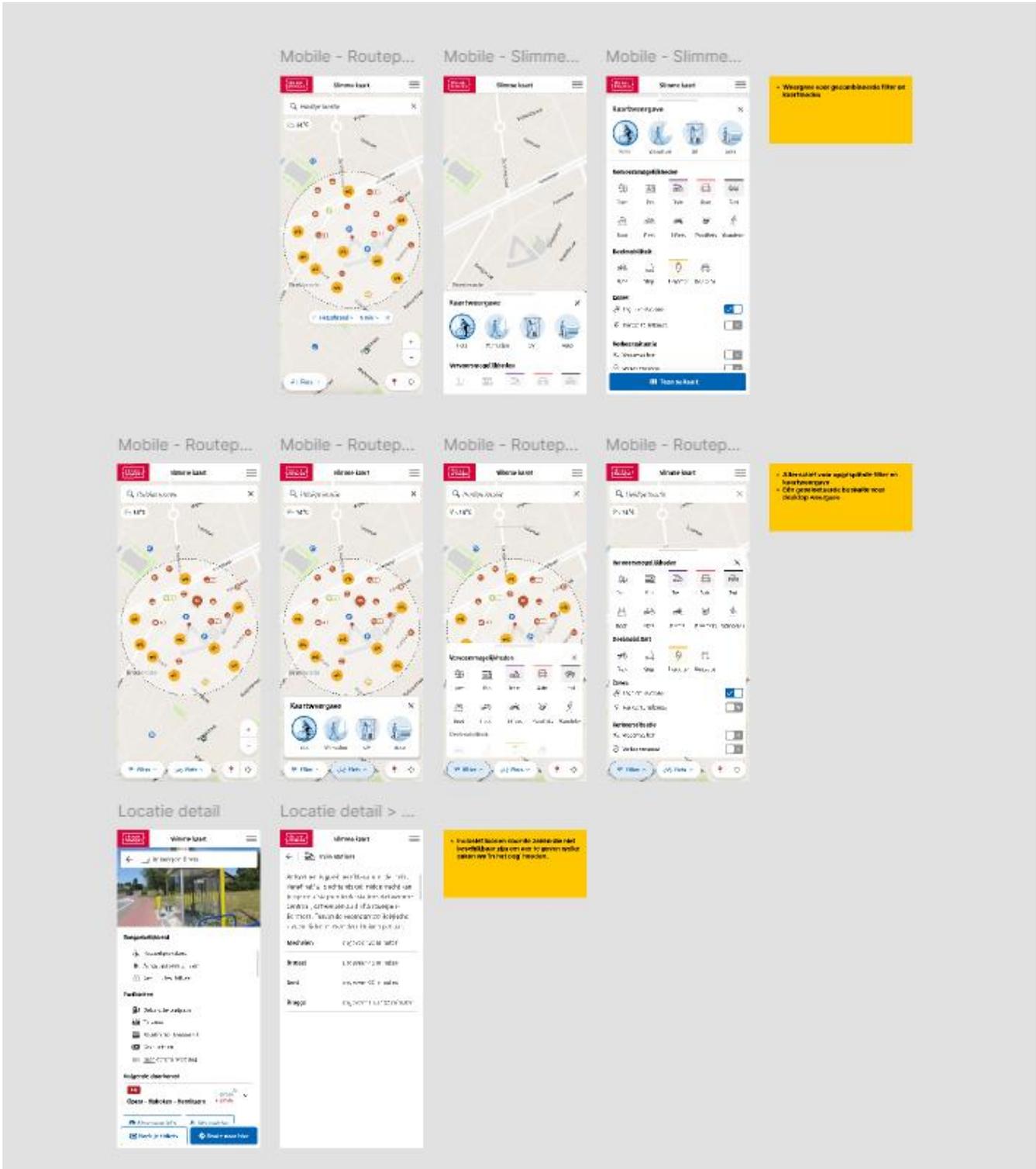


Figure 14 Concept designs

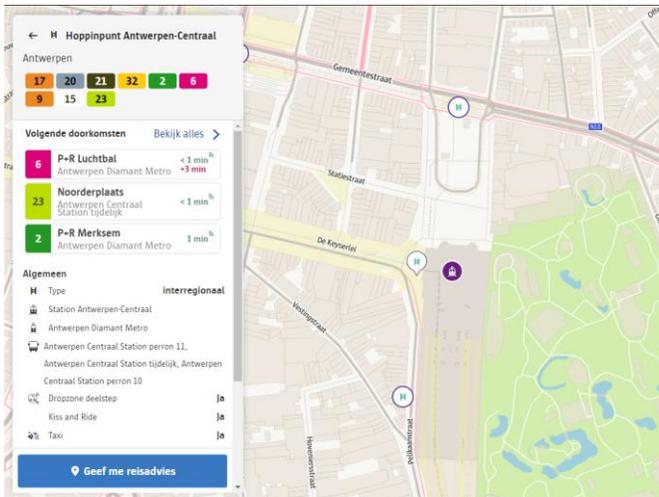


Figure 15 Actual implementation of information for a mobility up.

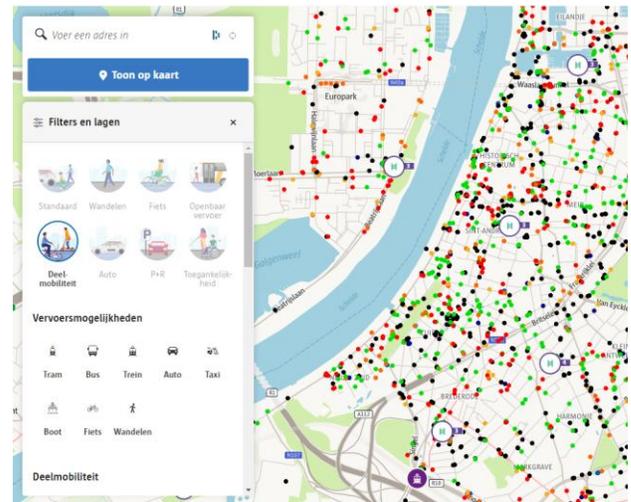


Figure 16 Dedicated view per mode with custom layers and base map

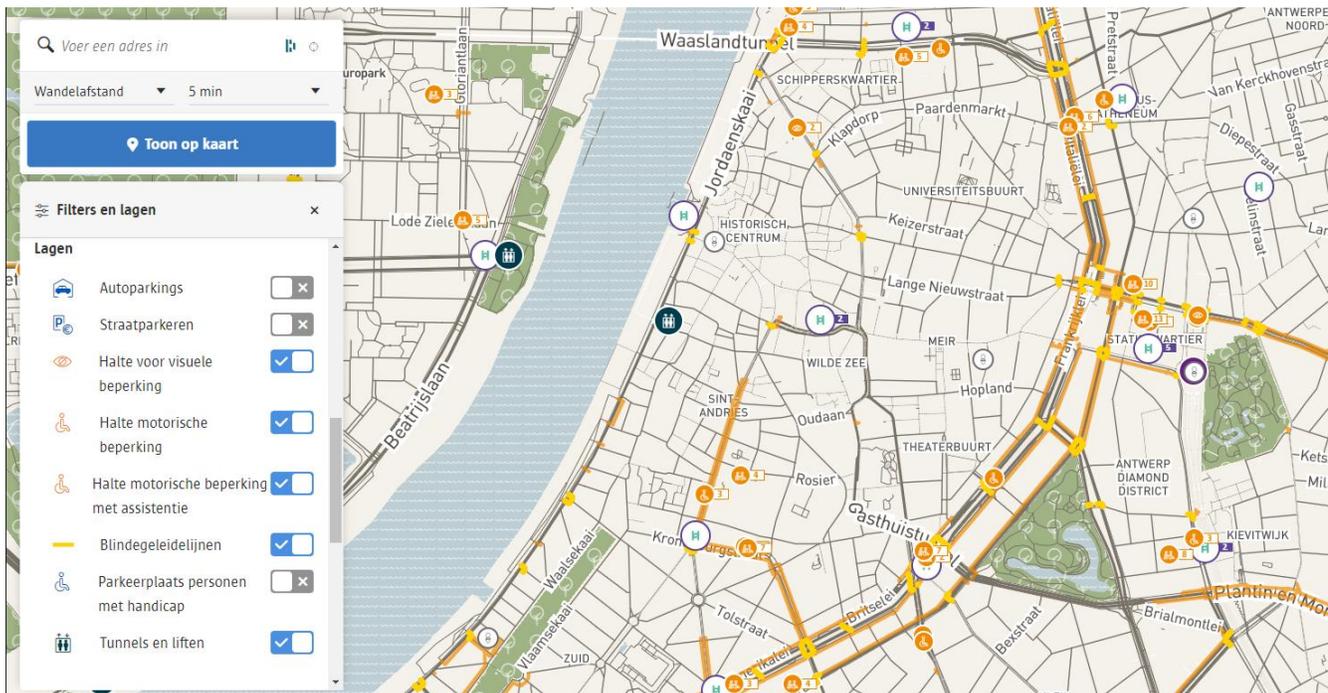


Figure 17 Dedicated accessibility map with extra info on parking, PT-stops, toilets etc.

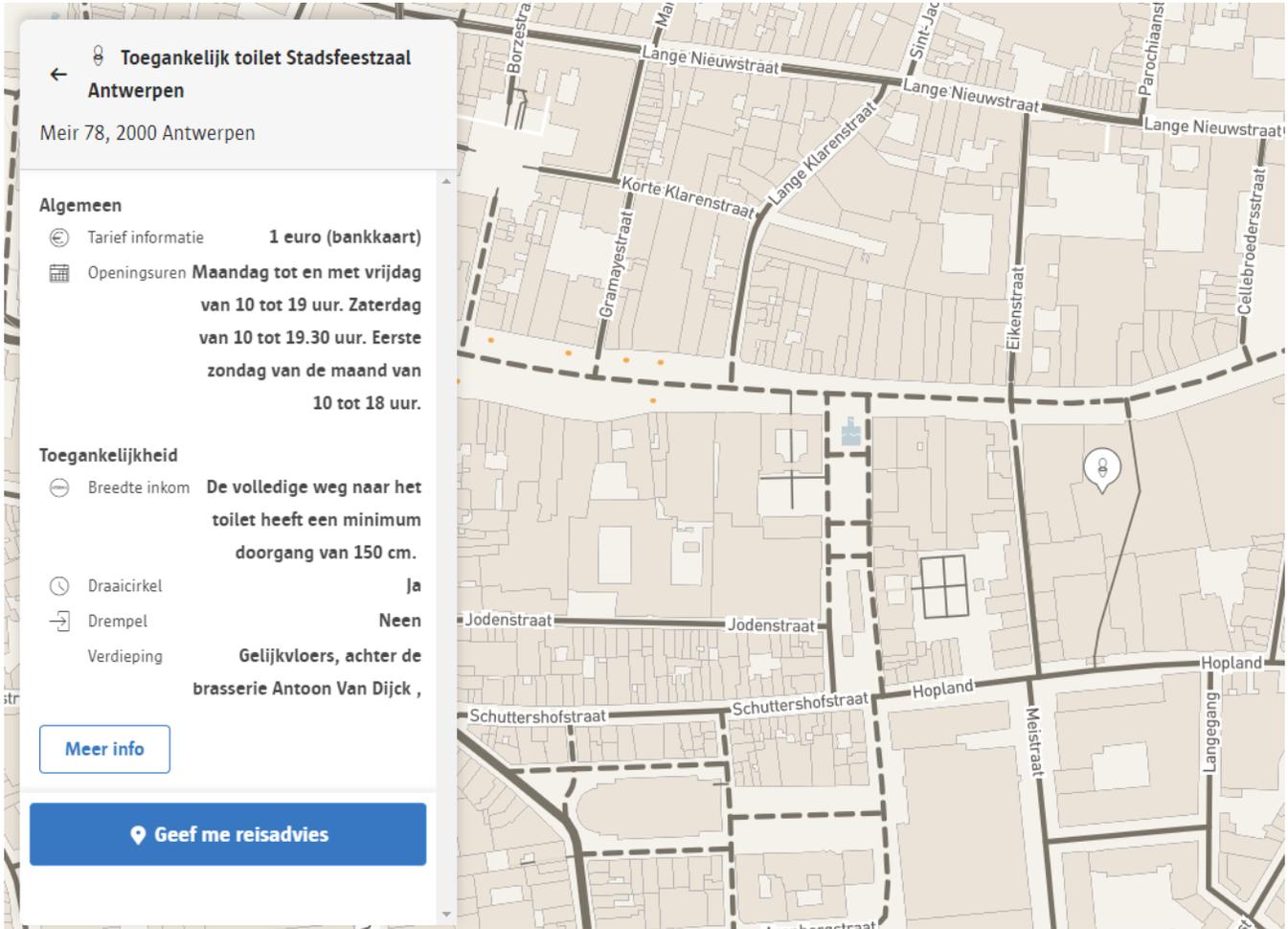


Figure 18 Detail information for accessible toilets

### 4.3.4 Actual and future Business model

Currently the full cost of development of both the website, route planner and app are covered by the city of Antwerp. Possible future business models and collaborative models are being researched.

### 4.3.5 Monitoring ANT-MS3\*

Since the route planner is an online tool, it is relatively easy to monitor and track usage of the route planner. The key indicator that can be used for the evaluation of this measure is the number of unique users visiting the website. Related to the SPINE-project, however, an even more interesting indicator is the number of route requests generated by users. Due to privacy reasons, it is not possible to track more information than this (origin-destination, route option chosen/taken, actual route followed...). Deeper insights related to the actual usage of the route planner will be collected through surveys.



Table 10: Monitoring ANT\_MS3

Monitoring Activity	Measurement approach	Measurement	KPI	Due Date
Number of route request	Website/app tracking	Number of route requests generated		Continuous
Number of navigation requests	App tracking	Number of times a user has started the navigation in the app.		

#### 4.3.6 Potential risks and mitigation measures

The main potential risks identified for the route planner and mobility map are:

**Lack of qualitative data:** a route planner needs a lot of various data (e.g. PT-time table, road network data...) sets which need to be of a high enough quality to provide routing advice that is useful and correct. This data is not always easy to find. Key mitigation measures include: 1) making the sharing of data a key element in regulations, procurement, and other collaboration tools. 2) active participation in data-related activities (e.g. Expert Group on Urban Mobility of DGMove, data standardization processes in Flanders...) on all levels to ensure clear regulation is drafted. 3) definition of clear data use cases to build trust among stakeholders.

**Lack of interest:** although Smart Ways to Antwerp is a recognized and strong brand, and the first version of the route planner and mobility map have been part of the communication before, it is uncertain whether the new version will generate enough interest to draw an interesting percentage of users away from key players like Google Maps and Apple Maps. Key mitigation measures include: 1) renewed media campaign to promote the new implementation, 2) extending the functionality to make it possible for third parties to implement the route planner through a widget on their own website.



## 4.4 ANT\_MS4: Traffic Management & PT prioritization

### 4.4.1 Description and experimentation area

Since 2018, the city of Antwerp has been using a new traffic computer 'VLCC' (Traffic Lights Coordination Centre) to control traffic lights. From 2023, all intersections in and around the city of Antwerp are controlled by this new traffic computer.

The intersections connected to the VLCC have different light controls and waiting times that can be monitored and programmed remotely. Which traffic lights are most applicable is determined by **detecting the various road users**. For example, the lights can only give certain directions green based on the presence of a road user and pedestrians, cyclists and motorized traffic in other directions will get more green lights and therefore have to wait less time.

In addition, the city of Antwerp is looking at which intersections can be made **conflict-free**. Fewer conflicts mean that different directions get separate green and the waiting time for the different road users increases. To limit the effect on the flow, the VLCC uses multiple detectors. At the intersections that cannot be made completely conflict-free, the conflict is indicated by a flashing light. This way, drivers know to watch out for pedestrians and/or cyclists crossing.

#### Detection of different road users

In order to use dynamic steering of the light, the traffic lights need to know when road users arrive at the intersection. For example, green times can be requested, extended or skipped. Depending on the road user, detection is done in different ways.

- **Pedestrians and cyclists** usually have to request green light via a push button. At some intersections, automatic detection via a thermal camera or radar detector is used. However, this is not possible at every intersection because cyclists or pedestrians can often approach from different directions or turn at a traffic light instead of crossing. In these cases, automatic detection would unnecessarily cause red lights for other road users.
- For **motorized traffic**, loops in the road surface detect whether more or less green time is needed. The detection of motorized traffic can only be done a few meters before the stop line. To be properly detected, you must therefore always drive up to the stop line and connect well to the green light.
- **Public transport** is detected in a different way. 'De Lijn' buses and trams are provided with equipment that sends signals when approaching an intersection. In this way, priority can be given to the public transport vehicles

In total, the city of Antwerp can dynamically control 120 crossroads in the city. The City of Antwerp already uses some of the technology provided by the SPINE technical partner Yunex, making it relatively easy to exchange data.

Since many of the traffic lights on key corridors are under the control of Flanders, an analysis was made to identify potential crossroads for the implementation of this SPINE measure. The selection criteria were:

- Traffic lights under the control of the city of Antwerp
- Equipped with the necessary hardware



- On a key public transport corridor
- Preferably connecting a P&R with the city center
- Both tram and busses
- Sufficient other modes using the crossroad

Only a very limited number of potential crossroads fit these selection criteria. The crossroad (Figure 19) selected for analysis by Yunex is in the north of Antwerp and is heavily used by both trams and buses coming from the P&R Luchtbal (Figure 20). In 2023 a new hospital also opened nearby which changed the dynamic of the crossroad significantly. Before the opening of the hospital, the main directions were north-south and traffic coming from the east direction. The exit on the west side was only used for very local traffic. Since the opening of the hospital, the west exit is also often used by traffic coming from the south and east side. The east-side traffic crosses the public transport lane and can influence crossing times significantly.

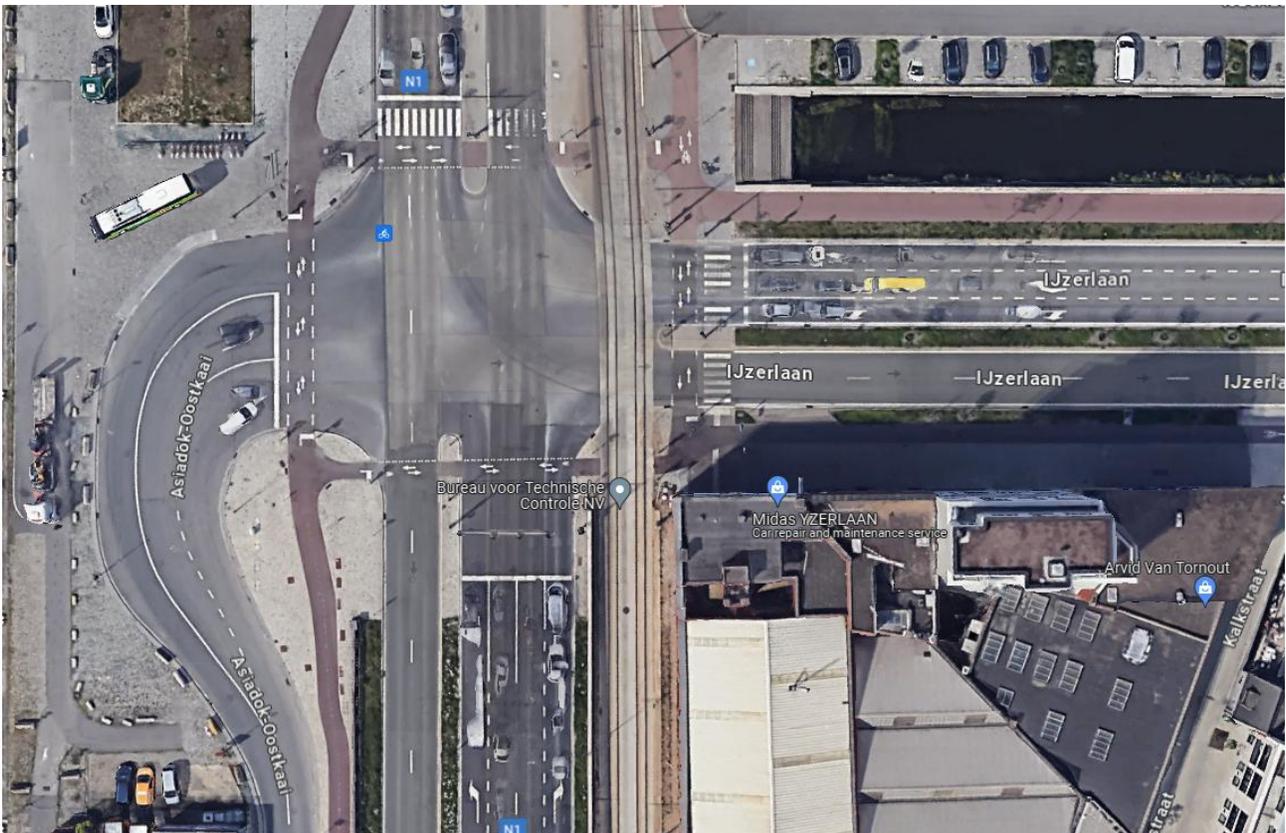


Figure 19: Satellite view of the first crossroad analyzed

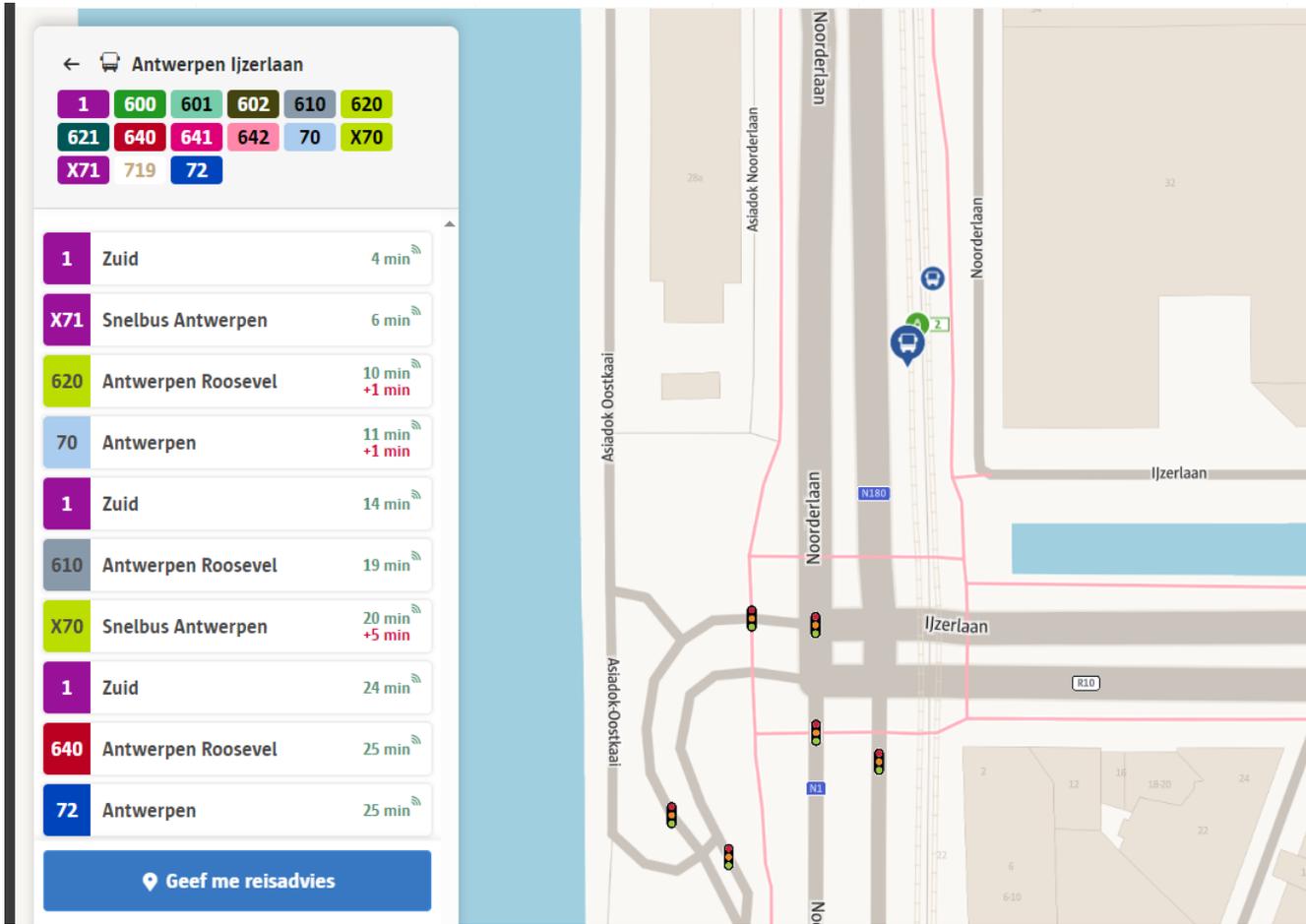


Figure 20 Southbound public traffic at the crossroad at 11am

#### 4.4.2 Actors and stakeholders

Table 11: Actors & stakeholders PT prioritization

Name	Description	Internal/external
Smart Ways to Antwerp	The redesign of the multimodal journey planner app is initiated and managed by the Smart Ways to Antwerp team. They have the final decision on the features required and take most of the design decisions.	Internal
VLCC-Team	Unit responsible for the programming of the traffic lights	Internal
YUNEX	Technical partner/solution provider for traffic light steering software. Partner in SPINE?	External



#### 4.4.3 Detailed Implementation plan

Optimization of the analyses for public transport prioritization in general and for the selected crossroad in particular will be further examined by Yunex in cooperation with the VLCC-Team of Antwerp within the framework of the SPINE project as described in the next sub-section 3.4.4.

#### 4.4.4 Actual and future Business model

##### Approach

In D.1.2, the lead cities' logic behind their basket of SPINE solutions has been investigated, detailing how these solutions could contribute towards the SPINE city's objectives, which partnerships and stakeholders should be involved, which actions are required and how this would affect their cost and revenues. It took the broader SPINE objectives as the main value propositions. However, the solutions developed in cooperation with the SPINE technical partners are piloted and tested, raising the question of whether they should be sustained after the project, and if so, which elements hinder or enable their further implementation within the lead city. In this regard, the technical partner involved in the living lab of Antwerp, Yunex, has been interviewed. This semi-structured interview focused on identifying the added value of their solution towards Antwerp's SPINE objectives, Antwerp's contextual factors impacting the applicability and suitability of the solution, the responsibilities of all stakeholders involved, and how a positive business case could be established.

##### Business model

As detailed above, Yunex's solutions for Antwerp include the smart traffic management system for public transport and public transport prioritization. The value proposition of these solutions is to better monitor and improve the public transport flow throughout the network. Currently, there is a lack of understanding of the current situation of the public transport flow. Therefore, further analysis is required to investigate the area of improvement in the traffic network.

Analyzing the current situation requires data input from various sources. This is also the main barrier for this solution to be easily implemented and further developed beyond the project. When the owners of the data, who could be various stakeholders such as public transport operators, road infrastructure authorities, or traffic operators, are not able to deliver raw data to Yunex, the processing of the data requires time and resources which affects the costs of this system for the local authority. Furthermore, the interest of the data owners could be different than the interest of the local authority. Additionally, data owners -including the local authorities- are not always aware of which data they own and the many ways this data can contribute to improvements elsewhere in the mobility system. It is therefore of critical importance that knowledge among all stakeholders in the mobility ecosystem is improved and that clear and exchangeable data use cases are created to ensure smooth data interoperability and accessibility. Data use cases clearly define what, why, how... related to the (re-)use, storage, protection and processing of data. These data use cases also make it possible to have clear agreements on how raw data is handled and for which purposes, building trust among stakeholders.

Only after the raw data is delivered, data standards can be established so that there is continuous monitoring of the public transport flow in the network. In Antwerp, Yunex has already implemented



their traffic management system, making it easier to also connect their interfaces of public transport management and green wave analysis to this central platform. This reduces the efforts (and related costs) to establish connections with the several data owners.

As stated, the first part of this solution focuses on the monitoring and analysis of the current situation. Based on the analysis conducted, certain areas of improvement would be suggested which enable data-driven decision making. One of the interventions that would contribute to the improvement of the traffic flow at certain intersections is the green light prioritization for the public transport vehicles. This is one of the features that Yunex is testing within the SPINE project in Antwerp. Additionally, their generic approach allows them to propose other features and solutions from their portfolio to optimize the network. Yunex also offers, as part of their service offer, hardware that collects data which feeds directly into the management system. This allows them to better assess the current situation and adequately propose solutions that would improve the current situation. If cities can implement a data management system that collects the raw data from various stakeholders, this reduces the costs from Yunex' solutions and improves the potential benefit from solutions such as green light prioritization.

For Antwerp to evaluate whether this solution can or has to be sustained after the project, it is essential that they closely monitor whether the implementation of green light prioritization effectively improves efficiency of the network and whether their understanding of the current barriers in the network improves when the PT traffic management system is implemented. Furthermore, it must be evaluated whether the current connections with traffic operators can be used within the added public transport management system interface, as this will significantly affect the potential costs.

The next step consists of discussing the evaluation criteria for this solution among city of Antwerp and YUNEX, to realize how some of the technical requirement and related issues raised by YUNEX could be tackled before implementing and paying for them. For the solutions implementation, Yunex needs data in raw format from various traffic operators, so they would be able to analyze the current situation and identify flaws in the network. If the data is not of sufficient quality or is unavailable Yunex provides, as part of their product offerings, hardware that can collect the required data.



## 5 Conclusions

This deliverable provides a comprehensive overview of the status of tasks related to the Antwerp LL solutions and measures planning and implementation. However, it is still too early to assess the various measures contribution and their impact on the overall goal of increasing the usage of public transport and other sustainable mobility solutions since none of the measures have been fully rolled out. In the next 6 months, it will be possible to measure the usage of the improved route planner. The impact of the other measures will be assessed by the end of next year in preparation of the final version of Antwerp LL Implementation Report (due M36). It is still expected that the combination of the various measures will contribute to improvement of users' experience with public transport and to achieve more sustainable mobility goals.

During this first phase of implementation of the various measures of the living lab in Antwerp multiple challenges have been identified. Challenges can be grouped in 3 main categories: data, behavior and governance

Although we live in a more digitalized world, getting the right data at a high enough quality to customize towards end-users is still a challenge. Most of the stakeholders see data as a very valuable resource and don't trust external parties for sharing the collected data. Next to the trust issue, most mobility providers still struggle with the technical challenges of providing data at high quality and with a descent Service Level Agreement (SLA).

When it comes to changing behavior, it should be noted that many factors play a vital role and not all factors can be influenced by a city. Recently a reorganization of the Flemish public transport (basis bereikbaarheid) has been carried out, several bus lines have been optimized and even cancelled. These external occurrences have resulted in a changed perception of trustworthiness of public transport and might have pushed some users back to the car. Switching people back to public transport after such actions takes a long time and the implementation of many supporting measures will be necessary.

Nevertheless, the achievements within the SPINE-project will have a positive influence on the traveler's experience by offering a seamless route planning and a transparent wayfinding in the main mobility hubs of Antwerp.

One of the key achievements within this reporting period is the integration of the mobility map into the multimodal route planner and all the additional actions like improvements of the data quality that was required. As an added value, the new implementation and the development of a widget now also makes it possible for third parties to easily integrate the route planner in their own websites and applications. This will increase the reach of the route planner and will ensure a higher impact.

Another key achievement is the alignment of the various design elements used in the route planner and for the digital screens at the mobility hubs. Not only will these design elements ensure a more seamless user experience, the activities within SPINE have also sparked others in the mobility department to rethink the parking guidance systems both in functionality (more multimodal information) and in design



We are confident the results of these achievements will be reflected in the measured target values of SPINE-KPI's as will be described in the Antwerp living lab final implementation report due at the end of next year 2025.



## Annex A: Antwerp KPI's (detailed in D1.2)

Indicator or ID	Indicator name	Indicator Definition	Measure ID	Baseline	Target
IND1	Average modal split of public transport	<p><b>Definition:</b> Percentage of trips using PT during a day (weekday, week-end day). For an area the model split of both the trips of the residents and the in- and outgoing people are analysed.</p> <p>Unit: % of trips with PT (bus+train)</p>	ANTW_MS1 ANTW_MS2 ANTW_MS3	11.6% (baseline year=2022)	15.10%
IND2	Citizens satisfaction with public transport services	<p><b>Definition:</b> User average reported satisfaction with the overall quality of the public transport system and/or the quality of a specific service. It measures the experience of the user/provider, against its expectations.</p> <p>Unit: % of user average satisfaction with a qualitative score (1-5) of the perception of quality</p>	ANTW_MS1 ANTW_MS2 ANTW_MS3	1 (very satisfied)-19.4% 2 - 42.3% 3 - 23.9% 4 - 9% 5 - (very unsatisfied)5.3% (baseline year=2022)	1 (very satisfied)-24.3% 2 - 42.3% 3 - 19% 4 - 9% 5 - (very unsatisfied)5.3%
IND3	User satisfaction with the SPINE solutions	<p>User average reported satisfaction with the overall quality of the SPINE solutions. It measures the experience of the user/provider, against its expectations.</p> <p>Unit:% of user average satisfaction with a qualitative score (1-5) of the perception of quality</p>	ANTW_MS1 ANTW_MS2 ANTW_MS3	There is no baseline. This Indicator is computed after the implementation of the SPINE measures	1 (very satisfied) & 2: 50% 3: 25% 4 & 5- (very unsatisfied): 25%
IND5	Number of cars entering the LEZ area of the city	<p>Average number of private cars that enter the LEZ area of the city centre during a day</p> <p>Units: cars/day</p>	ANTW_MS3	81.120 cars/day (baseline year=2019)	(5% decrease) 77.000 cars/day
IND6	CO2 emissions	<p>Amount of CO2 emitted in the city of Antwerp regarding road transport</p> <p>Units: kton CO2e / year</p>	ANTW_MS1 ANTW_MS2 ANTW_MS3	781 kton CO2e / year (baseline year=2019)	726 kton CO2e / year



IND9	noise pollution	Percentage of residents in the city being exposed to high noise levels (>=70 db(A) per day)  Units: % of city population	ANTW_MS1 ANTW_MS2 ANTW_MS3	13% of the city inhabitants (68.959 people) (baseline year=2017)	10% of the city inhabitants
IND24	Number of bike-sharing users	Number of bike-sharing users in the city  Unit: users	ANTW_MS1 ANTW_MS3	3.673 unique users (baseline year=2022)	30.000 unique users
IND25a	Number of trips conducted by bike-sharing	Number of bike-sharing trips in the city  Units: trips	ANTW_MS1 ANTW_MS3	17.281 trips (baseline year=2022)	200.000 trips
IND28	Number of scooter-sharing users	Number of scooter-sharing users in the city  Unit: users	ANTW_MS1 ANTW_MS3	611.188 users (baseline year=2022)	640.000 users (appr. 5% increase)
IND28a	Number of trips conducted by scooter-sharing	Number of scooter-sharing trips in the city  Units: trips	ANTW_MS1 ANTW_MS3	1.815.759 trips (baseline year=2022)	1.900.000 trips (5% increase)
IND45	Number of multimodal hubs improved	Number of multimodal hubs improved through SPINE project  Unit: number of hubs	ANTW_MS1	0	5
IND47	Demand in multimodal hubs	Number of users commuting through multimodal hubs  Unit: passengers	ANTW_MS1	8.953.349 passengers/year through the 5 hubs (baseline year=2022) (by bus, tram and metro)	9.850.000 passengers/year (appr. +10%)
IND49	Perceived quality of the multimodal hub	Perceived quality and suitability of infrastructure and facilities within the hub, including the design of platforms, waiting areas, ticketing facilities, and accessibility for individuals with disabilities.  Unit: % of perceived quality of the multimodal hub with a qualitative score (1-5)	ANTW_MS1	There is no baseline. This Indicator is computed after the implementation of the SPINE measures	1 (very satisfied)-25% 2 - 35% 3 - 20% 4 - 15% 5 - (very unsatisfied)5%



IND54	Installation of digital signages/interactive screens etc.	Number of digital signages that will be installed in the city  Units: digital signages	ANTW_MS2	0	20
IND56	Mobility integration in the multimodal app	Number of transport modes/mobility services integrated within the multimodal journey planner app  Unit: mobility services	ANTW_MS3	11 shared mob. Providers (90%) + 100% PTOs	100% of mobility providers active in Antwerp for more than 6 months
IND57	Multimodal journey planner app trips	Number of trips requested through the multimodal journey planner  Unit: requested trips	ANTW_MS3	21.508 requested trips (baseline year=2022)	24.734 requested trips
IND58	Multimodal journey planner app registered users	Number of users of the multimodal journey planner app  Units: users	ANTW_MS3	48.740 users (baseline year=2022)	56.051 users