SCALE-UP
User-Centric & Data Driven Solutions for Connected Urban Poles

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D7.3 Mobility baseline in the SCALE-UP FUAs

Version 1.0

D7.3 – Mobility baseline in the SCALE-UP FUAs			
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List of Acronyms	
Acronym	Meaning
API	Application Programming Interface
CRTM	Consorcio Regional de Transportes de Madrid
edM2018	Home Mobility survey of the Community of Madrid
EDV	Electric Delivery Vehicles
EMT	Empresa Municipal de Transportes de Madrid
FUA	Functional Urban Area
GDPR	General Data Protection Regulation
GHG	Greenhouse Gas
GIS	Geographic Information System
IoT	Internet of Things
ITS	Intelligent Transport Systems
LEM	Local Evaluation Manager
LEZ	Low Emission Zone
MER	Milieueffectenrapport; Environmental Impact Assessment
NGO	Non-Governmental Organisation
ML	Measure Leader
P&R	Park & Ride
PT	Public Transport
RCSWF	Regional Council Southwest Finland
RDI	Research, Development and Innovation
SECAP	Sustainable Energy and Climate Action Plan

SIM	Subscriber Identification Module
SULP	Sustainable Urban Logistics Plan
SUMI	Sustainable Urban Mobility Indicators
SUMP	Sustainable Urban Mobility Plan
UCC	Urban Consolidation Centre
vkm	Vehicle-kilometre
WHO	World Health Organisation
WP	Work Package

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1. Introduction

1.1. The SCALE-UP project and its evaluation

The SCALE-UP project is an innovation project that will develop and implement 28 innovative data-driven and user-centric mobility measures in 3 urban nodes – Antwerp, Madrid and Turku – in order to accelerate the take-up of smart, clean, safe and inclusive mobility.

A specific focus of the project lies in the development of strategies to develop upscaling beyond the urban level. This is accomplished in two ways:

(1) through vertical upscaling by integrating the strategies beyond geographical boundaries (city, functional urban area (FUA), TEN-T) through collaboration with all stakeholders and governance
(2) through horizontal upscaling by addressing, in a balanced way, the different layers that shape the multi-layered mobility system that we see today, i.e. a physical or infrastructural layer, a digital layer, and the human layer referring to the central position of the end-user.

To evaluate the efficiency and effectiveness of the implemented innovative measures and the strategies developed throughout the 3 urban nodes, SCALE-UP builds further on the CIVITAS evaluation experiences and uses a layered and integrated evaluation approach encompassing **3 main focuses of evaluation**:

- Evaluation of the mobility situation on the level of the city and the **Functional Urban Area (FUA)**: understanding the overall changes, evolution and trends in the urban nodes
- Evaluation of the **SCALE-UP measures**: impact evaluation and process evaluation, jointly providing a good understanding of how the implemented mobility measures contribute to changes in the city
- Evaluation of the **strategies for integration**: analysing the SCALE-UP concept of vertical (city, FUA, TEN-T) and horizontal (multi-layered mobility system) upscaling. The TEN-T dimension is covered in the evaluation of vertical integration. This is in support of WP1 who will validate these strategies.

This document presents the **baseline situation of the mobility evolution of the city and FUA** of the 3 SCALE-UP urban nodes at the start of the SCALE-UP project, which is an integral part of the first focus of evaluation. It also provides a solid description of the context for the innovative measures to be evaluated during the project lifetime. The evolution of the mobility situation in the city and FUA will be monitored

over the course of the SCALE-UP project and reported in D7.6 Moving forward to achieve SCALE-UP objectives in the SCALE-UP FUAs, in September 2024.

The baseline and impact and process evaluation results of the SCALE-UP measures, the second focus of evaluation, will be reported in D7.5 and D7.8 Impact and Process evaluation of the SCALE-UP measures 1 and 2 in May 2023 and January 2025 respectively.

The third focus of evaluation, the progress of the vertical and horizontal upscaling of the SCALE-UP urban nodes, will be reported in D7.9 Status of an efficient and effective vertical and horizontal upscaling January 2025.

1.2. Evaluation on the level of the FUA

The objective of the evaluation on the level of the FUA is to monitor the overall changes of the mobility situation in the SCALE-UP urban nodes over the course of the project and to capture the evolving context for the evaluation of the implemented SCALE-UP measures.

To enable this, two sets of indicators are defined:

- **Indicators** to **understand the context for change** in the FUA. Four qualitative indicators are selected to identify the context for innovative change in each urban node. The indicators are inspired by the approach developed in the CREATE project.
- **FUA indicators** that **monitor the mobility evolution at FUA level** in the perspective of the SCALE-UP objectives. These are qualitative and quantitative indicators. They capture the mobility related changes in each of the 6 CIVITAS impact categories: society-governance, society-people, transport system, energy, economy and environment.

The objective is to monitor these indicators and identify the overall change in the different urban nodes over the course of the SCALE-UP project and to understand this change. The observed change can be either due to the general evolution in the FUA, or due to the implementation of one or multiple SCALE-UP measures or due to the implementation of other measures or other strategies, or (most probably) due to a combination of these. As discussed in Chapter 3, stakeholder workshops will be organised, in each urban node, near the end of the project, to understand the observed change and isolate the impact of the SCALE-UP measures.

Ideally SCALE-UP would collect the data and gather the knowledge for the Functional Urban Area (FUA) as defined in the SCALE-UP project. However some data are only available for the city which is a clear administrative defined area and the SCALE-UP definition of the FUA will be developed in WP1 during the course of the project. Therefore, during this phase of the project, we collect all data on the level of the city and, if available, on the level of the area currently used by the SCALE-UP cities as the FUA for their city. For the monitoring of the changes near the end of the SCALE-UP project, we will assess whether the data for the FUA level will be updated depending on the conclusions of WP1 and the availability of data.

1.3. Context and aim of this document

This document presents the **baseline mobility situation** of the 3 SCALE-UP urban nodes – Antwerp, Madrid and Turku – **on the level of the city and Functional Urban Area**.

It draws an inventory of the mobility situation on the level of the FUA that can influence the impact of the implementation of the SCALE-UP measures. An evaluation of the 'baseline' or 'before' situation is necessary to assess the general evolution of the urban node and subsequent changes resulting from SCALE-UP measures and is carried out *prior* to the introduction of the mobility measures.

For each urban node, the baseline situation of the context for change will be presented and for each CIVITAS impact category the baseline situation of the FUA indicators of the 3 urban nodes will be reported.

This document is the result of the intensive cooperation of the SCALE-UP Local Evaluation Managers (LEMs) with the local partners in gathering the knowledge and collecting the data.

1.4. Structure of this document

This report presents the baseline mobility situation on the level of the city and the FUA of the 3 SCALE-UP urban nodes Antwerp, Madrid and Turku.

In Chapter 2, the baseline situation of the context for innovative change of each urban node is outlined, based on the assessment of four qualitative indicators.

Chapter 3 presents the baseline results of 24 qualitative and quantitative FUA indicators in 6 CIVITAS impact categories, for each urban node. The data collection method of each indicator is described, and figures of the last representative baseline year are reported, when possible complemented with the trend leading towards the baseline. An appraisal of the current baseline situation is given for each indicator.

Provisional conclusions and future actions are presented in Chapter 4.

2. Context for change

2.1. Overall methodology

A good insight into the **context for innovative change** is an important element in the overall understanding of why some cities are successful in the implementation of new strategies and measures and others are not.

To assess the context for change in the SCALE-UP urban nodes, a selection of relevant indicators is defined, inspired by the results and approach of the CREATE project[1].

Within the SCALE-UP project, 4 indicators are used to analyse the context for innovative change and to map the enabling conditions for innovative solutions. The following indicators are assessed:

- **Mood and Motivation**: level of acceptance of a new type of transport policy and the quality of the governance and organisational structures that drive a change in transport policy
- **Mass:** capacity to make change happen
- **Momentum:** elements to speed up change
- **Mechanisms**: strong processes to control and manage change

In order to understand the status of the city in relation to a favourable context for change, the level of maturity for each of these aspects will be captured at the start of the project, and, in the end phase of the project. This will allow to observe possible evolutions of these indicators in the course of the project. The understanding of these contexts for change will also be used in the measure related evaluation as a context with drivers and barriers for implementation and the success of a measure.

[1] The CREATE project was a 3-year Horizon2020 CIVITAS project, which ended in May 2018. It examined how 5 Western European capital cities have dealt with growing car use and congestion, over the past 50-60 years, to provide lessons for growing urban economies in Central and Eastern Europe and the EuroMed region. http://www.create-mobility.eu/

The status on each of the four indicators is assessed from:

- **Questionnaires and focus groups** to/with cities and important stakeholders at the start and end of the project
- **Identification of what is happening and published** in the community and what is formulated in urban policy

Annex 2: Indicators for the context for change gives a range of questions to assess the status for each indicator and examples from EU cities on their level of maturity on each aspect. This list of questions was used by the Local Evaluation Managers to organise knowledge gathering activities (e.g. focus groups with local stakeholders (e.g. MLs, representatives of different society groups, etc.)) in the local language. The approach was outlined in a SCALE-UP Knowledge Exchange webinar (10 November 2021) for all partners to get a common understanding of the indicators and the type of questions to be answered in focus groups with local stakeholders.

In the following sections, each urban node will present the baseline of the 4 indicators for the context for change based on workshops held with presentative stakeholders and publications in the community. For each indicator, an appraisal is given by identifying the drivers and barriers.

2.2. Antwerp

2.2.1. Methodology

Within the SCALE-UP project, 4 indicators are used to analyse the context for innovative change and to map the enabling conditions for innovative solutions:

- Mood and Motivation – resp. the level of acceptance of a new type of transport policy and the quality of the governance and organisational structures that drive a change in transport policy
- Mass – the capacity to make change happen
- Momentum – the elements to speed up change
- Mechanisms – the strong processes to control and manage change

These four aspects are measured through a focus group with the most important stakeholders, at the start and end of the SCALE-UP project. This first (baseline) focus group was held on the 17th of January 2022. The current covid crisis obliged the local evaluators to organise this focus group online via Microsoft Teams. The meeting was scheduled to last an hour and a half: long enough to allow for thorough discussion, but not too long in order to guarantee a good focus of all attendees. The attendees were both important stakeholders within the SCALE-UP project as well as stakeholders within the mobility field in Antwerp.

Attendees:

- Michiel Penne, project coordinator Smart ways to Antwerp and coordinator of the SCALE-UP urban node Antwerp
- Katia Kishchenko, responsible for communication within Smart ways to Antwerp
- Stijn Vernaillen, expert MaaS and Mobility data within the city of Antwerp and involved in data-driven Antwerp urban node measures
- Franziska Kupfer, policy adviser in the Antwerp Transport Region and involved in most of the measures concerning the Antwerp Transport Region
- Jeroen Van Houtte, Mobility Expert at Lantis/Antwerp Transport Region

The questions used within this focus group are shaped by the method presented in the SCALE-UP evaluation framework. The method is inspired by the CREATE project.

The methodology to evaluate the context for change was presented during a capacity building webinar of the SCALE-UP project by the SCALE-UP Project Evaluation Manager Dirk Engels.

The session was moderated by the local evaluators of the city of Antwerp, namely Sarah Van Acker (Traject) and Emilie Sion (Traject). Follow-up questions were asked during the focus group to get to the bottom of certain topics or to further elaborate on certain themes.

In the following paragraphs, the baseline situation per indicator for innovative change is displayed. As befits a focus group, the questions in Annex 1: FUA indicators in the impact category society-governance provided an initial basis, but the focus group continued in conversational form, whereby both the stakeholders themselves and Traject as the organizer of the focus group could respond to the given input. The paragraphs below will therefore form a continuous text per indicator and try to be a representation of how the stakeholders assess the innovative base of the local mobility context.

2.2.1. Mood and Motivation

Mood *identifies the level of* ***acceptance*** *of a new type of transport policy, whether citizens, planners and policy makers are open to new ways of organising the mobility and accepting new ways of living. Motivation identifies the quality of the governance and organisational structures that* ***drive a change in transport policy.***

Our policy makers/stakeholders of the city of Antwerp and the Antwerp Transport Region feel that there's a **constant ongoing discussion on mobility as well as on mobility policy** amongst the administration, amongst the citizens as well as between the citizens and administration. The present mindset is constantly looking for improvement and constantly daring to question current policies and projects at different levels: at the level of the citizens, the level of the administration and the political level.

The fact that Antwerp develops initiatives such as the employer approach and Smart ways To Antwerp serves as proof to the willingness of the administration to put mobility policy as a priority and creates a platform to organize a constant discussion on new developments within the city.[2] This focus on mobility spreads to the other administrative services as well, although the awareness within other administrative services didn't come automatically but was constantly brought to the table by the mobility team. Consequently, their colleagues were sensitized to include sustainable mobility in their operation.

A good example of how other administrative services consider mobility as an important aspect in their current operation can be found in the event sector. Whether or not visitors come to an event in Antwerp in a sustainable way is not necessarily covered by the mobility services but is still monitored by the city. Through regular communication and good cooperation between both services, visitors are encouraged to go to Antwerp sustainably.

Although there is a discussion within the city as well as the Antwerp Transport Region, the city takes **the pioneering role**, not only compared to the Antwerp Transport Region but also compared to the rest of Flanders. Our stakeholders within the Antwerp Transport Region noticed that **the discussion isn't as strong in every municipality.** Not every municipality has a mobility official, an employee dedicated to only mobility, and this is palpable within the degree of debate. Transport and mobility are of course broad topics, and municipalities tend to have strong opinions on certain topics but are less outspoken on others. **The quality and the degree of the discussion depends on the topic (see also further).**

[2] Smart ways to Antwerp is an initiative of the city of Antwerp that aims to improve mobility in and around Antwerp and make it more sustainable. The goal is to make half of all travel in the region more sustainable. In order to succeed in this set-up, it is important to tackle commuting and shifting. That is why Smart Ways to Antwerp has been starting an employer approach in recent years, in which accessibility managers guide companies towards more sustainable mobility and rush-hour-avoiding journeys.

The city dares to **experiment** to a high degree and let their territory be a playing field for new mobility providers. New mobility providers in Flanders often started in the city of Antwerp. The city of Antwerp tries to draw lessons from these experiments and the reactions of the public. Potential problems have already been addressed during this process and regulation is adjusted based on the city's experiences over time. Think of many providers of shared mobility, e.g. shared e-steps. Based on the experience, the city could work out the necessary regulations and frameworks needed to further expand. Other cities in Flanders can benefit from this knowledge. After their learning moment in Antwerp, mobility providers often establish themselves further in the rest of Flanders. These experiments in shared mobility would not succeed if the **Antwerp citizens were not open to trying out these providers**. New and more experimental concepts and themes do not only get room to experiment, but the city is willing to follow with the necessary financial aid. For example, the city has people dedicated to working on themes such as MaaS, shared mobility etc.

Drivers
Constant ongoing discussion on mobility policy in the city of Antwerp as well as the Antwerp transport region.
The willingness of the administration of the city of Antwerp to put mobility policy as a priority.
The city of Antwerp dears to take a pioneering role and dears to experiment.
The citizens of the city of Antwerp are open for trying out new mobility solutions.

Barriers
The discussion on mobility and mobility policy isn't as strong in every municipality in the Antwerp Transport Region and depends on the theme.

2.2.2. Mass

Even if there is a high acceptance to introduce some changes, it is crucial there is the capacity to make change happen. E.g. are the appropriate organisational structures and people with sufficient capacity in place to design, organise and operate new mobility services?

Within the city of Antwerp, there is **a special team for the mobility approach** of employers and employees. Within this team, several people have already built up quite a bit of **mobility and data expertise**. At the beginning of the project, the team relied on the external private partner Rebel, but since then, the Smart ways to Antwerp team has accumulated a fair amount of knowledge. Participating in European projects (CIVITAS, PORTIS, ...) helped in this knowledge building. From these European projects came the **necessary reports and scientific articles.**

The Antwerp Transport Region **team itself is a collaborative team**. The team members come from mobility-related organizations such as Lantis, MOW (Department of Mobility and Road works), De Lijn, etc. Thus, expertise from external partners is only needed on specific topics. However, the Antwerp Transport Region functions as an umbrella body and not as the acting administration within the municipalities. For example, the development of the e-bike system is implemented by Lantis. In addition, their focus is on policy preparation work and not on implementation. This means that also knowledge building/expertise within the municipalities is necessary. **Since not every municipality even has a mobility officer, extensive knowledge to operationalize policies is sometimes lacking.** The Antwerp Transport Region is also further limited by a lack of **budgets**, they have to rely on stakeholders for the implementation of the policies. The stakeholders of the Antwerp Transport Region have the feeling that the basic structure for the operation of the Antwerp Transport Region is certainly strong, but that there is still room for improvement.

The Antwerp Transport Region is of course a relatively new concept with its origins 5 years ago, the question arises whether this also plays a role. Our stakeholders within the Antwerp Transport Region report that they don't experience problems with being "new" and consider their 5-year run long enough to get themselves known and established. The experience of the Antwerp Transport Region builds on the cooperation that Lantis (previously know as Beheersmaatschappij Antwerpen Mobiel (BAM)) had set up for the future alliance and the cooperation of the mobility supervisors of MOW. As for experience in European projects, SCALE-UP is the second European project in which the Antwerp Transport Region participates, and they also take less of a leading role in this compared to the city of Antwerp.

As already mentioned above, **participation is a key element within the development of the mobility policy** of the city of Antwerp and the Antwerp Transport Region. In the part 'Mood and Motivation', the **workbenches** have already been cited, but actually, **the entire concept of the Antwerp Transport Region** is based on bringing together the necessary

partners around mobility policy, the municipalities, the bus company, train company, etc. They discuss mobility policy in the **Transport Regional Council.**

When looking at the strategy for supporting activities, there is a significant difference between the city and the Antwerp Transport Region. Smart ways to Antwerp has as goal to change the mindset of the employers, employees, citizens of Antwerp and does this by organizing large city-wide campaigns focusing on modal shift, hosting the route planner and many other activities and actions to change the mindset of the people of Antwerp and the people travelling from and to Antwerp. The Antwerp Transport Region thinks that the change in mindset is vital as well but does not yet have supporting activities, one of the goals of SCALE-UP for the Antwerp Transport Region is to look at the activities of the city of Antwerp and see which actions would apply to the Antwerp Transport Region.

Drivers
Experience within the administration of the city of Antwerp and the Antwerp Transport Region Team.
The city of Antwerp has a lot of experience in European projects. Even the Antwerp Transport Region participated already in 2 European projects, the SCALE-UP project included.
The city of Antwerp organises supporting activities for changing the mindset of the citizens of Antwerp.

Barriers
Not every municipality in the Antwerp Transport region has a mobility coordinator. The extensive knowledge to operationalize policies is sometimes lacking.
The Antwerp Transport Region doesn't organise supporting activities for changing the mindset of their citizens (yet).

2.2.3. Momentum

This aspect identifies whether elements to speed up change are available in the city. If a city wants to have a change, it needs to 'grab the moment'. For that, momentum is needed.

Multiple contextual elements influence the current mobility momentum. Some elements make it easier to implement policy, create awareness and push for the modal shift, other elements have however a rather negative influence on this momentum. A non-exhaustive list of these elements is listed below.

Regional mobility plans: Flanders is currently requesting the preparation of the mobility plans for the Antwerp Transport Region. This creates momentum within the Antwerp Transport Region to be actively involved and to rethink the current mobility status, also for freight. Those plans create clear political goals and create political momentum.

The use of data: At this moment, data collection and sharing becomes increasingly important, both for sharing to stakeholders and in the use of mobility plans. How can we use the data for mobility policy? This again creates a certain type of momentum, namely a tipping point in data use.

European knowledge exchange: The city of Antwerp can benefit from the European level by participating in forums, European projects, etc. Antwerp can not only learn from its projects but also the other experiments set up within the European field. For example, the alderman of mobility also participates in European forums and takes with him the experiences of other cities and countries, of which the city of Antwerp can benefit.

European, national and regional mobility plans: A lot is going on at the Flemish, national and European levels. There is a clear 'green' momentum, the topic of green mobility is getting higher up on the agenda. The fact that Antwerp can participate in European mobility projects and lies on the TEN-T network is considered a strong positive influence. The urgency is also felt at the national and Flemish level because legislation is constantly changing, e.g. the recently changed legislation for company cars.[3]This again encourages the city of Antwerp to execute their own policies faster, not only reactively when new legislation is introduced but also on a pro-active basis, implement policies before Flanders. By being pro-active, the city is able to have an influence on the chosen Flemish policy.

Road works at the Oosterweel connection: The works on the Antwerp Ring Road have recently started and are making traffic to Antwerp more difficult. The need to travel sustainably to Antwerp is therefore even greater for the residents, employees, and visitors. The goal for Smart ways to Antwerp is clear here: they want to ensure that employees

[3] Only electric company cars will benefit the tax advantage from 2026 onwards: https://www.standaard.be/cnt/dmf20210518_92159320

come to Antwerp in a smart way, in other words sustainable, and by doing so avoid traffic jams. Those yards also enforce the improvement of the cycling ways as alternative ways to reach the city.

COVID-19 crisis: The COVID-19 crisis had negative as well as a positive influence on mobility behaviour. People were scared to take public transport but cycling became more popular as a result.

Mobility budget: The mobility budget has been delayed; this delayed the implementation in the companies as there was more uncertainty about this. Lease cars remained the main option as this was the policy that had the most certainty.

Drivers
Regional mobility plans are in preparation.
Changing mindset in the use of data.
The city of Antwerp and the Antwerp Transport Region benefit from European knowledge exchange.
European, national, and regional mobility plans: The topic of green mobility is getting higher up on the agenda.
Road works at the Oosterweel connection push people to rethink their travel behaviour.
The COVID-19 crisis had a positive impact on active transportation.

Barriers
The COVID-19 crisis had a negative impact on public transport.
The delay of the mobility budget leaves companies in uncertainty.

2.2.4. Mechanisms

Last but not least, strong processes or mechanisms are needed to develop new solutions and to control and manage change.

There are defined **structures present to develop new solutions and manage change**, for the city of Antwerp as well as the Antwerp Transport Region. As mentioned before, there is a specific project team working on sustainable mobility and accessibility to the City of Antwerp, the Smart ways to Antwerp team. The Transport Regional Council provides the structural exchange and policy preparation in matters of mobility for the 32 participating municipalities. At the Flemish level, we also have mobility counsellors (in Dutch: mobiliteitsbegeleider). A mobility counsellor guides the Antwerp Transport Region and therefore often consults with the various municipalities. They are part of the specialized team themselves of MOW (Department of Mobility and Road works) and therefore frequently exchange knowledge within their team. This is just one of the examples of the many working groups and commissions the Flemish government organizes to exchange knowledge and to involve stakeholders. Other examples are the working groups around Mobipoints, shared mobility, etc.

Although there are many of these embedded structures like the aforementioned working groups, **there are still shortcomings on the Flemish and national level**, and these sometimes form **a barrier to the development of a policy.** For example, the exchange of information on various levels within the different governments. Flemish cities do keep in touch about these initiatives, but there is no embedded knowledge-exchange system or decision-making platform for this.

For the Antwerp Transport Region, their Roadmap 2030 has very recently developed Key Performance Indicators (KPIs) to allow for effective and measurable mobility change to happen. There are also clear objectives for the city of Antwerp, but these are less quantified. The most important objective is the 50-50%-goal, 50% of the movements within and to the city of Antwerp need to be sustainable.

The city of Antwerp and the Antwerp Transport Region have stable relations with several stakeholders: De Lijn, NMBS, etc. These working relationships are defined in business agreements and are not likely to change within the near future. The Transport Regional Council itself consists not only of the municipalities but also the stakeholders as the regional bus company, Flemish Waterway, Flemish department for mobility and roads works, etc. This means that the Transport Regional Council in its construction embedded the involvement of those specific stakeholders.

The **citizens themselves also participate** in the development of mobility policy and often voice their opinions. Three years ago, the city of Antwerp won **the CIVITAS CITY & ENGAGEMENT AWARD**: the city of Antwerp actively listens to the employers and the mobility providers and involves them in decisions. Next to that, the city tries to map the mobility-related needs of citizens and tries to bring them into contact with the providers. No one-way traffic but with the involvement of employers/providers/residents.

One of the biggest participation projects in which the citizens of Antwerp actively voiced their opinions and concerns can be traced back more than 20 years ago with the start of the project of the Oosterweel connection. This project started out as the physical completion of the Ring Road but eventually became a much larger project with a focus on a greener, healthier, and more sustainable city taking into account and involving many discussions and debates with different stakeholders. This shows that participation is still an important key element today within the city of Antwerp. Partner Lantis organizes the ever-ongoing participation process and involvement of the stakeholder groups. An example of such participation moments are the **Ring days**[4], in which Smart ways To Antwerp are also involved. Citizens who live near the Ring are informed and involved on those Ring Days on e.g. the placement of road lights.

In the Antwerp Transport Region, the municipalities organize '**working groups',** platforms for all stakeholders including interest groups and citizens to participate in the mobility policy and to voice their feedback. The interest groups as well as citizens themselves ask to be involved in the working groups. These groups are, in other words, a bottom-up participation organ.

However, the willingness to **be involved within the population** itself strongly **depends on the topic**, within the Antwerp Transport Region as well as the city of Antwerp. Parking spots are for example always a hot topic. In addition, while citizens might be involved in mobility topics, they **aren't always a proponent of the more sustainable choice.** For example, while traffic (both congestion and stealth traffic) is definitely seen as a crucial problem, active mitigation is not necessarily always put forward as the primary solution.

All these participation structures are not only capable of receiving input but of handling and implementing the given feedback as well. The input of the various stakeholders and residents is taken into account. For example, in the city of Antwerp, several logistics players had indicated that there was more need for framing: What does the city want, what's its vision etc. The city responded to this request by further developing its vision and policy.

Drivers
There are defined structures present to develop new solutions and manage change, for the city of Antwerp as well as the Antwerp Transport Region.

[4] During the Ring days, every resident of Antwerp and Zwijndrecht can express his opinion about the works on the ring road, the design plans, etc. More information can be found here: https://www.overdering.be/ringdagen/

The roadmap 2030 of the Antwerp Transport Region.

Barrier
There are still shortcomings on the Flemish and national level (e.g. exchange of information on various levels within the different governments), and these sometimes form a barrier to the development of a policy.

2.3. Madrid

2.3.1. Methodology

To provide an understanding of the context for innovative change four indicators were addressed in Madrid. The baseline for these indicators was collected in an online stakeholder workshop that took place on February 4th, 2022. For this activity, the following participants were included:

- Madrid city council (María Gema Ramos)
- Madrid City Council (Ángeles Cortés)
- Regional Transport Consortium (José Manuel Sánchez)
- Municipal Transport Company Empresa Municipal de Transportes de Madrid (EMT) (Sergio Fernández)
- AVANZA company
- ETRA company (Raquel Alario)
- Polytechnique University of Madrid (UPM)(Andrés Monzón, María Beltrán, Adriana Cortez)

The purpose of the workshop was to create a baseline for the Madrid urban node at the start of SCALE-UP in terms of where the urban node stands in the evolution of each indicator to support and enable change and innovative solutions. At the end of the project, a similar stakeholder workshop will be organised to see the evolution in the context for change.

For the workshop, a brief presentation including the main aspects of the project was prepared as an introduction for all participants. This presentation included a description of the eight measures to be implemented in SCALE-UP.

Eighteen questions were grouped in four categories aligned with the CREATE indicators. After presenting the project and Madrid´s measures the questions of each category were answered by the different participants.

The process was participative, everyone could respond to the question and add some comments to other participant responses. It was also highlighted at the beginning of the workshop that any additional comments, documents or ideas would also be welcome by email after the end of the workshop.

The workshop was done in Spanish so it would make it easier for the participants to interact, it lasted 1 hour and 45 minutes and the main conclusions extracted were sent to the participants so they could share this document with other colleges in case they had something else to add.

The overall appraisal is presented in the following sections.

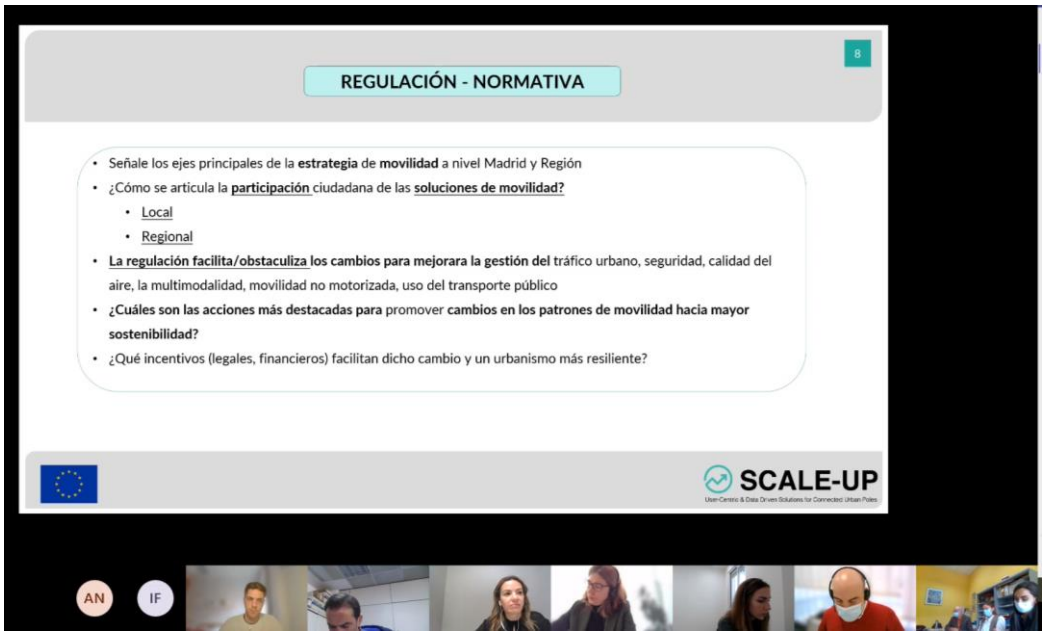


Figure 1: Participants of the Madrid workshop on the context for change

2.3.2. Mood and Motivation

Quality of planning approaches

In Madrid, transport and mobility policies have been taking sustainable urban mobility into account for a long time and at different levels. Since 2019, *Madrid 360 (Estrategia de Movilidad Sostenible)*, the SUMP of the city, whose objectives are focused on achieving more sustainable mobility, has been in use. As part of this strategy, the new *Ordenanza de Movilidad Sostenible* (Sustainable Mobility Ordinance) was published recently (September 2021), responding to social, economic, environmental, cultural, technical and technological changes related to mobility. It prioritises the health and physical integrity of citizens by improving air quality and road safety, promoting multimodality and the use of public space, through efficiency and innovation. It goes hand in hand with other ordinances, such as *Protección contra la Contaminación Acústica y Térmica (OPCAT)* (Protection against Noise and Thermal Pollution) and the recently approved *Calidad del Aire y Sostenibilidad (OCAS)* (Air Quality and Sustainability). At regional level, there is *Plan Estratégico de Movilidad Sostenible de la Comunidad de Madrid 2013-2025* (Strategic Plan for Sustainable Mobility of the Community of Madrid), which has objectives aligned with Madrid 360 strategy but can be considered less ambitious. This illustrates the existing gap between policies proposed at city and at regional level.

On 10th February 2022, *Junta de Gobierno de Madrid* (Governing Board of Madrid) approved the new *Plan de Movilidad Sostenible Madrid 360* (SMP Madrid 360[5]). This new mobility policy planning instrument until 2030 promotes the four 'S's of mobility: *Sostenible, Segura, Saludable y Smart* (sustainable, safe, healthy and Smart). The plan sets these main objectives for 2030: to reduce travel time on public transport by an average of 32.5 %; to reduce traffic congestion by up to 10 %; to reduce CO_2 emissions by 65 % compared to 1990 and to reduce road fatalities and serious casualties by 50 %.

The city is taking the lead in transport policy

There is clearly an ongoing discussion to upgrade transport policy in order to increase liveability, which dates back at least a couple of decades, and has been accelerating in the past years. Following the European Directive 2008/50/CE (2008) to establish more ambitious limits on emissions within cities (later materialized in the 2015 Paris Agreement), the city of Madrid has taken huge steps since 1968, when the first ordinance in environmental quality matters was published. The ongoing sustainability plans and ordinances have their foundations on previous documents, the Air Quality Local Strategy of the City (2006), and the successive Air Quality Plans (2011-2015 and 2015-2019). As we have seen in the previous

[5] The *Plan de Movilidad Sostenible Madrid 360* has been announced publicly but it's still not published and publicly accessible (on 25 February 2022)

question, Madrid is continuously proposing and approving plans and planning instruments to structure the city's mobility, meet European objectives and improve citizens' quality of life.

Plan Estratégico de la EMT 2021-2025 (EMT Strategic Plan 2021-2025) aligned with *PMS Madrid 360* (SMP Madrid 360) reaffirms the company's commitment to sustainable mobility, underlining it as one of the fundamental pillars. Among the corporate objectives included in this plan are: (1) move towards a green, decarbonised company that takes advantage of the benefits of the circular economy, and (2) promote the digital transformation of EMT and improve efficiency in the provision of mobility services.

Both at city level and regional level, Madrid is on a continuous pursuit to make of Madrid a reference in 21st century mobility, aligning its strategies with those of the European Union for sustainable mobility. Although EMT, which is one of the city's public transport operators, is clearly more ambitious, effective and ahead of Consorcio Regional de Transportes de Madrid (CRTM), the regional transport authority (which coordinates over 40 public transport operators). For instance, one of the eight main lines of action of *Plan Estratégico de la EMT* (EMT's Strategic Plan) is focused on corporative sustainability and social responsibility, with very ambitious short and midterm goals, such as increasing the electric fleet, from 179 electric buses in 2021 to 729 in 2027.

Again, in terms of a unified MaaS system and integrated e-ticketing option, the city is taking the lead. In Madrid (city and FUA) there are several travel planning applications (e.g., Google Maps, Moovit, City Mapper, Chipi, Madrid Mobility360 – EMT's-, or Mi Transporte – CRTM's-) currently available to enable the use of the quite complex transport network. Although all these planners are based on the combination of different mobility services (i.e., public transport, shared mobility, and ride-hailing services), none includes payment or e-ticketing integration, except for "Madrid Mobility360", launched in 2018 by EMT (operating Madrid's city bus services and the bike-sharing system BiciMAD). As part of SCALE-UP measure M4 (directly related to measure M8), CRTM is planning to develop their own MaaS app.

Public participation and discussion

Public acceptance varies depending on the context and the sector of population affected by the changes. New emerging mobility services, for instance, are widely accepted today in Madrid (especially at city level[6]), which has more sharing services than the average European metropolis. It is worth pointing out that each shared mobility service has its own coverage zone, although most are concentrated in Madrid city, so inhabitants at FUA level, even if they are willing to use new mobility services, cannot use these new services for their last-mile trips. According to a study conducted in Madrid, the willingness to adopt MaaS

[6] According to Arias-Molinares & García-Palomares (2020a), Madrid has 35 shared mobility services and a fleet of around 30 000 vehicles, managed by 29 operators (public and private).

appeared to be related to personal characteristics such as gender, age, education level, occupation, and household structure (Lopez-Carreiro, I., Monzon, A., Lois, D., & Lopez-Lambas, M.E., 2021). Unexpectedly, the place of residence (city versus outskirts) was not found to be significant. The acceptance of MaaS was also influenced by the individual mobility patterns. The study detected that private car users were not significantly attracted by MaaS, while individuals engaged with public transport and shared mobility services did intend to adopt it.

BiciMAD, implemented initially only in Madrid CBD (inside M-30 ring), has been more successful than expected in spite of, or maybe thanks to, the pandemic. BiciMAD points and fleet have been growing for the past years, and together with actions regarding charging points for electric vehicles, are being studied for being scaled-up to the rest of the city and the region (SCALE-UP measures M5 and M6). However, measures such as Park & Rides (P&Rs; SCALE-UP measure M2) have been more controversial, particularly in neighbourhoods where spontaneous parking areas have been turned into car parks linked to public transport. Some have been put on hold (Tres Olivos and Villaverde), while in other cases (Aviación Española) an agreement has been reached with the neighbours so that they can park at a lower fee.

Pedestrianizations and traffic restrictions (even temporary ones) are also quite polemic, especially amongst private vehicle owners and shop keepers, who believe their businesses might be negatively affected (Cadena Ser 2018). There have also been complaints from citizens who felt they had not been taken into account when decisions such as Sol pedestrianization were made (Telemadrid 2020). Actually, the City Council representatives expressed their worries about this matter, and for example, for some of the new low emission areas (part of SCALEUP measure M7), they have communicated more effectively with neighbours of the affected areas and have sat down with them to discuss the actions before the final plans were approved.

City Council and public transport operators (such as EMT) and the Regional Transport Authority CRTM, consider that the current information system and citizen participation in relation to urban mobility is adequate. Although some of the issues raised when implementing new mobility measures (such as stopping the construction of new P&Rs or pedestrian areas), might reflect otherwise. Regarding public awareness, any new mobility related and soon-to-be implemented measures are announced through the main means of communication (radio, television, press). As well as this, all related information is available online and broadcasted on time through public institutions' social media (LinkedIn, Facebook, Instagram, Twitter). Dynamic information panels are also used and when considered necessary information is distributed through the post to the residents of the affected areas.

All ordinances regarding mobility measures are subjected to public opinion and neighbours can submit allegations through INTRANET. Many of these allegations are duly attended and solved by the authorities in question, resulting in changes that improve acceptance, and/or the impact of a given measure.

The city of Madrid has been collecting citizens' opinions since 2006 in different areas that affect the city, in *Encuesta de Calidad de Vida y Satisfacción con los Servicios Públicos de*

la Ciudad de Madrid (Survey on Quality of Life and Satisfaction with Public Services in the City of Madrid), including mobility. The EMT also maintains an active relationship with different stakeholders, users and associations, mainly on specific issues such as accessibility through workshops, meetings and support programmes, among others. CRTM offers 25 physical points in the city to inform and attend public opinion and complaints, as well as online and telephone services. It is worth mentioning, that in the last published annual report (CRTM 2019), there are over 68 000 registered complaints in 2019 (number way above the public participation in campaigns or other organized events-like mentioned later), which should at least lead to a self-analysis and reflection on whether citizens' voice is appropriately handled in the regional mobility ecosystem.

Car traffic reality and perception

Madrid, like other European cities, repeatedly exceeds the pollutant concentration limits established by the EU Air Quality Legislation (Directive 2008/50/EC). In order to comply with acceptable air quality levels, in 2015 the local government established an air-quality protocol to respond to high NO_2 pollution peaks. This protocol implemented restrictions on the use of private vehicles, on-street parking and an odd–even license plate control scheme. In 2018, a low emission zone of 4.7 km^2 was established in the city centre. All these measures are added to a generalized pay-per-use scheme for on-street parking in operation in the urban core since 2006. Recently, local authorities have encouraged alternative mobility options as a way of promoting more sustainable behaviours based on less car-oriented lifestyles.

According to the 2018 Madrid Mobility Survey (CRTM, 2019), 14.7 million trips on average take place on a working day in the Madrid FUA. These trips are split across multiple modes, the main ones being private car/motorcycle **(39.0%),** walking and bike (34.0%), and public transport (24.3%). The balance towards environmentally friendly modes increases within the city of Madrid, where 40.0% of trips are made by active modes (i.e., walking and cycling), 34.8% by public transport services, and **20.3%** by private car/motorcycle.

When asked what the main issue in Madrid is, **46.8%** of the interviewed complain about traffic and congestion while only **6.8%** are worried about pollution levels according to a survey by *Grupo Análisis e Investigación 2015*. Pollution is therefore not one of the main concerns of Madrid's citizens. In the same survey, only 18.6% of residents in Madrid City Centre (CBD) show concern regarding pollution. However, the main cause of nitrogen oxide emissions is traffic. According to *Inventario de Emisiones de Contaminantes a la Atmósfera en el Municipio de Madrid 2019* (Madrid Inventory of Polluting Emissions) vehicles are responsible for 46.9% of nitrogen oxide emissions, making them the main cause of pollution in the city.

Even though there is a much larger percentage use of private car in the region than in the city (almost double), it is again the city which is taking the lead in terms of policies and actions being proposed to mitigate all the problems from an excess of car use and incentivize the use of more sustainable modes of transport. PMS Madrid 360 (SMP Madrid

360) does address car traffic as a crucial problem requiring active mitigation, and its 10 strategic lines and 120 actions reflect this. With the aim of reducing traffic by up to 10% and reducing CO_2 emissions by 65% (complying with the European Ambient Air Quality Directive), it proposes to expand and improve public transport infrastructures, promote active mobility (walking and cycling), manage car parks with sustainability criteria, promote micro-mobility and intermodality, stimulate the change of the circulating fleet for less polluting vehicles, promote technological change and the optimisation of the urban distribution of goods, etc.

Drivers
The city authorities have an open mind to accept new transport concepts.
Car traffic is perceived as a huge problem, if other options are offered effectively, drivers might change to more sustainable modes of transport.
There is motivation to use MaaS and new mobility solutions at city level.
There is a generally accepted SUMP at city level, with strong sustainable goals & actions. It is widely advertised and citizens are familiar with it. This could be a driver for the region (if properly scaled-up).

Barriers
Lack of consensus about MaaS in the region.
Citizens take some time to accept new mobility policies.
Lack of effective communication strategies and information channels with citizens.
Lack of unified and updated SUMP-strategy at city and regional level.

2.3.3. Mass

Capacity in established structures

Mobility in Madrid (at city and FUA level) is characterised by a dense, highly integrated, and well-structured multimodal public transport network. In order to make this possible, there is a close relationship between Madrid City Council, and the two main transport figures in Madrid: the EMT (public transport operator, owned by the City Council) at city level, and the CRTM (transport authority, coordinating all modes of transport and operating companies providing a multimodal system in the region), at FUA level. This interrelation and their management and organisational structures favour the implementation of different measures necessary to achieve a more sustainable mobility. Both EMT and CRTM, when asked, claim to have the means and the capacity to design, organise and operate new mobility services. Although, especially EMT, is aware of the consequences the pandemic has had in public transport use, which they are still trying to overcome.

On their webpages, you can see some interesting figures. The EMT, which employs almost 10.000 people, dedicates almost 6% (around 550) of its personnel resources to mobility services. In contrast, CRTM, which coordinates more than 40 operators in the region (including EMT), does not have that capacity (Annual Report 2019 CRTM).

Madrid City Council, CRTM and EMT all have experience in European projects. All stakeholders have a similar perception of their experience. Participation in projects such as SCALE-UP is enrichening, offers new viewpoints and helps to find possible mistakes, contributing to identify space for improvement. Participation in European projects –explain EMT representatives-, has accelerated the implementation of new solutions, either through imitation or through different mechanisms to share experiences. Some of the main advantages and insights gained from participation in European projects are, according to EMT representative: (1) financing for new projects/ideas, (2) positive impact of the company's or institution's image for participating in an innovation project supported by the European Union, (3) support from the European Union makes it possible to carry out ideas which were not considered viable or a priority.

Cooperation forums connecting actors

This area clearly has a large margin for improvement, since there is not a formal or ad hoc forum as such, to promote cooperation among different actors. However, EMT, CRTM and Madrid City Council work together regularly in relation to different activities/projects regarding sustainable mobility strategies. This might be a problem, since they meet once there is a conflict or a common project that requires collaboration, but not regularly, which is kind of reflected in the lack of common and up-to-date strategy in terms of mobility policies (i.e. SUMP at the different levels).

Working arrangements between institutions and mobility service providers are mainly through concessions which are generally long-term. Contracts are tendered out to secure a transparent, legitimate and fair contract procedure.

Nevertheless, internally, each organization does have in their corporate mandate the initiative to cooperate and collaborate with other actors. For example, CRTM, claims to involve and encourage all operators, manufacturers, suppliers and users to comply with the objectives of sustainable development with concrete and visible actions that improve social, economic and environmental performance. In its annual report (2019), the CRTM highlights the creation of the first Mobility Innovation and Training Centre in Spain.

Strategies to support modal change

In 2020, Madrid launched a campaign called *Muévete en EMT* to encourage the use of public transport in Madrid, particularly the bus and local electric bike service *BiciMAD*. The goal was to give the message that public transport is a reliable and sustainable option, especially after the pandemic. *DGT* (Traffic Department) has also launched several campaigns in Madrid during 2020 and 2021 to promote bicycle use.

In 2020 *Consejería de Transportes, Movilidad e Infraestructuras* (Office for Transport, Mobility and Infrastructure, Madrid Region) also launched a campaign stressing the safety, comfort and reliability of public transport and taxi to promote its use.

One of the main axes of Madrid's new SMP Madrid 360 is the promotion of responsible mobility through education, information and governance (campaigns, surveys). This means an investment by Madrid City Council of 1 978 million euros for the development of the proposed actions. The largest budget item in this plan (729 million) will be allocated to promoting active mobility, followed by the improvement of transport infrastructure.

CRTM's last Annual Report available (2019), summarizes some of the main strategies followed by the Public Transport Authority in the region, in order to support modal change. The figure "El Club de Amigos", helps improve citizens' experience and perception on public transport in the region. It promotes activities such as raffles to win various prizes, (i.e. tickets, discounts to events and even unique experiences, exclusive premieres, backstage shows with your favourite character or special discounts). For example, the musical "Billy Elliot" or "Kooza" (Cirque du Soleil), where the award-winning users were able to meet the cast of artists. This club also organizes competitions and cultural, musical, sports and leisure events. The communication of all these activities has been carried out only through their website (clubdeamigos.crtm.es) which during 2019 received more than 180 000 visits, with the participation of 1 841 users in 17 promotions.

CRTM also had during 2019, a campaign (ventex20) targeting young people in order to make public transport a more attractive option, organizing competitions and cultural, musical, sports and leisure events. The communication of all these activities has been carried out only through CRTM website and Metro de Madrid social media. More than 8 000 young users participated over more than 90 promotions.

Drivers
Decision makers at city level (especially EMT, closely working with City Council) have a strong capacity to develop new mobility services. This is still lacking at FUA level, due to the large number of public transport operators and the lack of last mile new mobility options outside the city (the strong city wave could be scaled to FUA and region).
Private and public mobility actors work together towards more sustainable mobility system.
There are research groups on sustainable mobility solutions and both City Council and EMT and CRTM regularly participate in European-funded new mobility projects.
The City Council and Transport Authorities all work strongly in the promotion of responsible and clean mobility.

Barriers
Difficulty of CRTM to propose and implement new mobility measures due to the high number of operators they manage.
Lack of competencies of EMT (to push strong initiatives to change towards more sustainable mobility system) at FUA and regional level.
There are no formal or ad hoc fora as such, to promote cooperation among the different actors involved in Madrid's mobility ecosystem at FUA and regional level.

2.3.4. Momentum

Incentives to push change

At national level, MOVES II Plan, within the framework of *Plan de Recuperación, Transformación y Resiliencia* (Recovery, Transformation and Resilience Plan), financed by the European Union (NextGenerationEU), is a boost for sustainable mobility. The MOVES II Programme of incentives for efficient and sustainable mobility was approved in 2020, at the proposal of *Ministerio para la Transición Ecológica y el Reto Demográfico* (Ministry for Ecological Transition and the Demographic Challenge). The coordination and monitoring of MOVES II is carried by *IDAE Instituto para la Diversificación y Ahorro de la Energía* (Institute for Energy Diversification and Saving) and the different Spanish regions are responsible for its management and for carrying out the calls for proposals in their respective territories.

At regional level, the MOVES II programme in Madrid, seeks to promote the implementation of actions to support mobility based on criteria of energy efficiency, sustainability and promotion of the use of alternative energies, including the provision of charging infrastructures for electric vehicles. At city level, the *Plan de Ayudas Cambia 360* 2021-2021 (Cambia 360 Aid Plan 2021-2023) offers many types of aids such as financial help for the purchase of private electric vehicles, freight and delivery vehicles, scooters, bicycles and motorbikes, as well as grants for the installation of charging infrastructure.

In addition, there are various incentives, mainly monetary, such as free on-street regulated parking (SER) for electric and hybrid vehicles, as well as exemption from *Impuesto sobre Vehículos de Tracción Mecánica IVTM* (Tax on Motor Vehicles). Another example of an incentive is the free use of P&R for citizens who have a public transport card. Regarding freight, there are economic incentives for fleet renewal, better conditions for operators who use a clean fleet, providing them with a larger time window for delivery, better timetables, or parking advantages, among others.

There are other, non-monetary incentives related to city planning itself. For example, as part of *PMS Madrid 360* (SMP Madrid 360), it is proposed to expand and improve public transport networks, as well as bicycle lanes and parking, expand the *BiciMAD* system, or facilitate micro-mobility and intermodality; all of this is expected to have an effect on the habits of citizens, towards a more sustainable mobility, by having a better and greater range of alternatives to using private vehicles. In addition, *Ordenanza de Movilidad Sostenible* (Sustainable Mobility Ordinance) includes restrictions on the most polluting vehicles that will be applied periodically, which are expected to promote the use of electric vehicles, as well as greater use of public transport and active modes.

Potential game changers

COVID-19 has caused important changes in mobility, for instance, a considerable decrease in the use of public transport. In January of 2022, the number of trips recorded by EMT is equal to the 80% of the trips made before the pandemic (2019). On the other hand, changes in the territorial structure in Madrid in the last 15 years as well as the growth of the metropolitan ring have had an impact on mobility. Financial and business hubs developments attract a large amount of activity and give place to many trips from some peripheries to others, also changing the type of trip, from point-to-point to multipoint (2 out of 3 trips are multipoint and not origin-destination).

The "EnBiciporMadrid"-blog (https://www.enbicipormadrid.es/) is a citizen initiative that volunteers from Madrid city and region write to encourage the use of more sustainable modes of transport, as well as inform and raise awareness of safety and pollution issues. There are different annual events directed towards a change in urban mobility. For example, the "University Gymkhana for Sustainable Mobility" organized by Madrid public universities, or the Engineering Week of UPM Escuela de Caminos, help to raise awareness of the consequences that daily mobility has on the environment and factors such as safety and air quality, promoting public transport and cycling and promoting healthy habits.

Drivers
At national level, the MOVES II Plan, is a boost for sustainable mobility.
At city level there are new incentives to promote the use of hybrid and electric vehicles, carpooling and cycling, such as free parking, accelerating the use of alternative mobility solutions.
At city level there are multiple incentives for logistic companies that use new clean mobility solutions, such as a wider delivery schedule, free parking, etc.
The COVID-19 period pushed the rethinking of mobility in the city (bicycle use has grown), although it has posed a slowdown in the pre-pandemic growing use of public transport in Madrid, and public transport authorities have a challenge ahead.
Demographic increase in the past decades, followed by new urban developments (both residential and business or industrial hubs) have accelerated changes in mobility policy and led to a change in the characteristics of trips: 2 out of 3 trips are now multipoint. These changes are drivers for new solutions, although they can also pose threats.

Barriers

Laws that provide incentives for people who buy electric vehicles, might be a barrier for the use of public transport and other clean mobility solutions.
Most initiatives to accelerate the use of alternative mobility solutions are promoted by the city (not so much the region).
There are very few citizens' groups or citizens-organized events that promote initiatives for alternative mobility solutions.
The COVID-19 period has slowed down the growing trend of the previous years in the use of public transport, in favour of the private car.
The pandemic has led to an increase in the demand of housing in the suburbs and this might increase even more the share of motorized private vehicles, since eventually we will go back to working in person.

2.3.5. Mechanisms

Structures to monitor, steer and manage change

According to administration representatives and the main transport operators, new mobility options are developed following a 3-phase process (design and planning, organization, and implementation and execution). Stakeholders have outlined the main issues for each of these:

- Design/planning of the service: When it comes to planning, existing data should work as a foundation to establish potential demand. However, in many cases there is either not enough data available or the capacity to process it.
- Organisation/implementation of the service: When it comes to implementing a new service, the impact it will have - regarding context and public space - is taken into account. However, most of the complaints or problems resulting from new services are related to pedestrians and their surrounding environment.
- Execution: When a new shared mobility service is in operation, new challenges arise, for example, working out where to charge electric vehicles or how to solve pendulum movements to ensure a correct redistribution.

Based on experience, when a new service or measure is implemented, changes and readjustments are made to get public acceptance or increase its positive impact.

There is a good relationship between Madrid City Council, EMT and CRTM (which includes the different local and regional bus services, metro and light rail). A clear example of this is the public transport pass, which includes all available modes, both in the city and the region. On top of this, all transport modes (either belonging to the city or the region or FUA) use the same infrastructure, which is made available to them, and is maintained by either of the levels, depending on the field of action. All this in aid of a joint mobility. Another example of the stability of the relationship between the city and stakeholders are the P&R facilities: The City Council gets the land and is in charge of the building works, while EMT is in charge of the exploitation through a turnkey contract.

Participatory processes

Recently, Madrid's City Council implemented a political reform to establish more participatory decision-making processes. This expansion of participatory budget processes led to the creation of an online portal for citizen involvement ("Decide Madrid") where citizens can decide what is done with a part of the city's budget (*presupuestos participativos*). Different projects are proposed for this part of the budget, and undergo several phases such as obtaining support, evaluation (analysis and technical viability) and are finally subjected to a popular vote, so that in the end the City Council carries out the most voted projects. Anyone over 16 can propose a project individually, or collectively, as part of an association or a non-governmental organisation (NGO). The budgets decided in

2021-2022 are executed starting in 2023, and are of 50 million euros, of which 35 million are for projects in specific districts and 15 million for projects that affect several districts if not all.

Even though participatory budget processes are aimed at involving all citizens, findings from previous CIVITAS projects such as ECCENTRIC in Madrid, point out potential risks. Innovative measures require a more detailed explanation and discussion with those participating in open decision-making processes, who sometimes dismissed them to the benefit of more conventional measures. While many municipalities in the Madrid region are introducing and expanding the concept of co-creation design, participatory budget and other initiatives, in order to increase citizens' involvement, these type of initiatives require additional efforts, which are not always possible. Especially in the case of innovative measures (such as new mobility solutions), in order to reach all population segments and have fruitful discussions on long-term outcomes rather than short-term outputs, participatory budget processes need to be coupled with stronger social policies; otherwise, these processes risk to reinforce the position of already socially dominant groups and elites (Aparicio 2020).

Drivers
Madrid has a city department with persons of the different city/regional sectors to manage new strategies in an integrated way (a good example is public space design and maintenance).
There is an integrated monitoring and evaluation approach to optimise running policies towards the sustainable goals set (especially in EMT).
There are existing mechanisms for citizens to participate in new mobility solutions in the city.

Barriers
Even though Madrid's **complex** governance structure may favour **an effective** mobility management on regional and city level, this might be acting more as a barrier at FUA and regional level, when trying to scale-up effective measures at city level (a good example is CRTM and the over 40 operators managed).
Participatory decision-making processes can sometimes be a barrier for socially inclusive policies, especially if not properly implemented with all the resources needed.

2.4. Turku

2.4.1. Methodology

The context for change at the Turku Urban Node was evaluated in a focus group workshop arranged by the Turku Local Evaluation Managers (LEMs) on the 10th of December 2021. There were 9 participants: SCALE-UP personnel from the city, the Regional Council of South-West Finland and Turku University of Applied Sciences, as well as some key persons from the city and the regional administration. The workshop included an introduction to the SCALE-UP approach to evaluate the context for innovative change by the LEM and a moderated discussion on each of the indicators (Mood and Motivation, Mass, Momentum, Mechanisms). The participants were divided into two groups. After discussing each indicator, the main findings were summarized on post-it notes and the LEM presented the views to the whole group.

2.4.2. Mood and Motivation

The level of acceptance of new types of transport policies was under scrutiny in the first part of the workshop. Below are summarized by category the main findings that describe the Mood and Motivation regarding this subject matter in the city of Turku and the FUA.

Policies & governance

Overall, the general mood towards the status of transport policies seems to be that of lack of interconnectedness. There are policies to promote sustainable transport and mobility but in general, a holistic vision of policy level development is lacking, and policies do not intersect well enough. Also, although there are policies directed at promoting sustainable urban transport (e.g., parking policies, cycling development plan) the acceptance of these policies in the eyes of the citizens is not very high. There is, for example, a regional SUMP but its connection to the city of Turku was found to be a bit of a question mark.

Similarly, in addition to poor policy-level interconnectedness, the lack of cross-sectoral cooperation to promote sustainable mobility was found to be significant. Interconnections between city divisions have a clear impact on the success of transport policies, and cross-sectoral administration is important also from the point of view of successful pilots and achieving long-term impact from pilots and projects. It was generally deemed that sustainable transport and mobility has been promoted from the point of view of the urban environment division and not, for instance, from the point of view of education services or the welfare services division. This clearly reflects the lack of a city-level SUMP: an integral part of the SUMP where different divisions are brought together, and all the relevant parties are involved is not currently fulfilled in the city. The cycling development plan, for example,

has been devised to a great extent from the perspective of street and traffic planning, not encompassing all relevant city sectors.

Overall, it is unclear how different plans and strategies intersect even within the street and traffic planning office. The general sensation seems to be that between sectors and divisions there is rather little crossing over of plans and strategies. Each division or service area seems to be focusing on its own agenda, with only a few people who work to glue together the shared interests of the respective parties. In many cases the need for this type of "gluing together of interests" has been recognized by those working with these issues, but more often than not these people do not, however, possess the mandate to push for more concerted efforts for joint development. Hence, the overall impact of what is actually being done to promote sustainable transport and mobility does not amount to the extent it could with better cross-sectoral integration of development.

When looking at mood and motivation to promote sustainable mobility from a more general point of view, one must not overlook the fact that the interests of the FUA and the interests of the city of Turku alone may differ significantly when it comes to transport and mobility development. In the FUA, public transport coverage is not that high beyond the Föli area, which can be observed in the rather low modal share for active travel modes. On a more positive note, there is potential in utilising transport related forums (both in the city and FUA) to promote sustainable mobility from multiple viewpoints to a wide range of stakeholders. Forums to promote traffic safety are positive examples of cross-sectoral cooperation bringing together actors from multiple sectors. However, traffic safety forums do not exist in all FUA, although e.g. Turku has recently begun the work of setting up such a forum.

The recently updated regional transport system plan includes low-emission, safe and sustainable transport modes. However, there are challenges in having a common regional strategy which is independently implemented by the municipalities. All in all, practical implementation of mobility related strategies at the city level may be insufficient or incomplete although the intentions tend to be good. There is also a lack of strategic leadership, which may result in wasting precious resources on actions or activities, which support the overall goal poorly.

Lack of a holistic vision

In the city of Turku and to some extent also in the FUA, there are large-scale processes to improve transport and mobility ongoing at the same time. In addition, there are several mobility-related initiatives and pilots ongoing, and the general mood is in favour of these sorts of actions. The so-called big picture, nevertheless, is still somewhat unclear. There is willingness to look for new types of initiatives and mobility policies, but this willingness does not necessarily translate into concrete actions too easily. As an example, discussions on adding a tramway to the public transport system in the city of Turku have been ongoing ever since the early 1990's both on the level of citizens and decision-making bodies. A general plan and impact assessments have been made. Three options were examined and

compared: a trunk bus system, a tramway and a superbus. The tramway was found to most effectively meet four out of the five objectives set. Yet the final decision for the construction still awaits, and the current estimate is that the investment decision could be made by 2024. Based on this example and several others, one could state that major improvements could be made in terms of better coordination of separate initiatives and objectives – and this applies to many city sectors, not just transport and mobility.

The general mood towards mobility pilots is certainly positive in the city and the FUA. The city administration actively supports piloting of new mobility solutions. Here, however, the challenge is with implementing the pilot or project results into practice after external funding has ceased. Although piloting as such is promoted, there does not seem to be established practices of assessing whether the pilot results and experiences should and could be integrated to the day-to-day practices of, say, winter maintenance of cycling routes or similar. The reproachful glance here is again turned to the lack of holistic vision – when it is not clear *how* the city wants to achieve its stated goals (and goals and objectives there are plenty of), it is no wonder that pilot results would be systematically interpreted in the frame of that vision.

Generally, there is a lack of understanding of the all-encompassing nature of transport. Many actors representing different sectors or stakeholders do not see that they could (or should) have a role in transport related issues. However, building a comprehensive regional transport system requires the views and perspectives of a wide range of officials and stakeholders, including major employers of the region such as Valmet Automotive, Meyer Turku or the Hospital District.

Public participation and discussion on mobility policies

In general, public discussion is active in issues related to transport and mobility in the urban node. The importance of interaction in gaining acceptance to transport policies has been clearly recognized at the level of decision-making. Citizens are good at requesting things and creating expectations. Based on some participatory processes, citizens are also often even more prepared to make bolder changes than city officials. There is, however, a disparity between whose voice is heard, or who is listened to. The voice of the "average citizen" is often muffled under the cries of the extremes – be it those of the private car owners or the avid cyclists, for example.

Quite interestingly, according to the focus group, even the media were found to clearly possess differing agendas when it comes to attitudes towards transport policies. The Finnish-speaking local newspaper, Turun Sanomat, was found to possess a marked stance towards the interests of private car owners, whereas the Swedish-speaking Åbo Underrättelser was clearly more directed towards sustainable modes of transport.

When it comes to the mobility-related associations and organizations, it was found that their role could be a whole deal more prominent in the promotion of sustainable transport policies. The local cyclists' association Turpo (as well as other similar associations and organizations) are rather invisible but to those already interested in the issue and/or part of

the target group. Here, there is thus clearly room for wider and more active role-taking in the discussion fora.

A culture of private car use

There is strong support for private car use in the urban node, backed up by some influential parties. Some of the biggest property owners, for example, are pro-private cars and very vocal about it. On the other hand, there is strong support for cycling and the improvement of cycling conditions in the city. Here, opposite extremes are accentuated.

However, although civic debate on transport and mobility is often loudest when it comes to promoting the interests of private car owners, it's worth acknowledging that even among the private motorists there are those who are very much in favour of sustainable mobility promotion. There have been, for instance, frequent requests for more extensive public charging infrastructure for e-vehicles and the lack of such clearly named a hindrance for the procurement of e-cars for many.

On a more positive note, topics such as accessibility have been "trending" in the recent years – this is something that can create good preconditions for further policy development on improved sustainable transport modes as well. Leading a car-free life is also a rising trend in Finland overall and in cities in particular – there are more and more young adults who do not get their driver's license the first moment possible. Here too, however, one can observe a conflicting trend as the popularity of microcars and similar does not seem to be waning among the young. The recently established Excellence Center for Physical Activity of Children and Adolescents could bring new perspectives to the promotion of active modes especially among the younger generations.

It should be noted that the pandemic has created a modal shift from PT to private cars due to the perceived unsafety of PT. It remains to be seen whether this is a permanent shift or if we will see a rise in PT usage after things eventually normalize. It is noteworthy that the pandemic has widened the concept of safety to also cover health safety, which is less often tackled in transport planning.

Electrification and other technological development trends may work against PT and other sustainable modes as they may transform previously less acceptable private vehicles into acceptable transport modes. Driving a cool and technologically advanced e-car may suddenly become more attractive than using PT or biking. Technological advancement may even amplify the interest in private car ownership, which has traditionally been part of the Finnish ethos.

Drivers
There is potential in using some of the existing and underutilised structures (e.g. the local area forums, the various regional transport system forums or the stakeholder forum) in

the city and FUA for the promotion of sustainable mobility from multiple viewpoints to a wide range of stakeholders.
Overarching strategies related to e.g. accessibility, digitalization, equality or various transport related EU directives may indirectly or directly encourage planning practices which are good for all.
The recently updated regional transport system plan includes low-emission, safe and sustainable transport modes.
There are several mobility-related initiatives and pilots ongoing, and the general mood is in favour of these sorts of actions. In addition, there is willingness to look for new types of initiatives and mobility policies and the general mood towards mobility pilots is positive in the city and the FUA.
The media clearly possess differing agendas when it comes to attitudes towards transport policies; some media outlets are readier to promote sustainable mobility than others.
There is a lot of underutilised potential in mobility-related associations and organizations. Their role could be more prominent in the promotion of sustainable transport policies.
There is potential in citizens' attitudes, however political decisions are partly in favour, partly against actual actions to promote sustainable mobility transition.
Public discussion is active in issues related to transport and mobility in the urban node. Citizens are also good at requesting things and creating expectations. For example, there is strong support for cycling and the improvement of cycling conditions in the city and citizens frequently request for more extensive public charging infrastructure for e-vehicles.
Leading a car-free life is a rising trend in Finland, especially in cities.

Barriers
Political support for sustainable mobility is inadequate, which causes a chronic lack of resources in sustainable mobility related activities.

Transport and mobility are a dispersed whole with a lack of cross-sectoral and stakeholder cooperation. In addition, policy-level interconnectedness is poor.
There is rather little crossing over of plans and strategies between sectors and divisions and the need of "gluing together of interests" has been recognized by those working with these issues.
There is a lack of a city-level SUMP: an integral part of the SUMP where different divisions are brought together, and all the relevant parties are involved is not currently fulfilled in the city.
There are challenges in having a common regional strategy which is independently implemented by the municipalities. The interests of the FUA and the interests of the city of Turku alone may differ significantly when it comes to transport and mobility development.
There is also a lack of holistic vision: it is not clear *how* the city wants to achieve its stated goals. The coordination of separate initiatives and objectives is inadequate. This applies to many city sectors, not just transport and mobility.
The willingness for new types of policies and initiatives does not necessarily translate into concrete actions. In addition, implementing pilot or project results into practice after external funding has ceased is challenging.
Many actors representing different sectors or stakeholders do not see that they could (or should) have a role in transport related issues. There is also a disparity between whose voice is heard, or who is listened to.
The COVID-19 pandemic has led to unforeseen consequences: a modal shift from PT to private cars due to the perceived unsafety of PT.
Pro-private motoring attitudes are prevalent. Although there are good intentions to reduce private car usage, the opposition is often strong and backed up by some influential parties. In addition, electrification and other technological development trends may work against PT or other sustainable modes. Driving a technologically advanced e-car may suddenly become more attractive than cycling or using PT.

2.4.3. Mass

The capacity to make change happen in terms of promoting sustainable transport and mobility was under scrutiny in the second part of the workshop. Below are summarized by category the main findings that describe the Mass regarding this subject matter in the city of Turku and the FUA.

Capacity in established structures

The Turku region public transport system, Föli, provides easily accessible and smooth public transport services in six municipalities within the FUA. The Föli area includes the municipalities of Turku, Kaarina, Raisio, Naantali, Lieto and Rusko. Föli organizes and promotes public transport services in the area, plans timetables, sets ticket prices and handles the marketing and passenger communications for public transport. As such, it is a well-established and rather well-resourced actor with a strong capacity to organize transport services. Föli is also open to exploring new avenues in the field and has in the recent years taken part in several projects related to changing the mobility behaviour of citizens or new mobility technologies, for instance.

In 2021, Turku city underwent some administrational restructuring on the transport and mobility services. A new service area, Mobility Services, was established that will provide all the public transport services in the Föli municipalities. In addition, the service area is responsible for producing and developing mobility services in Turku and the city region. The mobility projects related to this topic (including SCALE-UP) were moved under the "Urban mobility solutions" sub-unit of the service area. This administrational rearrangement is a good start for achieving greater mass to design, organize and operate new mobility services in the city. It will remain to be seen, however, whether the desired impact will be reached. A critical issue is inadequate resourcing and lack of permanent staff. In the recent years people have tended to come and go, with only a few people working permanently on these issues. This has resulted in a partial lack of continuity and loss of know-how, things which naturally do not create ideal conditions for improved capacity to make changes. Another worry expressed by the focus group here is related to the lack of incentives for the staff to seek for new projects and pilots, e.g. by applying for funding – there is no compensation for the extra effort needed for writing project proposals and such, a demanding task to be undertaken for the staff when already having their schedules filled up to the rim with day-to-day tasks.

Within the Turku FUA, there are well-established cooperation structures related to transport system planning in the region. The Turku regional transport system plan covers the whole FUA, aiming to specify the transport system plan of the South-West Finland region. The plan promotes the functioning of the transport system, traffic emission reduction and sustainable and safe transport. The cooperation structure, led by the Regional Council of Southwest Finland, covers the FUA municipalities, with several sub-groups and steering groups on specific topics meeting on a regular basis (this structure is explained in more detail in Section 3.3.3.1 Quality of cooperation structures). In addition to enhanced capacity, this

structure brings clarity and continuity to transport planning in the FUA, with a monitoring system in place to follow up the progress made to attain the stated goals. It should be expressly noted here that regionally, within the FUA, this overarching cooperation structure works well at the same time making it explicit that within the city sectors such cooperation is not nearly as well established.

A potential avenue of further cooperation between relevant actors was found to lie within the traffic safety work being initiated in the region. This is however not an official structure embedded in the governance system of transport and mobility, but more an unofficial cooperation structure between city/regional organizations working on traffic safety issues.

Overall, it is not always quite clear who are the right people to advance issues within the organisations – in other words, who has the capacity to influence issues. This is related to the mandate conundrum mentioned in the previous section – although there may be those who are development-oriented and willing to take the extra effort to advance transport policies, mobility services and the like, they may not be the ones with the mandate – the capacity – to do so.

Cooperation forums connecting actors

Mobility service development together with stakeholders has progressed in leaps and bounds within the recent years in the urban node. A good example of this is the cooperation forum established for shared mobility companies and operators and the city (Lipatol), which was initiated with project funding but has now been established as a permanent cooperation structure with bi-yearly regular meetings.

Cooperation between the city and housing associations was deemed good by the focus group. This has taken form via projects related to e.g. e-mobility. There is surely room for improvement here, too, however the current basis for cooperation was considered very satisfactory. In addition, the local forums, which the city uses regularly as a channel to communicate for example sports and recreation related issues could be used to promote active modes especially for specific target groups in different parts of the city.

Cooperation with companies, however, is lacking ambition and resources. No goals have been set for improved company cooperation. There have been some attempts to promote a business incubator but no support structure exists for this type of activity. A Customer, Relationship and Management system (CRM) is still not in operation in the city after having been delayed. Existence of such a system would facilitate contacting companies. An issue to mention is the fact that the city administration is not really in favour of early-stage development with companies, e.g. with emerging technologies, but has explicitly stated that company cooperation should focus more on already established practices and technologies.

There are still clear advantages too in the Turku area that can make company cooperation more efficient. There are many companies in the region, which means greater mass and,

subsequently, more opportunities. Some of the big employers are already partly involved in the effort, although they could still be more involved in transport and mobility development.

When it comes to cooperation with research institutions, it is clear that there is a lack of research, development and innovation (RDI) activities for sustainable mobility in the region. There is no higher education in transport and mobility planning or similar. The general feeling among the focus group participants was that there is too little RDI cooperation between the city, research institutions and companies. It has actually been declared on the Turku city side that RDI cooperation is not among the city's core operations. This is not to say that there is no cooperation between research institutions, the city or the regional administration and companies – there is – however this cooperation is mostly fragmentary, not established or relying on any permanent cooperation structures. Having stated this, it should be noted that on some subject-matters, such as service design, RDI cooperation is already rather well-functioning.

A few years ago, the city of Turku initiated an unofficial cooperation forum for actors working with sustainable transport and mobility issues in the area. This forum includes representatives from research institutions (University of Turku, Turku University of Applied Sciences), authorities (city of Turku, Regional Council of South-West Finland) and the main business and innovation clusters (Turku Business Region). This forum is not, however, an established structure and has been on hiatus since 2020: The forum has no official mandate, and to gain that, it would need ambition and an expression of support from the higher administrational levels.

Strategies to support modal change

The urban node hosts a range of strategies and plans to promote sustainable mobility development. The Turku Region Transport System Plan was just recently updated. In the current Turku region MAL agreement (2020-2031) concerning land use, housing and transport planning, a sustainable and low carbon urban structure and traffic system is developed with the goals of achieving a lively and attractive walking and cycling city, an increased share of sustainable transport and decreased share of passenger car transport by 2030. Monitoring takes place to measure progress in reaching these goals. The Turku Climate Plan 2029 has been prepared in accordance with the common model of the European Union (SECAP, Sustainable Energy and Climate Action Plan) and it includes climate policies and milestones for years 2021, 2025 and 2029, covering several measures to promote sustainable mobility. There are strategies to support modal change, for sure, however the effectiveness of the implementation of those strategies is not always clear. There can sometimes be noted, for example, a clear discrepancy between what is stated and what is actually done. In the FUA, the goals stated in the strategies may not always coincide with the municipalities' own decisions.

Drivers

The Turku Climate Plan 2029 includes climate policies and milestones for years 2021, 2025 and 2029, covering several measures to promote sustainable mobility and modal change.
The Turku Region Transport System Plan was just recently updated and the Turku region MAL agreement (2020-2031) concerning land use, housing and transport planning covers also transport issues. The Turku regional transport system plan covers the whole FUA, aiming to specify the transport system plan of the South-West Finland region. The cooperation structure, led by the Regional Council of Southwest Finland, covers the FUA municipalities, with several sub-groups and steering groups on specific topics meeting on a regular basis. This has brought clarity and continuity to transport planning in the FUA, with a monitoring system in place to follow up the progress made to attain the stated goals
There are well-established cooperation and planning structures to promote sustainable mobility policies (transport system planning, stakeholder forums, district forums) in the FUA and in Turku. There is also an unofficial cooperation structure between city/regional organizations working on traffic safety issues and a cooperation forum established for shared mobility companies and operators and the city (Lipatol). Turku has well-functioning local forums which are regularly used to communicate sports and recreation related issues. These forums could be used to promote active modes.
The Turku region public transport system, Föli, provides easily accessible and smooth public transport services in six municipalities within the FUA. Föli is open to exploring new avenues in the field and has in the recent years taken part in several projects related to changing the mobility behaviour of citizens or new mobility technologies.
The newly established service area, Mobility Services, will provide all the public transport services in the Föli municipalities. The mobility projects related to this topic (including SCALE-UP) were moved under the "Urban mobility solutions" sub-unit of the service area. This administrational rearrangement is a good start for achieving greater mass to design, organize and operate new mobility services in the city. RDI cooperation is well-functioning on some other subject-matters also, such as service design.
Cooperation between the city and housing associations has taken form via projects related to e.g. e-mobility.
Turku has initiated an unofficial cooperation forum for actors working with sustainable transport and mobility issues in the area some years ago. However, this forum is not an established structure and has been on hiatus since 2020.

Barriers
Municipalities' interests vary when talking about sustainable mobility promotion – this means that strategies and related goals may be interpreted differently.
Overall, it is not always quite clear who are the right people to advance issues within the organisations – in other words, it is not known who has the capacity to influence issues.
There are strategies but their implementation sometimes lags behind. The effectiveness of the implementation of strategies such as Turku climate strategy 2029 is not always clear. In the FUA, the goals stated in the strategies may not always coincide with the municipalities' own decisions.
Lack of cross-municipal cooperation and tools, which would support even better multimodality across municipalities.
Cooperation is not nearly as well established within the city sectors as it is regionally. Cooperation with companies is also lacking ambition and resources. Attempts at promoting cooperation via a business incubator have been made, but no support structure exists for this type of activity.
Turku city has declared that research, development and innovation (RDI) cooperation is not among the city's core operations. Inadequate resourcing and lack of permanent staff may hinder sustainable mobility related activities on many levels. For example, there is no compensation for the extra effort needed for writing project proposals, which may discourage city employees applying for funding for new projects and pilots. As a result, there is a lack RDI activities for sustainable mobility in the region between the city, research institutions and companies.

2.4.4. Momentum

Elements to speed up change regarding issues of sustainable transport and mobility were under scrutiny in the third part of the workshop. Below are summarized by category the main findings that describe the Momentum regarding this subject matter in the city of Turku and the FUA.

Incentives to push change

In general, the context for change in the urban node is strongly driven by national and EU-level legislation. The EU climate goals are binding, thereby setting up a baseline both for national, regional and local goals and objectives. Upcoming directives, such as the Intelligent Transport Systems (ITS) Directive on the deployment of ITS, already push for the development of digital infrastructure in the mobility sector. The New EU Urban Mobility Framework, proposed by the European Commission in 2021, aims to support Member States, regions, cities and other stakeholders in the transformation to safe, accessible, inclusive, smart, resilient and zero-emission urban mobility. The framework is likely to accelerate actions and investments in the Turku urban node too.

The National Transport System Plan for 2021–2032, a strategic plan for developing the transport system, also drives the change on the level of local governments. The plan includes a description of the current state of the transport system and changes in the operating environment, a vision for transport system development by 2050, objectives set for the Plan and their specific strategic guidelines, as well as an action plan containing measures for the central and local governments to achieve its objectives. The Sustainable Growth Programme for the Transport Sector 2021-2023 promotes business-driven innovation, internationalisation, and growth based on sustainable solutions in the transport sector. According to the focus group, this programme should be made better use of in the urban node.

A concrete incentive directed at Finnish companies is the tax benefit for employer-provided bicycles, introduced by the Finnish government from January 2021. In this scheme, employer-provided bikes are acquired by leasing, and at the end of the leasing period the employee can redeem the bike cheaply at its residual value. This benefit, however, is not applicable to cities as employers, which was deemed a significant drawback by the focus group. Although not applicable to the city as an employer, the benefit can be seen to promote sustainable commuting in general in the city and in the FUA.

There is also a growing need to create incentives which promote equality and inclusion in sustainable mobility. Not all have the possibility to buy a bicycle or an e-bike without support mechanisms. This is especially the case with vulnerable groups such as immigrants or families with children.

Potential game changers

Transport has been amongst the sectors hardest hit by the COVID-19 pandemic. The impacts of the pandemic for remote work, planning for transport connections, public transport and the like have been a test for the resilience of urban transport systems. The impacts on the sensation of safety of PT users, for example, may have long-term consequences for the demand of public transport. In the Turku regional public transport system Föli the PT usage rates dropped significantly during the pandemic. The situation has not, however, hindered Föli from continuing with its renewal plans, such as the widening of the PT coverage, or the trunk route renewal, which has been in the works for some time now. Although Föli has the willingness to expand its operations, the economic consequences of the pandemic to PT have still been dire, which has meant some necessary postponement on these development trajectories.

The implications of the COVID-19 pandemic also call for some innovative travel chains needed for longer distance traveling. As remote work has proliferated and become a norm to many, the urbanization rate has experienced a slight deceleration as the allure of living closer to nature, in more spacious living quarters has led to a slight decrease in the attraction of the biggest cities in Finland.

The ageing population, being a global megatrend, is something that the urban node cannot escape. The demographic momentum observed here may have unexpected consequences for public transport in particular, as smaller age groups may translate into less PT users. At the same time, however, some emergent trends point to an opposite direction: the car-free life is rising as a trend, and nowadays there are more and more young people who don't get a driver's licence at all. Paradoxically, at the same time there has been talks on the national level on lowering the age limit for the driving permit, something that does not exactly work to promote sustainable mobility.

One of the most remarkable developments in the whole country of recent decades, Finland's health and social services reform was finally sealed as representatives were elected for the newly formed, self-governing wellbeing services counties in January 2022. The responsibility for organising public healthcare, social welfare and rescue services will be transferred from municipalities to wellbeing services counties from the beginning of 2023. The key objective of the reform is to improve the availability and quality of basic public services throughout Finland. A renewal of services of this scale naturally implies great restructuring needs for related transport services as well. There is huge potential to plan for more efficient transport services within the wellbeing services counties – however, it is doubtful that there will be transport experts to plan them. A large part of the budget related to these services will be removed from the city under the counties jurisdiction. The impacts of this renewal on the transport and mobility sector thus remains to be seen.

Drivers

Binding EU and national goals build up momentum for change.
The transport system plan and the MAL agreement are established structures which entail goals whose fulfilment is monitored regularly.
There is potential in the welfare services reform to majorly improve the efficiency of transport functions in that sector.
A concrete incentive directed at Finnish companies is the tax benefit for employer-provided bicycles, introduced by the Finnish government from January 2021.
Despite the COVID-19 pandemic Föli is continuing with its renewal plans, such as the widening of the PT coverage, and the trunk route renewal.
Car-free life is rising as a trend, and nowadays there are more and more young people who don't get a driver's licence at all.
Due to the ongoing health and social services reform, the responsibility for organising public healthcare, social welfare and rescue services will be transferred from municipalities to the newly formed, self-governing wellbeing services counties from the beginning of 2023. There is huge potential to plan for more efficient transport services within the wellbeing services counties.

Barriers
Decreasing resources – e.g. welfare services reform takes about half of the resources from the city to the welfare services counties. This means that the city will no longer have any influence on these issues. Moreover, the newly formed, self-governing wellbeing services counties are not likely to have transport experts to plan their transport services.
Finding the right incentives to drive the transition to sustainable mobility is not straightforward. For example, the tax benefit for employer-provided bicycles is not applicable to cities as employers, which is a significant drawback.
The pandemic may drive or act against sustainable mobility, this remains to be seen. For example, COVID-19 has had a negative effect on the sensation of safety of PT users. Thus, the pandemic may have long-term consequences for the demand of public transport.
Demographic momentum created by the ageing population may have unexpected consequences for public transport as smaller age groups may translate into less PT users.

2.4.5. Mechanisms

The processes to develop new solutions, control and manage change regarding issues of sustainable transport and mobility were under scrutiny in the fourth and final part of the workshop. Below are summarized by category the main findings that describe the Mechanisms regarding this subject matter in the city of Turku and the FUA.

Structures to monitor, steer and manage change

Turku has been recognized among the world's leading climate cities for some years in a row now, thanks to its climate measures. The assessment is based on comprehensive plans and actions, including the publishing of climate data, comprehensive emission inventories, setting of emission reduction targets and climate action plans available. And plans and strategies there surely are, and to a fair extent monitoring of reaching stated goals as well. To name a few examples in addition to regular emissions monitoring, for instance, the fulfilment of the goals set in the MAL agreement (agreements concerning land use, housing and transport) are regularly monitored and published online. TEA-viisari, a tool for municipalities to describe the development of health promotion capacity building, monitors active modes as well.

The cycling barometer has now been performed twice to survey the attitudes of the residents of Turku regarding the promotion of cycling. The traffic environment survey in the Turku core region has been performed three times and is to be repeated regularly in the future. It also maps the potential change of attitudes. The Finnish National Travel Survey collects basic data on mobility in Finnish municipalities and is repeated approximately every six years. The "School on the move" (Liikkuva koulu) survey gathers data on school children's mobility habits and the views of school staff to support the schools in developing the physical exercise culture. In addition, the government offers a support scheme for practical mobility management activities, which can be applied for annually. Although the funding is intended for small-scale mobility management projects, it enables the city and regional actors to carry out activities that might not otherwise be possible.

As part of the development of a new master plan, the City of Turku sought to engage its citizens in the planning process in May 2020 via the "Turku deliberates"-citizens' panel. It contracted Åbo Akademi University and Tampere University to do this. A democratic innovation called a deliberative mini-public was applied here to discover an informed public opinion on the transport system in the city centre. Random sampling was used in recruiting participants, of which there were 171. Policy recommendations were formed based on the results of the panel.

In short, information is collected and analysed. But how is the information gathered applied in practical planning? How is the data utilized in the city or the region? This is something that raised some concern among the focus group members. It was also recognized that certain meters are lacking, for example ones that would measure innovativeness aspects.

There are several well-functioning meters in use for singular processes, but not widely enough. Also, it is not uncommon that as a result of a specific process baseline data is collected but no follow-up data at all – monitoring lacks, well, monitoring. Another thing is that for the most part data is very dispersed. With some mobility related data, for example, it has been very difficult to find a party within the city organization that would take the ownership of data collected – let alone make it public via established channels. Platforms already exist, for example the Lounaistieto platform could be a good place to collect data from various sources.

Another thing that was mentioned as a mechanism to steer change was procurements. In the urban node, public procurements are at least to some extent steered by quality criteria related to environmental impacts. When making the latest subcontract for running some of the bus routes, Föli included sustainability criteria in the competitive tendering process. As a result, there are now 61 e-buses in the fleet, a remarkable rise from the 6 e-buses in operation in 2020.

Participatory processes

Generally speaking, the participative processes for local communities are partly inadequate in the Turku urban node. There are structures and processes for participation but it is not always clear where they lead. No established practices exist for deciding which issues in particular should be brought under participatory decision-making. Some of the structures are of course more established than others. The "Voice your opinion" internet service, for instance, is maintained by the city of Turku for residents to voice their opinions and to be heard in various cases, which are coming, or are already, under preparation. Others can read and leave comments on opinions which will be reported and summarized to be used by preparers and decision makers. This process is rather well-known among the citizens and widely utilized as a feedback channel for planning and realization of city services. On the other hand, the SECAP update, for instance, included no stakeholders outside the city organization in the update process. The city has refined participatory processes in the city districts, but there is still room for improvement.

The regional traffic system work involves a wide range of stakeholders, but it could be more participatory when it comes to involving citizens. In addition, it is not always guaranteed that the views of various stakeholders are considered in the actual planning phase. It is natural that the relative weight of stakeholders may influence the extent to which their views are taken into account in the plan. Thus, smaller municipalities or other less prominent stakeholders may feel that their views are not equally important in regional transport planning.

It is still recognized in the urban node that processes such as participatory budgeting increase the interest in participation on the citizens' behalf and may promote cross-sectoral cooperation within the city's service areas. A participatory budgeting process is actually currently ongoing at the time of writing, with the focus on children and youngsters. Some mobility related initiatives were suggested in the first round of budgeting proposals. The

climate work overall in the city was considered a positive thing, with some participatory elements such as youth panels on in the scope of the Carbon neutral Turku campaign. Participatory processes were also applied in making of the circular economy roadmap in the form of a citizen's panel.

Drivers
There is a lot of potential in integrating different datasets and indicators gathered by different city sectors or regional actors to create a holistic and up-to-date understanding of the status of transport / sustainable mobility related issues.
The context for change in the urban node is strongly driven by national and EU-level legislation. The Intelligent Transport Systems (ITS) directive, on the deployment of ITS, already pushes for the development of digital infrastructure in the mobility sector. The New EU Urban Mobility Framework, proposed by the European Commission in 2021, is likely to accelerate actions and investments in the Turku urban node too.
The National Transport System Plan for 2021–2032, a strategic plan for developing the transport system, also drives the change on the level of local governments.
The Sustainable Growth Programme for the Transport Sector 2021-2023 promotes business-driven innovation, internationalisation, and growth based on sustainable solutions in the transport sector. This programme should be made better use of in the urban node.
Turku has been recognized among the world's leading climate cities for some years based on the comprehensive assessment of plans and actions, including the publishing of climate data, comprehensive emission inventories, setting of emission reduction targets and climate action plans available. Monitoring of reaching stated goals is also frequent.
As part of the development of a new master plan, the City of Turku sought to engage its citizens in the planning process in May 2020 via the "Turku deliberates"-citizens' panel: a deliberative mini-public was applied here to discover an informed public opinion on the transport system in the city centre.
In the urban node, public procurements are at least to some extent steered by quality criteria related to environmental impacts.
A participatory budgeting process is currently ongoing with the focus on children and youngsters.

Barriers

Structures and processes exist for participation but their connection to actions is often unclear.
There are no established practices for deciding which issues should be brought under participatory decision-making
A lot of Information is already collected and analysed but the data is not necessarily used or applied in practical planning. Certain meters are lacking, for example ones that would measure innovativeness aspects. There are several well-functioning meters in use for singular processes, but not widely enough. With some mobility related data, for example, it has been very difficult to find a party within the city organization that would take the ownership (and subsequent responsibilities related) of data collected.
Mobility related data (e.g. opinions of citizens) is collected to some extent but there are no established practices for the utilization of this data in decision-making.
The regional traffic system work involves a wide range of stakeholders, but it could be more participatory when it comes to involving citizens. In addition, it is not always guaranteed that the views of various stakeholders are considered in the actual planning phase.

3. Functional Urban Area impact indicators

3.1. Introduction

The aim of the FUA indicators is to capture the mobility related changes in the 6 CIVITAS impact categories — society-governance, society-people, transport system, energy, economy and environment — in each of the urban nodes.

At the start of the SCALE-UP project, a dedicated selection of FUA indicators was made to monitor the evolution at FUA level in the perspective of the SCALE-UP objectives. This was the result of an intensive process involving multiple discussions with the Project Evaluation Team and between the Local Evaluation Managers and the local partners in the urban nodes. The selection of these FUA indicators is inspired by the indicators described in the CIVITAS 2020 process and impact evaluation framework in relation to the CIVITAS impact categories and by the Sustainable Urban Mobility Indicators (SUMI) methodology[7]. The selection procedure of these FUA indicators was based on a thorough exercise looking at the relevance in each impact category and in relation to the implemented SCALE-UP measures and data availability (at city, FUA or other level), not only for the baseline reporting, but also to monitor and evaluate changes during the SCALE-UP project.

The SCALE-UP urban nodes aim to be **as consistent as possible** in its **data collection approach,** both across the SCALE-UP nodes and during different data collection moments. In the society-governance impact category, a SCALE-UP common approach is taken by the urban nodes, as outlined in Annex 1: FUA indicators in the impact category society-governance. In the other CIVITAS impact categories, all urban nodes start from a common generic definition of the indicator which is detailed further depending on data availability and the need of each urban node to keep consistency with previous data collection campaigns in the city and the FUA.

In this document the baseline data of the urban nodes is collected **on the level of the city** and the **Functional Urban Area (FUA)** and in some cases (additionally) on **regional level**. Since in most cities data are traditionally only collected at city level, collecting data at FUA level showed to be a challenge and was not always possible. In line with the European guidelines on the collection of urban mobility indicators and taking into account the SCALE-UP objectives to work on the

[7] https://transport.ec.europa.eu/transport-themes/clean-transport-urban-transport/sumi_en

integration of the different urban levels, collecting the baseline data was therefore seen as an opportunity to engage the different stakeholders in starting to collect these types of data not only at city level, but also at the FUA level.

Therefore, baseline results will be presented, whenever possible, on the level of the city and FUA. By collecting and monitoring these indicators on both city and FUA level important insights are gained on the diversification between city and FUA and provides a good context for the measure level evaluation.

In the following sub-sections, the baseline situation of the FUA indicators of the 3 urban nodes is presented and discussed for each CIVITAS impact category. When possible, the trend towards the baseline is described and quantified. This results in a better understanding of the baseline and will help to define the business-as-usual scenario.

The aim is to further monitor these FUA indicators over the course of the SCALE-UP project and to identify overall changes in the urban nodes in the different CIVITAS impact categories, and to understand why we observe these changes. Changes in the city or FUA will be (fully or partly) attributed to :

1. general national, and EU evolutions
2. the general evolution of the city/FUA,
3. the implemented SCALE-UP measures, or
4. the implementation of other measures

In the SCALE-UP project, stakeholder workshops will be organised, in each urban node, near the end of the project, to understand the observed change and isolate the impact of the SCALE-UP measures. The participants will be presented with the observed trend in the FUA indicator and will then be asked to identify which measure(s) or general trend could be attributed to explain the observed evolution in the indicator, based on their initial reflection and the discussion with the other stakeholders. These results will be reported in D7.6 Moving forward to achieve SCALE-UP objectives in the SCALE-UP FUAs, in September 2024.

In the following section the areas of data collection (city and FUA) of each urban node are described, and the subsequent sections present the baseline results in each CIVITAS impact category.

3.2. Areas of data collection

3.2.1. Antwerp urban node

The urban node Antwerp consists of the city of Antwerp and the surrounding Antwerp Transport Region.

3.2.1.1 *The city of Antwerp*

The city of Antwerp is located in the north of Belgium, close to the Dutch border. It is the second-largest Belgian city, after Brussels and it holds a strong economical, regional role, partly because of hosting Europe's second-largest port (Figure 2). The city itself covers a large area, namely 20 429 hectares and consists of 7 districts (Figure 3). The city is characterized by the large ring road that surrounds the busy city centre and by the very elongated port area in the south of the area (Figure 2).

Figure 2 : Location of the city of Antwerp within Belgium and the port and ring road of Antwerp

Source: Google maps

3.2.1.2 The Functional Urban Area of Antwerp

The Functional Urban Area corresponds roughly to the Antwerp Transport Region. The Flemish region, the Dutch-speaking part of Belgium, is divided into 15 transport regions. These transport regions give an official political voice to municipalities within the decision-making process of mobility policy within that specific region, but they are also, with their recent implementation in 2019, a relatively new concept.

Figure 3: The city of Antwerp divided in districts

Source: https://www.antwerpen.be

The Antwerp Transport Region consists of 33 municipalities with the city of Antwerp located in the south-westside of the region (Figure 4) Most of those municipalities lie within the province of Antwerp (Flanders is divided into 5 provinces). However, the municipality of Beveren lies in East-Flanders. This leads to certain data and administrative barriers (e.g. the indicator for cycling quality).

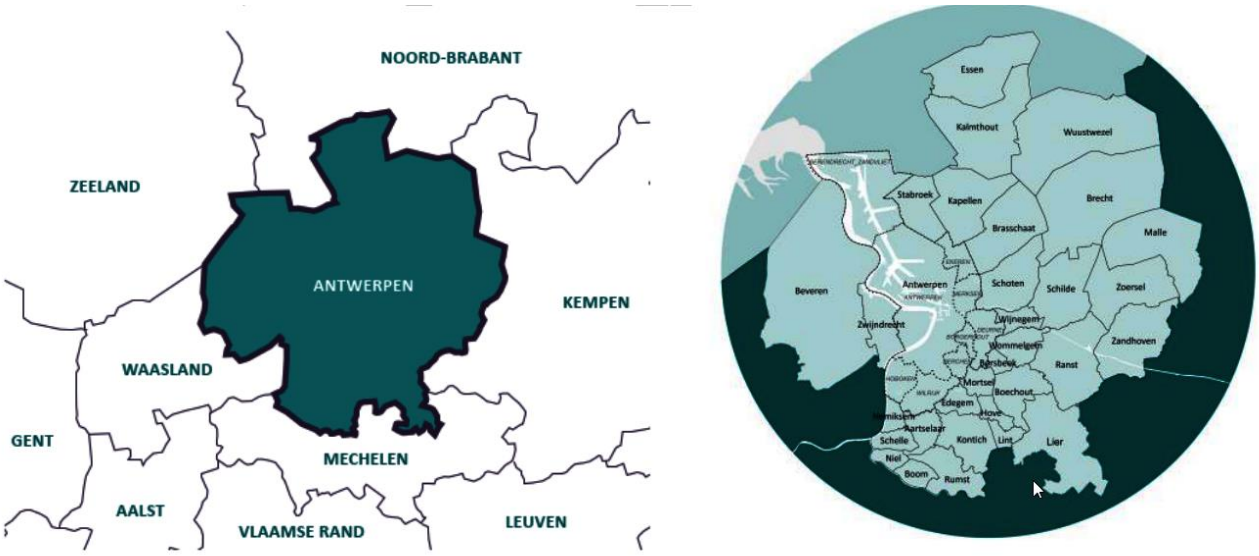


Figure 4: Antwerp Transport Region in detail

Source: Antwerpenmorgen.be

3.2.2. Madrid urban node

Madrid is the capital and most populous city of Spain. The term 'Madrid' is used for different functional areas or administrative boundaries:

1. Madrid Regional Area
2. Madrid Metropolitan Area
3. Municipality of Madrid
4. Madrid city centre (CBD)

Madrid's TEN-T Urban Node comprises all these different definitions and boundaries.

- **Madrid's Regional Area (CBD + Madrid Periphery + Metropolitan ring + Regional Ring)** is 8 028 km^2, it has 179 municipalities and a population of around 6.7 million people (around 48.9% corresponds to the Municipality of Madrid)
- **Functional Urban Area** is made up of the Municipality of Madrid plus the municipalities of the Metropolitan Ring.
- **The Municipality of Madrid (city of Madrid = CBD + Madrid periphery)** has a population of 3.3 million people. It is administratively divided into 21 districts, which are further subdivided into 131 neighbourhoods.
- **Madrid city centre (CBD),** is the area inside M-30 road ring, with approximately 1 million inhabitants.

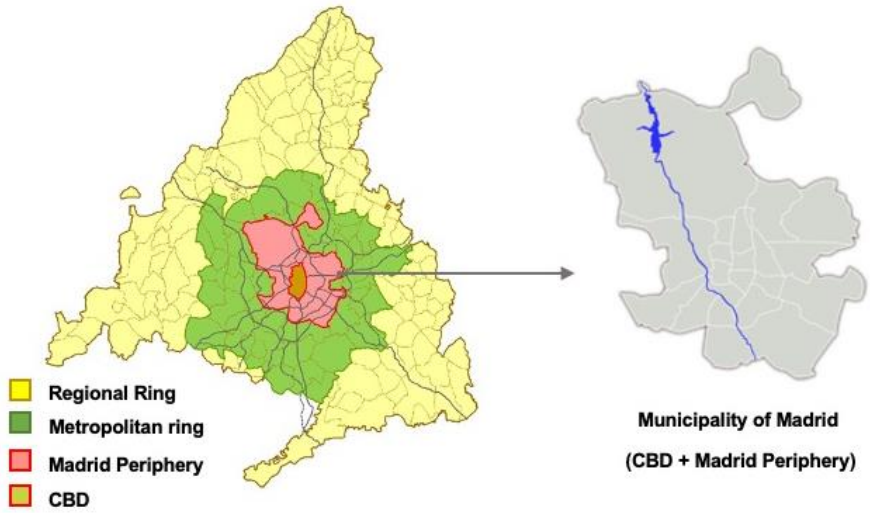


Figure 5: Madrid administrative and functional boundaries

3.2.2.1 The city of Madrid

As previously mentioned, the city of Madrid is made up of the central business district (CBD) + Madrid Periphery, with a population of 3.3 million people and 21 districts. Figure 6 shows the 21 districts in detail.

Figure 6: Madrid´s city districts

3.2.2.2 The Functional Urban Area of Madrid

The Functional Urban Area is made up of the city of Madrid (CBD+ Madrid Periphery) and the municipalities considered in the Metropolitan ring (Figure 7).

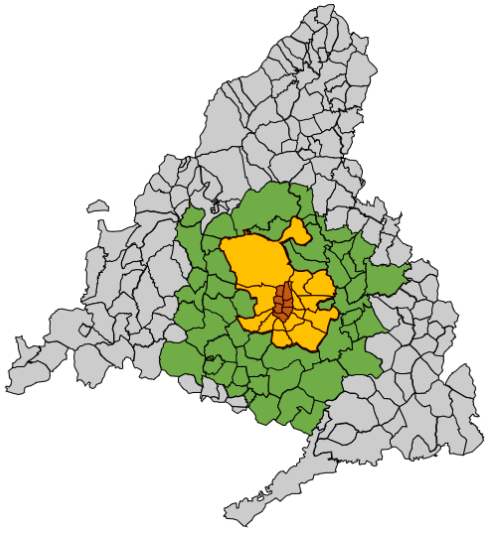


Figure 7: The FUA of Madrid

3.2.3. Turku urban node

3.2.3.1 *The city of Turku*

Turku is located in the southwestern coast of Finland at the mouth of the river Aura. In addition to the distinctive river landscape, the city is characterized by seven hills located in and out of the city centre. The total land area of Turku is 245.7 square kilometres. Population is around 195 350 (09/2021) of which 82.2 % speaks Finnish as native language, Swedish 5.5 % and other languages such as Russian 12.3 %. The city has spread out to a long and narrow land area: the distance between the northernmost and southernmost tips is 45 kilometres while the city is only 15 kilometres wide at its widest. Turku has several islands of which the largest ones are inhabited. Out of the total land area 97.7 square kilometres have been planned. Turku shares municipal borders with Aura, Kaarina, Lieto, Masku, Mynämäki, Naantali, Nousiainen, Parainen, Pöytyä, Raisio and Rusko.

3.2.3.2 *The Functional Urban Area of Turku*

The Functional Urban Area includes altogether 13 municipalities: The city of Turku and the municipalities of Naantali, Raisio, Kaarina, Lieto, Paimio, Sauvo, Rusko, Nousiainen, Mynämäki, Masku, Parainen and Aura.

The FUA has a total population of 356 806 residents (November 2021), ranging from the biggest city in the area, Turku, to the smallest municipality Sauvo with its 2 962 residents. According to preliminary data from November 2021, a slight population rise could be observed in all the FUA municipalities but Mynämäki and Parainen.

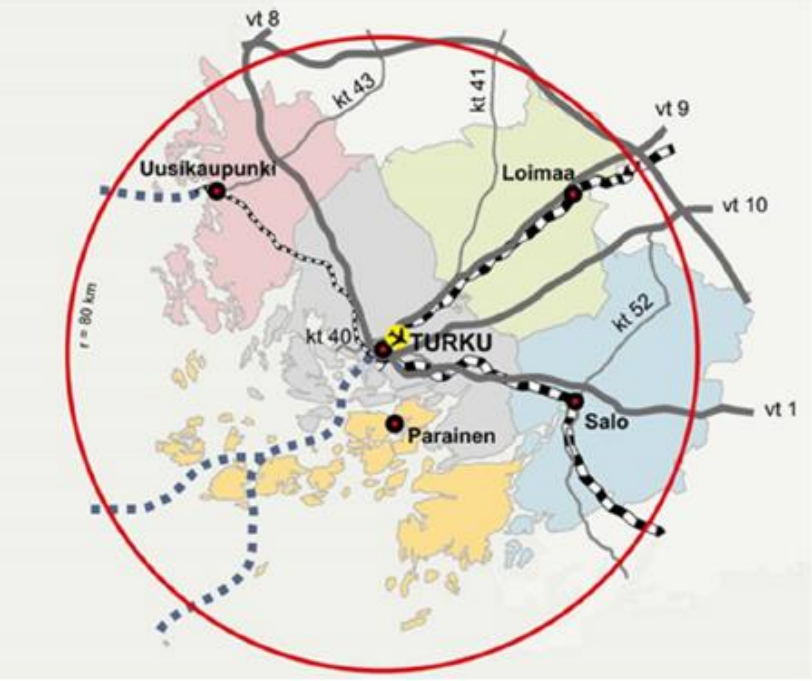


Figure 8: Turku region main corridors.

3.3. Society-Governance

Four qualitative indicators are selected to measure the evolution in the impact area society-governance. Information on these indicators is collected through observations (e.g., reports, websites...), questionnaires (e.g. to the administrations of different FUA departments, mobility experts, etc.) and/or discussions with local stakeholders (e.g. different administrations). A common SCALE-UP approach was used to collect this information by defining, for each indicator, a list of items to question. Datils are given in Annex 1: FUA indicators in the impact category society-governance.

Table 1: FUA indicators monitored by each of the urban nodes in the CIVITAS category society-governance

Indicator	Definition
Quality of cooperation structures	Quality of the cooperation between the different city/FUA departments and stakeholders
Quality of planning approaches	Quality of the SUMP/SULP/planning approaches in the FUA
Quality of the data layer	Quality and type of data collected on the FUA level, specifically data on active modes
Level of data driven	Availability and quality of mechanisms in the management of the multi-modal mobility system that are data driven in real-time or as part of the operational planning of the system

Table 2 gives more details on the data collection method of each urban node on city and FUA level in relation to the common SCALE-UP approach to collect information on these 4 qualitative indicators. The baseline results for these 4 indicators are given in the following sections, for each urban node.

Table 2: Data collection methods of each urban node of society-governance indicators

Indicator	Data collection method on city and FUA level (*)		
	Antwerp	**Madrid**	**Turku**
Quality of cooperation structures	Interview with stakeholders of the city and FUA, based on questions from the common SCALE-UP approach	Additional questions during the context for change workshop, based on the common SCALE-UP approach	Interview with key persons at the city of Turku and the Regional Council of South-West Finland, based on questions from the common SCALE-UP approach
Quality of planning approaches	Interview with stakeholders of the city and FUA, based on questions from the common SCALE-UP approach	Additional questions during the context for change workshop, based on the common SCALE-UP approach	Interview with key persons at the city of Turku and the Regional Council of South-West Finland, based on questions from the common SCALE-UP approach
Quality of the data layer	Interview with the data expert Stijn Vernaillen of the administration of the city of Antwerp based on questions from the common SCALE-UP approach	Additional questions during the context for change workshop, based on the common SCALE-UP approach	Interview with SCALE-UP site coordinator Stella Aaltonen and data management at the regional information service based on questions from the common SCALE-UP approach
Level of data driven	Interview with the data expert Stijn Vernaillen of the administration of the city of Antwerp based on questions from the common SCALE-UP approach	Additional questions during the context for change workshop, based on the common SCALE-UP approach	Interview with SCALE-UP site coordinator Stella Aaltonen and data management at the regional information service based on questions from the common SCALE-UP approach

(*) Unless indicated otherwise, the same data collection method is used for collecting the data on the FUA and city level.

3.3.1. Antwerp

3.3.1.1 *Quality of cooperation structures*

Analysis and appraisal of the formal and informal cooperation structures and decision-making procedures within the city and the Functional Urban Area (FUA).

Source/method

This indicator was assessed during an interview with the respective stakeholders within the city of Antwerp, Michiel Penne and Marijke De Roeck, and within the FUA, Franziska Kupfer. The interview with the city stakeholders was conducted on 10/02/2022. The interview with the FUA stakeholders was conducted on 04/02/2022.

Observations

- **Internal cooperation between the mobility department and other city departments**

On the level of the city, various departments have an impact on how the mobility policy is shaped. The department of mobility consists of 5 sub-departments working on the mobility system with a.o. a team working on the 50/50 modal shift defined in the Roadmap 2030 (see further), cooperating with the team of Management and Operations, regulating the IT backbone of the parking policy and the Low Emission Zoning, with the team of Smart ways To Antwerp, focussing on communication and participating with stakeholders and behavioural aspects within the mobility policy, and with the team that works on Public Space.

The cooperation between the various mobility-related departments within the city is organised on the one hand on an ad hoc basis when there is a topical need, e.g. team temporarily clustered around data and mobility. On the other hand, it is organised on a structural basis via a biweekly meeting of the managers of the different departments and the aldermen of mobility. This structural meeting is acting as an information-sharing platform allowing to boost cooperation between the departments and allowing to stay aligned with plans and visions coming from the policy area.

- **Interaction of the city mobility department with mobility stakeholders**

The cooperation between the city administration and external mobility providers can occur in two ways: some companies are subsidized and report every 3 months in a live meeting; other companies act on a contractual basis and are not seen on a structural basis, but only ad hoc when there is a necessity. Furthermore, there are various departments, as mentioned above, that can or need to make contact with the mobility providers and vice versa.

- **Interaction with other bodies responsibilities for parts of the mobility organisation**

With regards to **the interaction of the city and other bodies responsible for parts of the mobility organisation**, the Transport Region Council needs to be mentioned (see also further). The city is represented at this Council, as are all the municipalities of the Antwerp Transport Region, by the (mobility) aldermen, with the aldermen of the city of Antwerp as the political president. The mobility administration of the city does not take part in this meeting on a structural basis, only when there is a request for expertise and content. This is experienced as one of the barriers to allow for intensive and fluent cooperation as the experts in the mobility matter are not present at this policy defining meeting on a structural basis. Also, there is no consultative body allowing for the mobility-related experts of all municipalities in the Antwerp Transport Region to exchange knowledge and expertise.

- **Organisational body on the level of the Functional Urban area**

The **Team Transport Region** is a policy preparing and advisory body to support the Antwerp Transport Region in its functioning and operations. It is important to note that the Team Transport Region is not an entity on its own, but consists of different stakeholders detached partly or full-time by mobility-related entities operating within the Antwerp Region such as Lantis, a mobility-focussed Flemish government company that manages the realisation of complex projects in the Antwerp region, the Flemish transport company De Lijn and the Flemish Department of Mobility and Public Works. Furthermore, it also follows that the Team Transport Region has no financial means of its own.

With regards to the process that **the governance and decision-making within the Antwerp Transport Region** follows: the Team Transport Region prepares a proposal that is often first pitched at the so-called thematic workgroups including all stakeholders (citizens' movements, civil servants, mobility experts of the municipalities and the city of Antwerp, De Lijn, Lantis, etc.) that work together to develop the content of the proposal together and in a participatory way. When a

proposal is agreed on within the workgroups – note that not all proposals are validated or discussed within the workgroups - it then needs to pass the Transport Region Council, which includes a political and an official president, different political representatives of the municipalities, districts and cities within the Antwerp Transport Region and a representative of the Antwerp Transport Region. However, as mentioned above, this does not include city or municipality mobility experts of the administration. Also, not all municipalities dispose of the dedicated mobility coordinator within their administration, so there is great diversity in the knowledge of the different stakeholders. The Transport Region Council makes decisions on a unanimous basis, with this specific aspect possibly leading to slow decision-making and compromises of the original proposal, especially since so many different municipalities with their specific mobility and infrastructural challenges are represented within this meeting. The final step of the policy-making process is for the proposal to be approved or disapproved by the Flemish Government.

All-in-all, many different levels with a lot of stakeholders need to be passed before a mobility policy can be finalised and carried out in the Antwerp Transport Region. Also, compared to other transport regions in the country, Antwerp has a history of active and involved citizens and some very society-sensitive topics, such as the Oosterweelverbinding, making the context of decision-making complex.

However, the fact that decision-making follows a participatory process, via a.o. the workgroups, increases the quality, democratic content and the stakeholders support of policy proposals. In conclusion, it can be stated that the cooperation structure is complicated with a lot of levels and stakeholders involved and that the decision-making process is slow but effective seen that decisions are supported in the end by a wide base of stakeholders. Also, both aspects tend to favour compromises to keep decisions moving forward and making improvements in the mobility system.

Current appraisal

In conclusion, a calibrated but complex cooperation structure is in place on the level of the city and the FUA with many stakeholders and levels, connecting the citizens with the administration and politics. Participation is embedded to a certain extent in the cooperation structure of the Antwerp Transport Region. Also, some knowledge sharing gaps were defined within the structure of the Transport Region Council. As a result, decision-making is effective but not fast. Decisions tend to be reached through the making of compromises. This overview is not limitative but is aimed to give an idea of the level of cooperation and decision-making processes.

The following barriers and drivers can be listed that define the baseline situation on the quality of cooperation.

Observed drivers or strong aspects::

- A strong history of citizen movements in the city of Antwerp aiming for a sustainable modal shift
- A strong history of involvement and participation with the citizens within the city of Antwerp
- A calibrated administrative structure within the city and the FUA, with especially on the level of the city a large amount of employees, divided in different departments, working on mobility
- Meeting platform with external mobility providers, on an ad-hoc or very regular basis
- A calibrated meeting structure within the various mobility-related departments
- The Antwerp Transport Region operates in a highly democratic manner: participative cooperation structure on the level of the FUA leading to effective decision-making

Observed barriers or weak(er) aspects:

- The governance and decision-making within the Antwerp Transport Region needs to pass many stakeholders and many levels leading to complex and slow decision-making and the tendency to go for compromises
- Financial and operational barrier: the Team Transport Region is not an entity on its own, but consists of different stakeholders detached partly or full-time by mobility-related entities operating within the Antwerp Region
- Financial and operational barrier: no own funding for the Antwerp Transport Region
- The mobility administration of the city does not take part in the Transport Region Council on a structural basis, only when there is a request for expertise and content.
- There is no consultative body allowing for the mobility-related experts of all municipalities in the Antwerp Transport Region to exchange knowledge and expertise

3.3.1.2 Quality of planning approaches

Analysis and appraisal of the planning approach in the city and FUA and above.

Source/method

This indicator was assessed during an interview with the respective stakeholders within the city of Antwerp, Michiel Penne and Marijke De Roeck, and within the FUA, Franziska Kupfer. The interview with the city stakeholders was conducted on 10/02/2022 and with FUA stakeholders was conducted on 04/02/2022.

Observations

- **Status and quality of the SUMP of the city of Antwerp**

The first Sustainable Urban Mobility Plan (SUMP) of the city of Antwerp dates from 2006 and is in line with the vision of Roadmap 2030 (see further). In 2015, a new SUMP was finalised; this version was updated recently with aspects related to digitalisation and innovation. This renewed last version is currently in the process of being approved politically. Furthermore, an Environmental Impact Assessment (Milieueffectenrapport; MER) for the integral plan might also have to be created. The creation of a MER for the whole project might cause large time delays and seems not useful as for the separate parts of the plan a MER will be created anyway. An action list is coupled to this long-term vision plan that is actualised every 6 months. The need for a modal shift comes from civil movements, however, the description of how and what will be precisely aimed for to realise a modal shift, as written down in the SUMP, is a technocratic affair without the participation of citizens. The logistical sister of the SUMP, the Sustainable Urban Logistics Plan (SULP), is currently under preparation. When finished, it will be the first time the city produces a detailed logistical plan.

- **Status and quality of the mobility planning on the FUA of Antwerp**

The long-term vision Regional Mobility Plan for the FUA of Antwerp is called the Routeplan 2030 (Roadmap 2030), aiming for structurally higher use of sustainable modes of travel, setting targets towards a modal shift consisting of 50% sustainable mobility resources such as walking, cycling, public transport and mobility sharing devices. The motor driving this change is multimodal travel behaviour within the mobility system, where travellers combine different modes of transport to reach their destination fast and sustainably. This is called combi-mobility and illustrated in Figure 9.

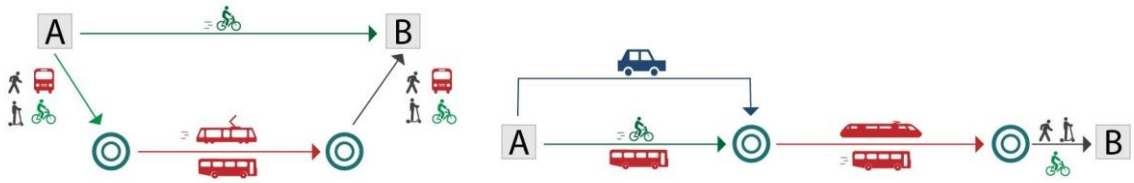


Figure 9: Combi-mobility according to the Roadmap 2030

Source: Antwerp Transport Region

An action plan with tangible actions is linked to this long-term vision plan, however, the action plan still needs to be validated. Budgets are allocated but come from other entities than the Antwerp Transport Region. A part on freight transport will also be included in the Roadmap 2030 but due to the scope of freight transport (broader than passenger transport), the main initiatives will be from the Flemish level or the Port of Antwerp.

- **Other mobility related plans to implement a strong sustainable mobility strategy**

Furthermore, there exists **no integrated land-use mobility plan for the region**; every entity produces a plan according to their domain of expertise: the Planning Department produces a land-use plan and the Antwerp Transport Region produces a mobility plan. For the Antwerp Transport Region this is the Roadmap2030. Although there is no structural meeting between the different governmental departments working on land-use policies and visions, there is some consultation when needed on specific topics. However, this means we cannot speak of an integrated approach between planning and mobility.

It needs to be noted that on a higher Flemish level, spatial structure plans describe the strategic multi-disciplinary vision and what the spatial planning regulations are, also including mobility. However, this is a high-level theoretical multidisciplinary plan that doesn't seem to reach the level of the administration.

Next to this long-term vision, aiming to be realised for 2030, a more short-term mobility plan, focussing only on the public transport network of De Lijn, also exists, namely the **Transport Plan**. The approval of the Transport Plan has proved to be difficult because of the many stakeholders needed for the validation.

Current appraisal

The following barriers and drivers can be listed that define the baseline situation on the quality of planning approaches.

Observed drivers or strong aspects:

- An established tradition of making Sustainable Urban Mobility Plans (SUMPs) on city level, including and action list
- The first Sustainable Urban Logistics Plan (SULP) on city level is being created
- Presence of an established long-term vision plan for 2030, namely the Routeplan 2030, on the FUA level
- The city SUMP frames within the vision plan Routeplan 2030

Observed barriers or weak(er) aspects:

- We note slow political approval of the renewed city SUMP
- There is no validated action plan for the long-term vision plan Roadmap 2030 on the FUA level
- No presence of a SULP yet on city level
- There is no structural meeting between the different governmental departments working on land-use policies and visions on the FUA nor on the city level, but a split approach for land-use or mobility on the level of the region/city

3.3.1.3 Quality of the data layer

Analysis and appraisal of the quality of the data layers with an extra focus on active modes.

Source/method

This indicator was assessed during an interview with the data expert Stijn Vernaillen within the administration of the city of Antwerp that took place on 16/02/2022.

Observations

On city level, different kinds of **data platforms** exist that collect various types of data and make it available through various channels.

Firstly, there is **geographical data** that is collected in an ArcGIS environment. The data that can be published openly, is made available to the public via https://portaal-stadantwerpen.opendata.arcgis.com/ and via https://stadinkaart.antwerpen.be.

Secondly, the city also assembles various real-time data related to the mobility system, collected via their own platform Digiplos GIP and made available to internal and external parties via Application Programming Interfaces (APIs) on a contract-base.

Thirdly, historical data related to the mobility system is collected and stored depending on the type of data, the age of the data and requirements for applications. The city uses hot and cold storage, aggregated and raw storage.

Various tools are employed for analytics (custom or COGNOS). For shared mobility a custom developed platform/engine called M4 is used.

Finally, data gathered via surveys or via other aggregated sources is also available to the public via https://stadincijfers.antwerpen.be. Depending on the application and the data, analysed data is also available through various dashboards and reports based on various platforms. Data made available to the public are:

- https://stadinkaart.antwerpen.be
- https://stadincijfers.antwerpen.be
- www.slimnaarantwerpen.be: a mobility map & routeplanner Slim naar Antwerpen app (iOS en Android)

Current appraisal

In conclusion, the city has built up a lot of knowledge on the gathering and use of data but acknowledges that there is potential to have a more qualitative data output to allow for a higher level of data-driven decision-making. Today, lots of data are already gathered on city level, and deployed by various internal and external parties. The general public also has access to a lot of data via platforms provided by the city. Although the data themselves are gathered, not all data is employed to their potential usage. The building stones (~data) and reporting tools are present, so decisions can be made driven by these data. However, all data is not integrated yet, meaning that not all information is machine-readable, e.g. the contracts of the different providers of shared mobility. Within the framework of NxT mobility, the city works to make data more integrated: they work on the data-governance structure, documentation and metadata, tools to analyse (mobility) data in order to combine or enrich them. Due to the high number of datasets available in the city, this is time-consuming and costly. Therefore, the city needs to decide on the level of data-driven what it is aimed for, considering the goal and usage aimed for, but also the costs associated with this.

3.3.1.4 Level of data driven

Analysis and appraisal of the level to which extend the multi-modal mobility system is planned, organised and used in a data driven way

Source/method

This indicator was assessed during an interview with the data expert Stijn Vernaillen within the administration of the city of Antwerp that took place on 16/02/2022.

Observations

Four **main (real-time or not) mechanisms** that are steered and pushed by the data collected can be identified in the management of the multi-modal system:

- The presence of a real-time mechanism parking guidance system keeping track of the occupancy rates in parkings and guiding cars towards free parking places
- The presence of an operational mechanism where shared data and insights in shared mobility usage (the platform M4) based on trip data, such as number of trips per day or number of vehicles in the fleet. Used for evaluation of the operating license of the shared mobility provider and insights used for developing policies.
- An overall traffic management system with dynamic traffic lights regulating the traffic flows based on detection of cars, public transport and cyclists.

Current appraisal

Nowadays, the gathered data (real-time or not) are used mostly retro-actively to evaluate and to steer policy and decision-making, but in a rather static way. The next step would be to allow for decision-making by using the data in a more dynamic way and to predict the expected near future based on historical data.

Next to this, it would be good to approach the usage of data mode-independent in order to achieve the modal shift in the long run, meaning both data-driven and outcome-based, independently of the mode of transport, whether talking about public transport, shared mobility systems or private displacements such as walking and cycling. Nowadays, this equation is mostly approached from each mode separately.

3.3.2. Madrid

3.3.2.1 Quality of cooperation structures

Source/method

This indicator was assessed using findings obtained in **Madrid's context for change workshop** held on 04/02/2022 (see Section 2.3 Madrid). Specific questions related to the quality of cooperation structures and planning approaches were included to evaluate these two indicators. We had two key representatives responding to the main issues on cooperation structures and planning approaches in Madrid. First, Maria Dolores Ortiz Sanchez, Director of Planning and Mobility Infrastructures Department at Madrid City Council. And then, Sergio Fernandez Balaguer, Project Manager at EMT on Research Projects department, who works closely with the Mobility and Transport Planning Department, as an affiliated organization.

Context

The Department of Mobility and Transport Planning (Planificacion e Infraestructuras de Movilidad) belongs to one of the 9 Government Areas in Madrid's City Council: "**Environment and Mobility**", which is responsible, at city level, on the one hand for environment and sustainability issues, and on the other, for traffic management & monitoring and for planning & mobility infrastructures. The "Environment and Mobility" Government Area is responsible for managing and monitoring mobility, vehicle removal and traffic ticketing system, transportation and parking, environmental control, parkland, cleaning & waste management, environmental quality and sustainability, water management, planning of mobility and transport infrastructures and relations with CRTM (responsible for transport and mobility at regional level).

The "Environment and Mobility" Government Area has two affiliated companies and organizations:

1. Municipal Transport Company of Madrid, S.A. (EMT)
2. Mixed Economy Company "Madrid Calle 30 S.A."

The most relevant findings are presented below.

Observations

- **Internal cooperation between the mobility department and other city departments**

There is a cooperative environment between the mobility department and other city departments including EMT which is the Municipal Transport Company owned by the Madrid City Council. EMT as the global manager of surface mobility in the city of Madrid is responsible for the management and operation of urban bus services, public bicycle (BiciMAD), municipal tow truck, public and resident car parks, and cable car. All the departments in charge of these services have fluent communication mainly through meetings that include the actors involved in the issue to be treated at different administrative levels. These meetings are arranged when a special issue occurs or to deal with specific objectives from the different projects some of the departments are working on (an example the participants of the workshop gave were the SCALE-UP measures they were working on together).

The City Council Representative, Maria Dolores Ortiz Sanchez, used "Public Space" decision making and implementation (for example Madrid's SCALE-UP measure M7, Sol Pedestrianization) as an example of how cooperation between the different departments works. She mentioned "Public Space" as one of the most complex, involving many departments and sub-departments, depending on the specific measure or action. The most common interactions and collaborations occur between:

- The "**Urban Development Government Area"** and within in it the Urban Planning Department, the Strategic Planning Department, involving the urban evaluation & urban renewal sub-departments, and the Urban Management Department
- The other Department under "**Environment and Mobility Government Area**": Environmental Coordination Department, including sub-departments of water management & green spaces and sustainability and environmental control
- The "**Economy, Innovation and Employment Government Area**": sub-department managing local business and restaurants/cafés and their relation to streets
- The "**Works and Equipment Government Area**": the sub-departments Pubic space, works and infrastructures; Preservation of public roads; and accessibility
- The "**Culture, Tourism and Sport Government Area**": sub-department of cultural patrimony and within it, urban landscape and public art
- The "**Family, Equality and Social Welfare Government Area**" and responsibilities related to promotion of equality

For more information, see Public Space and Mobility. The transformation of Madrid's Distrito Centro.

- **Interaction city mobility department with mobility stakeholders**

There is an adequate relationship between Madrid's City Council Planning and Mobility Infrastructures Department and EMT (the city's main transport operator) and with CRTM (the Regional Transport Authority, which coordinates the different local and regional bus services, metro, and light rail). The clearest example of this is, the public transport pass, a unified ticketing system, which includes all available modes, both in the city and region. All transport modes (at city and FUA level) benefit and make use of the same transport infrastructure, which is made available to them and is maintained by either level depending on the location. There are no regular or pre-set meetings among the city mobility department and mobility stakeholders, however, most of them work together regularly in relation to different activities/projects regarding sustainable mobility strategies. The Madrid City Council, EMT, and CRTM which can be considered the main mobility stakeholders are directly or indirectly involved in most of the mobility projects of Madrid (city and region).

- **Organisational body on the level of the Functional Urban Area**

Under Madrid's Regional Government, La Consejería de Transportes e Infraestructuras, is the body in charge, at regional level, of the development, coordination and control of the execution of the Spanish Government's public policies in matters of transport, mobility, highways, railways, aeronautical facilities and other transport infrastructures. Under its scope it has 3 General Directorates:

1. Transport and Mobility
2. Highways
3. Collective Transport Infrastructures

At FUA level (if we understand FUA as being part of the Region) the responsible administrative body is the "Direccion General de Transportes y Movilidad de la Comunidad de Madrid". This Regional Department has competencies on the region's transport and mobility technical regulation, mobility and sustainable transport policy implementation, promotion of dialogue and relations with public or private organizations that provide services or have competences in matters of mobility and transport planning within the regional scope, Mobility planning, monitoring and control of the Madrid Community Mobility Plan in coordination with the rest of the affected public administrations, authorization and inspection of land transport services and facilities (both for passengers and goods), inspection plans and any other services necessary for the exercise of the Spanish Government Ministry (MITMA, Ministerio de Transportes, Movilidad y Agenda Urbana) competences in terms of land transport, aeronautical facilities or other transport infrastructure.

- **Interaction with other bodies responsibilities for parts of the mobility organisation**

CRTM (Madrid Regional Transport Consortium), the region's Public Transport Authority, was created in 1985, as a public body that concentrates the competencies in matters of regular passenger transport in Madrid's region. It manages and regulates all collective public transport in the Madrid Region, ensuring a multimodal transport system for the Madrid Region (including city and FUA) by coordinating all modes of transport which includes 324 inter urban bus lines, 312 urban bus lines, 10 suburban rail lines, 13 metro lines and 3 light rail lines.

The governance structure of Madrid contributes to a better mobility management on regional and city level. EMT, the main public transport operator of the city of Madrid, being an affiliated organization of Madrid's City Council, can be considered part of the City Council itself, and therefore has a close and day-to-day relationship with the Planning and Mobility Infrastructures Department, having regular meetings and making decisions together in all mobility and transport actions in the city. At FUA level, it is more complex. The CRTM is in charge of everything related to passengers' mobility in the whole region, and therefore has to have meetings at different levels (in terms of administration and territory). On one hand, it is an organization that depends on the Regional Government (and therefore depends on Consejeria de Transportes de Madrid and within this of Direccion General de Transportes de Madrid) and on the other, with Madrid City Council (since it includes operators, like EMT or Metro de Madrid, operating in the city, and therefore uses infrastructure belonging to the city).

Current appraisal

Summarizing, Madrid's hierarchical governance structure facilitates the implementation of mobility and transport strategies and European Directives. At city level: Madrid's City Council (with main administrative body "Planning and Mobility Infrastructures Department") works closely with EMT (main mobility operator in the city and City Council's affiliate). At regional level (including FUA), CRTM (as main passengers' Public Transport Authority in the region) makes a bridge-connection between Madrid's Regional Government (and therefore with the MITMA right above at national level, and Europe) and the different municipalities conforming the Madrid Region (including the City of Madrid). The pursuit of these 3 strategic actors (City Council, EMT and CRTM – all SCALE-UP partners), to make Madrid a reference in 21st century mobility, is making them align their strategies with those of the European Union towards a more sustainable mobility and is fostering the cooperation between different mobility stakeholders.

3.3.2.2 Quality of planning approaches

Source/method

The quality of the planning approaches was also evaluated in the workshop dedicated to obtain the baseline for the context for change (on 04-02/2022), including some specific questions related to the topic.

Observations

In Madrid, transport and mobility policies have been taking sustainable urban mobility into account for a long time and at different levels. Since 2019, *Madrid 360 (Estrategia de Movilidad Sostenible)* (Madrid 360 Sustainable Mobility Strategy), the SUMP of the city of Madrid, whose objectives are focused on achieving more sustainable mobility, has been in use. As part of this strategy, new *Ordenanza de Movilidad Sostenible* (Sustainable Mobility Ordinance) was published (September 2021), which responds to social, economic, environmental, cultural, technical and technological changes related to mobility. It prioritises the health and physical integrity of citizens by improving air quality and road safety, promoting multimodality and the use of public space, through efficiency and innovation. It goes hand in hand with other ordinances, such as *Protección contra la Contaminación Acústica y Térmica (OPCAT)* (Protection against Noise and Thermal Pollution) and the recently approved *Calidad del Aire y Sostenibilidad (OCAS)* (Air Quality and Sustainability).

On 10 February 2022, *Junta de Gobierno de Madrid* (Governing Board of Madrid) approved the new *Plan de Movilidad Sostenible Madrid 360* (Madrid 360 Sustainable Mobility Plan – SMP Madrid 360). This new mobility policy planning instrument until 2030 promotes the four S's of mobility: *Sostenible, Segura, Saludable y Smart* (sustainable, safe, healthy and Smart). The plan sets these main objectives for 2030:

- to reduce travel time on public transport by an average of 32.5 %;
- to reduce traffic congestion by up to 10 %;
- to reduce CO_2 emissions by 65 % compared to 1990 and
- to reduce road fatalities and serious casualties by 50 %.

At regional level, there is *Plan Estratégico de Movilidad Sostenible de la Comunidad de Madrid 2013-2025* (Strategic Plan for Sustainable Mobility of the Community of Madrid 2013-2025), which has objectives aligned with the Madrid 360 strategy but can be considered less ambitious due to its age.

Current appraisal

The New Plan de Movilidad Sostenible Madrid 360 (Madrid 360 Sustainable Mobility Plan – SMP Madrid 360) was approved on February 10th 2022 and sets 2030 as a horizon to promote a safe, sustainable, healthy and smart mobility. At the regional level, which includes the FUA, the Strategic Plan for Sustainable Mobility of the Community of Madrid 2013-2025 has objectives aligned with the Madrid 360 strategy and is currently in an upgrade period.

Main strong elements:

SMP Madrid 360 is very much aligned with the European Green Deal to be climate-neutral by 2050, and aims to comply with the air quality targets set by the European Union legislation. SMP Madrid 360's main axis is public transport, and is organized around these main strategies:

- More and better public transport
- Improvement of transport infrastructure
- Promotion of active mobility (walking and cycling)
- Car park management with sustainability criteria
- Facilitating modal integration through micromobility and intermodality
- Stimulating fleet replacement for less polluting vehicles
- Promoting technological change and optimization of the urban distribution of goods
- Applying innovative technological and logistical elements to optimize the mobility system
- Moving towards safe mobility
- Encourage responsible mobility through education, information and governance

Observed weaker aspects:

On the other hand, the current planning document at regional level (Strategic Plan for Sustainable Mobility of the Community of Madrid 2013-2025) empathised these types of measures:

- Traffic control and regulation road structure network
- Private vehicle management
- Collective transport promotion
- Improvement of urban quality
- Mobility management
- Universal accessibility
- Transport of goods

- Mobility integration in urban policies
- Environmental quality and energy saving
- Transportation plans for work travels and large centres of activity
- Road safety improvement
- Monitoring and control

As can be seen, these type of measures are leaving out some of the main and necessary aspects (that SMP Madrid 360 does include) towards a more sustainable mobility strategy such as: active mobility promotion, technological changes applied to goods distribution and mobility system, educational and information strategies to raise awareness, fleet replacement towards cleaner modes, modal integration through micro-mobility and intermodality, private vehicle parking managed with sustainability criteria, and putting the user and public transport as the main axis of the whole mobility ecosystem. This is why the Strategic Plan for Sustainable Mobility of the Community of Madrid it is being upgraded in SCALE-UP measure M1.

3.3.2.3 *Quality of the data layer*

Analysis and appraisal of the quality of the data layers with an extra focus on active modes.

Source/method

In the workshop dedicated to obtain the baseline for the context for change on 04/02/2022, some additional questions were included to evaluate the quality of the data layer and the level of data driven from the perspective of different administration departments representatives.

Observations

Regional level

Madrid has an Open Data Initiative platform where all the data produced or compiled by public administrations are made available to citizens. In this platform there are 22 main categories of data where transport and urbanism are included. Most of the data available in the platform is static and off-line.

Madrid´s Regional Transport Consortium also has a data catalogue where different data related to urban buses, metro, light and suburban rail, and interurban buses is included.

Both platforms are available to the public:

- https://www.comunidad.madrid/gobierno/datos-abiertos#temas
- https://datos.crtm.es/

Moreover, the Regional Transport Consortium has a specific multimodal mobility portal (https://datos-movilidad.crtm.es/) where it is possible to explore and download mobility data in different formats so it can be used to create new APPs, or to be included in existing ones to solve problems related to mobility. These data are grouped in eighteen categories that include data from the metro, from urban and interurban buses, pedestrians, charging network for e-vehicles, carsharing, among others.

City level

Madrid´s City Council has an Open Data Portal dedicated to promoting access to municipal government data. It has 518 different sets of data, from which 80 correspond to transport categories. These data include a.o. traffic counting, number of accidents, parking places usage, pedestrian counting.

Moreover, EMT has a Data Portal with information about the different services provided by EMT (bus, public bike, mobility, parking). Most of the available data is static.

Both platforms are available to the public:

- Madrid's City Council Open Data Portal
- https://opendata.emtmadrid.es/Home

The Madrid City Council also makes the data available to internal and external parties via the Application Programming interface APIS REST.

The table below gives an overview of the main mobility related data available at city or regional level.

Type of data	Collected on city level	Collected on regional level	On-line (real-time)	Off-line	Provided by	Made available to

Traffic conditions	x	x	x	-	General Direction of Traffic (DGT)	Citizens
Air pollution	x	x			Portal web calidad del aire del Ayuntamiento de Madrid	Citizens
Air quality	x	x	x	x	Consejería de Medio Ambiente, Vivienda y Agricultura Dirección General de Descarbonización y Transición Energética Área de Calidad Atmosférica	Citizens
Traffic accidents	x	x		x	General Direction of Traffic (DGT)	Citizens
Pedestrian flow	x			x	Madrid's City Council Open Data Portal	Citizens
Cycling flow	x			x	Madrid's City Council Open Data Portal	Citizens
Public parking places	x		x		Madrid's City Council Open Data Portal	Citizens
BiciMAD users	x			x	Madrid's City Council Open Data Portal	Citizens

Current appraisal

In the last years the city has gained a great deal of experience with data collection and analysis, but there still is the need for a more qualitative data output to enable for more data-driven decision making. Currently, a large amount of data is

collected at the city and regional level and is used by a variety of internal and external parties.

The general public has access to a lot of data through the city´s platform, EMT platform, the regional platform and CRTM´s platform. Despite the fact that the data is gathered, not all data is used to its full potential. Data and reporting tools are in place, allowing data-driven decisions to be made. However, not all data has been integrated as can be seen by having 5 different platforms (3 at regional and 2 at city level) with many data sources included in each of them.

3.3.2.4 Level of data driven

Source/method

In the workshop dedicated to obtain the baseline for the context for change on 04/02/2022, some additional questions were included to evaluate the quality of the data layer and the level of data driven from the perspective of different administration departments representatives.

Observations

City level

- Madrid's City Council has designed a data system that collects occupancies in real time from car parks that voluntarily wish to provide them and offers them through the municipal open data platform steering cars to parkings with free places, avoiding search traffic in the city. (https://experience.arcgis.com/experience/d1b5c70a19a149d6a86e1d861b6d0183/page/Plazas-libres/)
- The Protocol on traffic restrictions based on air quality depends on two factors: nitrogen dioxide (NO_2) and the weather forecast. The Protocol establishes concentration levels of NO_2 in the air that are more restrictive than those established by current legislation, in order to start taking measures before reaching levels that are harmful. The Protocol is activated if these levels are exceeded and the forecast of the State Meteorological Agency (AEMET) is unfavourable (i.e. it is not expected that the ventilation conditions of the atmosphere will be adequate to dissipate pollution). All the data is public (like already mentioned in other parts of this document): in this link you can consult the hourly measurements and in this other link the AEMET forecasts.
- Smart traffic lights: In 2018, one of the winning participatory budgets was "smart traffic lights" for the City of Madrid. This measure was meant to implement smart traffic lights throughout the city of Madrid. The use of real-time traffic data, would speed up traffic jams caused by traffic lights that remain red for too long, as they are programmed by time and not by real-time traffic. These intelligent traffic lights considerably reduce the waiting time at each traffic light (40%), speeding up the circulation of all the streets of the city and, in turn, that of pedestrians. Traffic lights learn from drivers' behaviour and create smoother traffic. These smart traffic lights work with a magnetic or optical detector. It works with a traffic application and regulators that are capable of adapting to the traffic flows at each access on a crossroad and at the same time provide adequate coordination between successive signalized crossings that regulate a

road. It is essential to have enough detectors, either magnetic or optical, that communicate the data to the traffic application in real time, so that it can modify the times of each of the phases during the same cycle. In the same way, as the vehicles arrive at the next intersection, it is able to accommodate itself so that the time of the green phase is maximum. There are already areas that have this adaptive system, but it is undoubtedly necessary to increase this system to more areas of the city.

Current appraisal

A wide range of data collected in Madrid are used to analyse and drive policy and decision-making retro-actively and mostly in a static way. More dynamic mechanisms are already in place in relation to parking, air quality related actions and traffic management.

The current goal is to develop a more dynamic data-driven decision-making tool which could serve to build evolution and prediction scenarios in mobility in Madrid at different levels (task included in SCALE-UP measure M4).

3.3.3. Turku

3.3.3.1 *Quality of cooperation structures*

Source/method

To gain information on the quality of cooperation structures in the city and the FUA, interviews were conducted with key persons at the city of Turku and the Regional Council of South-West Finland. From the city, site coordinator Stella Aaltonen was interviewed on the 8th of February 2022. From the Regional Council, planning director Heikki Saarento and senior planner Salla Murmann were interviewed on the 2nd of February 2022.

Observations

- **Internal cooperation between the mobility department and other city departments**

In the city of Turku, transport and mobility planning is administrationally placed within the Urban Environment Division. The Urban Environment Division is responsible for organising operating conditions needed for the growth of an attractive city, developing urban environment and the structural functionality and attractiveness of the city. The division has four service areas, two of which are connected to transport and mobility planning.

Within the Urban Environment Division, the Urban Design and Land Property service area is responsible for the city's land use and transport design, planning, and the acquisition, development and conveyance of the city's land property. The service area also monitors the development of urban structure. Within the service area, the Transport Planning unit is responsible for the traffic technical maintenance, planning and development of the transportation system (apart from public transport) in accordance with requirements of functionality, safety and sustainable development. The unit monitors the development of safety and the amount of traffic within the transport network and participates in the maintenance of the regional transport model. The unit compiles project plans related to developing the transport system and participates as an expert in preparing need and project plans of other facility and infrastructure projects.

Within the Urban Environment Division, the service area of Mobility Services organises public transport services open to all in the Föli municipalities of Turku city region. Within the service area, the Regional Public Transport unit is responsible for preparing and implementing affairs related to the area of Turku Region PT

Committee in conformity with its orders. The Urban Mobility Solutions unit, on the other hand, is responsible for implementing and developing other types of mobility services in Turku, such as the bike share system, parking pilots and other matters related to improved travel chains.

So, the Transport Planning unit and the Mobility Services service area are separate entities with separate responsibilities. Members from both units take part in the transport system planning work, chaired by the Regional Council of South-West Finland, explained in more detail in the following sub-chapter. Transport system planning work is representative and relevant parties are assigned to represent their units to the thematic subgroups, such as the traffic safety or smart mobility groups. It is however up to the units themselves how the information generated in these groups is implemented in the unit's own work.

Outside the formal structure, some problems with the flow of information have been recognized between the above-mentioned service areas and units, as well as other units that are connected to transport and mobility issues, such as the Education or Recreation service areas. On the head of unit level there may be exchange of information related to e.g. transport system planning issues, however, this information may not trickle down to the relevant employees. The issue, in a nutshell, is that the information does flow to the direction of the Regional Council of South-West Finland but not necessarily within the city organization itself, towards the relevant service areas or units. There is hardly any cooperation between the Transport Planning unit and the Recreation Services service area, for instance, and if such cooperation does occur it's often linked to specific persons. In short, there are no established cooperation practices between the units. Despite some recent restructuring of the Mobility Services service area, there is still no higher organization structure in the city that would cover all mobility related issues connected to different operating areas. The lack of such an administrational arrangement has been recognized as a shortcoming in the city. There are plans and processes to promote different aspects of sustainable transport and mobility (e.g. parking policy processes, cycling promotion), but those processes are separate from each other and not coordinated on the upper administrational levels.

In the very recent administrational rearrangement covering the whole country, the responsibility for organising public healthcare, social welfare and rescue services will be transferred from municipalities to wellbeing services counties from the beginning of 2023. This means that the health and welfare services, formerly under the city's jurisdiction, will in the future be governed by the wellbeing service county. Here, a completely new interface is created for a vast array of transport functions as they are transferred away from the city's sphere of influence. This means that the whole service network and subsequent transport and mobility related decisions will no

longer be steered by the city. The wellbeing service counties will steer the decisions and resources directed towards connected transport and mobility services, and there is the risk that the parties making these decisions will not be mobility experts.

- **Interaction city mobility department with mobility stakeholders**

In 2021, a dialogue and cooperation forum was established between the shared mobility companies and public transport operators and the city. The forum will convene twice a year and this cooperation will be further developed within the scope of SCALE-UP.

Apart from the above-mentioned dialogue, there are no regular, established cooperation structures with stakeholders. If there are, or have been such, they have been connected to a certain project or process, such as land use planning. This shortcoming is very much connected to the fact that the city does not yet have a proper SUMP. There is the regional SUMP, but no city-specific SUMP. The Sustainable Energy and Climate Action Plan (SECAP) update will go under council's decision-making process in April 2022. In the SECAP update, both SULP and SUMP are mentioned, as well as other goals related to carbon-neutral mobility.

- **Organisational body on the level of the Functional Urban area**

Transport and mobility planning on the FUA level at the Turku urban node is implemented via an established working arrangement, the transport system planning work, chaired by the Regional Council of South-West Finland. This work brings together all the FUA municipalities, regional administration and relevant national actors, such as the Finnish Transport Infrastructure Agency, Finnish Transport and Communications Agency and the Ministry of Transport and Communications. The transport system planning work is closely connected to regional land use planning work, with regular, thematic joint meetings (2-4 times / year).

The transport system planning work is divided into four thematic subgroups: those of traffic safety, traffic management, smart mobility and public transport. A variety of stakeholders is involved in each of the subgroups' work, depending on the theme. The traffic safety subgroup, for example, includes representatives from the police and fire and rescue services, in addition to the municipalities.

The transport system planning work is guided by the Transport System plan 2020, a comprehensive plan covering the main outlines, themes and actions related to transport system development in the FUA. The most significant transport system development measures presented in the plan are part of the national MAL agreement 2020-2031 between the 13 municipalities of the region and the Finnish state on land use, housing and transport. Regular monitoring of the achievement of

the objectives of the MAL agreement is under the responsibility of the Regional Council of South-West Finland.

The Transport System plan 2020 of the Turku city region has been devised in cooperation with the 13 FUA municipalities: Aura, Kaarina, Lieto, Masku, Mynämäki, Naantali, Nousiainen, Paimio, Parainen, Raisio, Rusko, Sauvo and Turku. The plan is, effectively, the region's SUMP, and has been devised according to SUMP principles. The Regional Assembly approves the regional plan, and each of the FUA municipalities approve the objectives set for them in their local councils.

- **Interaction with other bodies responsibilities for parts of the mobility organisation**

Twice a year the transport system planning and land use planning representatives arrange planning meetings with a larger stakeholder group that includes decision makers, citizens, associations, companies and other relevant stakeholders. In addition, the thematic subgroups also include representatives from some national bodies as described in the previous section.

Current appraisal

Main drivers:

- The established structure of the transport system planning work is a strong driver on the regional level (both the South-West Finland Transport System plan, Turku City Region Transport System Plan and their connections to the National Transport System Plan)
- The MAL agreement and regular monitoring of the achievement of the objectives stated in the agreement

Observed barriers or weak(er) aspects:

- Poor flow of information between city units or service areas
- Lack of established cooperation practices between the units connected to transport and mobility within the city organization
- Separateness of mobility related policies, plans and processes and lack of coordination on the upper administrational levels of the city of Turku.

3.3.3.2 Quality of planning approaches

Source/method

To gain information on the quality of planning approaches in the city and the FUA, interviews were conducted with key persons at the city of Turku and the Regional

Council of South-West Finland. From the city, site coordinator Stella Aaltonen was interviewed on the 8th of February. From the Regional Council, mobility management specialist Marja Tommola was interviewed on the 20th of January 2022 and planning director Heikki Saarento and senior planner Salla Murmann on the 2nd of February 2022.

Observations

- **Status and quality of the SUMP of the city of Turku urban node**

Currently, the city of Turku does not have a SUMP. A regional SUMP has been made but it covers the larger Turku core region and is hence not city-specific. There are strategies and plans that guide sustainable mobility development in the city, however. The SECAP includes several mobility policies and the commission has outlined that SECAP and SUMP need to be streamlined to support each other (SUMP is subordinate to SECAP).

The cycling development programme also sets goals for the development of cycling conditions in the city. Walking conditions are developed within the scope of the development programme on walking and use of public space, advanced as part of the project Space4People (https://urbact.eu/space4people) and being brought under decision-making in spring 2022. The parking policy outlines were established in a development process in 2019, setting better conditions for providing shared vehicle services in the city. The national MAL agreement 2020-2031 sets goals for transport, the fulfilment of which is monitored in the scope of the transport system planning work as explained in the previous section.

There are plans to devise a city SUMP in connection with the SECAP update, however the realization of this process is still under discussion.

- **Status and quality of the mobility planning on the FUA of the Turku urban node**

The Turku FUA Transport System Plan 2020 is a comprehensive plan covering the main outlines, themes and actions related to transport system development in the FUA. The plan has been devised following SUMP guidelines and includes all the main mobility planning aspects on FUA level. The plan directs the transport system planning work, as described in the previous section.

The SUMP Self-Assessment tool was applied to evaluate the Turku FUA Transport System Plan 2020 and improve mobility planning in the Functional Urban Area in August 2021. The results demonstrate how well the planning activities fulfil the

principles of a SUMP, enabling FUA actors identify the strengths and weaknesses of the chosen approach.

The self-assessment was performed by the Regional Council of South-West Finland, together with a transport consultant in a dedicated meeting. Data for the SUMP assessment is collected by the municipal departments and some external organisations who participate in the transport system planning work. The assessment of the contribution of measures in achieving the agreed vision, objectives and targets was, however, carried out via intuitive reasoning by the participants instead of a systematic criteria-based process. The assessment included questions on the following aspects:

1. Vision and objectives ("Does the SUMP contain a widely supported long-term vision of urban mobility?")
2. Measurable Targets ("When performing a data audit to account for available data and possible gaps, which data sources did you consider?")
3. Integrated Transport ("Which methods have been used to assess the contribution of measures to achieving the agreed vision, objectives and targets?")
4. Implementation Plan ("Do you have allocated responsibilities for implementation of the measures in the SUMP?")
5. Institutional Cooperation ("Which of the authorities in the area covered by the SUMP have been regularly involved in SUMP development?")
6. Participation ("Which of the following stakeholders did you involve in the SUMP development process?")
7. Monitoring and Evaluation ("How often are the indicators for the SUMP targets going to be measured to review progress?")

The results of the self-assessment are demonstrated in the diagram below:

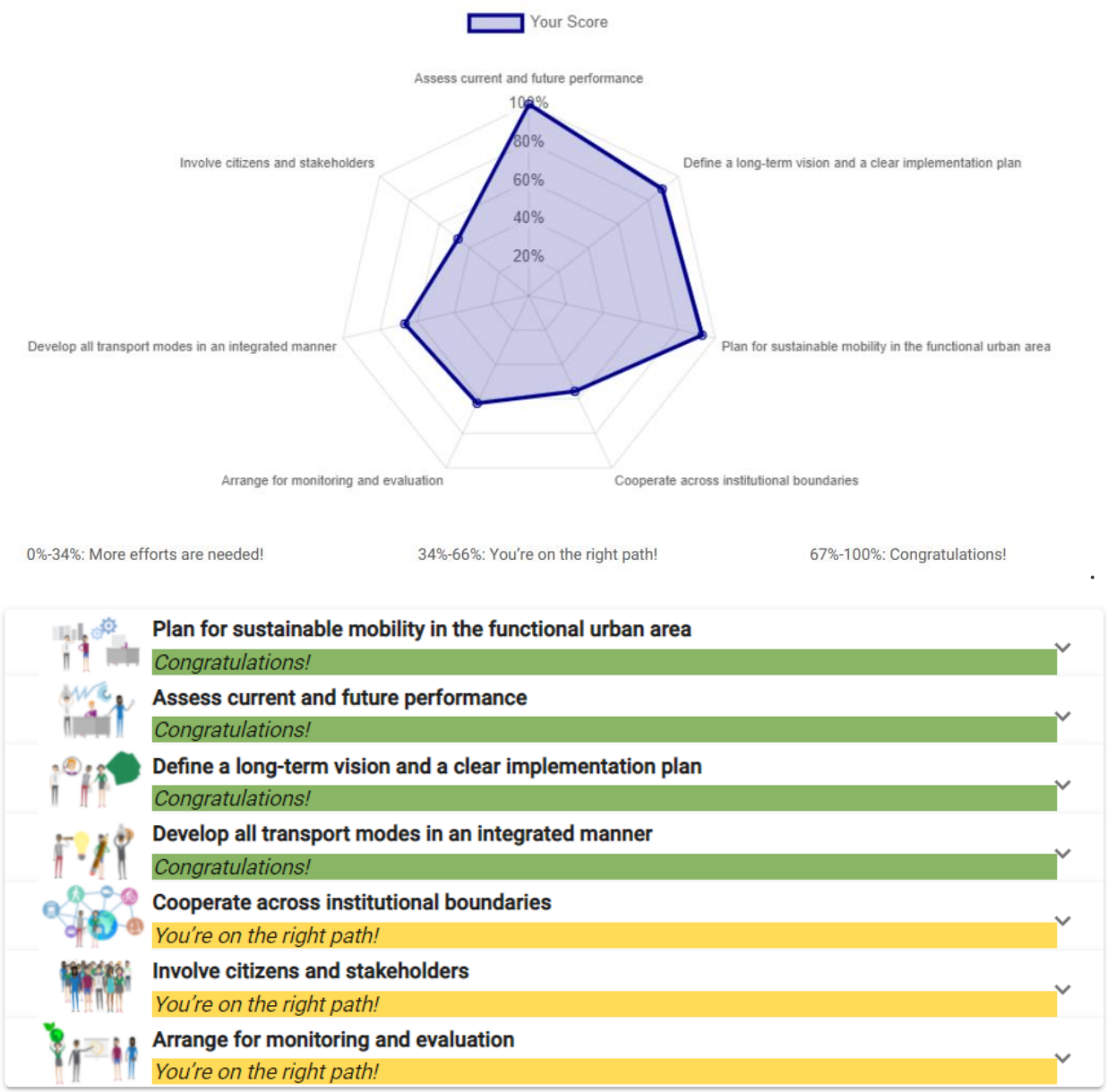


Figure 10: Results SUMP self-assessment of the Turku FUA Transport System Plan 2020

The assessment indicates a successful effort in assessing current and future performance (score: 100%), defining a long-term vision and clear implementation plan (89%) and planning for sustainable mobility in the FUA (93%). The score for the involvement of citizens and stakeholders (48%) indicates room for improvement, as well as the cooperation across institutional boundaries (58%) and arranging for monitoring and evaluation (63%) as well as developing all transport modes in an integrated manner (67%). Overall, the SUMP was assessed to be at least on the right path in fulfilling the SUMP principles.

Based on the assessment, some actions have been defined for the coming years to improve the aspects that were recognized as needing further attention. The aim is to strengthen a multisectoral view in the transport planning work, e.g. by including expert advisors in transport system working groups and by increasing the number of planning and partnership fora. It was also recognized that interactive methods could be utilized in a wider spectrum via e.g. directed interviews to complement surveys. Data collection and data utilization for monitoring purposes as well as better availability of mobility data were identified as needing further development. It was also acknowledged that communication needs better planning and resourcing. Overall, the genuine commitment of the upper administrational level in all relevant organisations to fulfil the land use and transport objectives was considered crucial in the future – sustainability goals should be a cross-cutting theme in all actions, not just something extra that needs to be done to keep up appearances.

- **Other mobility related plans to implement a strong sustainable mobility strategy**

On a national level the Finnish state concluded agreements concerning land use, housing and transport (MAL) with the main city regions of Finland. These agreements enhance cooperation among the municipalities in the respective city regions and between the municipalities and the state in the steering of community infrastructure and coordination of land use, housing and transport. In the current Turku region MAL agreement (2020-2031), a sustainable and low carbon urban structure and traffic system is developed with the goals of achieving a lively and attractive walking and cycling city, an increased share of sustainable transport and decreased share of passenger car transport by 2030.

On an urban level the Turku Climate Plan 2029 has been prepared in accordance with the common model of the European Union (SECAP, Sustainable Energy and Climate Action Plan) and it includes climate policies and milestones for years 2021, 2025 and 2029. The plan includes both climate change mitigation and adaptation. The objective is to collectively implement the goal of a carbon neutral city area by 2029, as laid out in the city strategy, and to consolidate Turku's position as an international pioneer of climate solutions. In the plan sustainable mobility is promoted via several measures, including active mobility and development of public transport, which have an important role in the implementation of a carbon neutral Turku. Simultaneously, they have a positive impact on the healthiness and safety of the urban environment, the physical and psychological wellbeing of citizens and quality of life. New mobility solutions also represent a significant development target and platform for innovations and business. The SECAP update

is upcoming in spring 2022 and will also include updated targets for transport and mobility, e.g. related to SULP.

The Turku city cycling development strategy for 2029 provides the framework for developing cycling conditions in the city, entailing both actions and concrete goals. It is recognized, for example, that the potentials of winter cycling in the city are not fully harnessed.

Current appraisal

Main strong elements:

- Regional mobility planning is well-structured and inclusive
- There is a regional SUMP, the Transport System Plan 2020, steering sustainable mobility planning in the FUA
- The Turku Climate Plan 2029 defines a long-term vision and clear implementation plan for mobility planning
- The MAL agreement enhances cooperation among the municipalities in the region

Observed weak(er) aspects

- Lack of city-specific SUMP in the city of Turku
- Involvement of citizens and stakeholders in mobility planning
- Cooperation across institutional boundaries should be greatly improved
- Commitment of the upper administrational level in all relevant organisations to fulfil the land use and transport objectives

3.3.3.3 Quality of the data layer

Source/method

A review of the availability and type of data was made by interviewing SCALE-UP site coordinator Stella Aaltonen on the 8th of February 2022, and data management experts Maiju Kähärä and Natalia Räikkönen at the regional information service, Lounaistieto, which operates under the Regional council of South-West Finland on the 22nd of January 2022.

Observations

Both in the city of Turku and the FUA, mobility-related data is scattered and when there is data, it is most often static and off-line. The only on-line real-time data available provided by the city (the regional transport office Föli) is the information on public transport stops, routes, timetables, prognoses, real time busses and exceptional situations.

On FUA level, the regional information service, Lounaistieto (https://www.lounaistieto.fi/), manages a platform that also collects mobility-related open data. Most of the data available on this platform, however, is static.

A platform called Avoindata.fi (https://www.avoindata.fi/fi) collects open data sources, including data on traffic. Most of the data is static.

Data is also collected nationally by several different agencies and institutes. Some of the provided data is real-time online data, for instance on road weather or traffic numbers.

The National Traffic situation map can be found here: Liikennetilanne (fintraffic.fi)

Official maps of the city of Turku can be found here: Turun karttapalvelu (turku.fi)

Below are presented the main traffic or mobility related data to be found on different platforms/websites of the Turku or the FUA municipalities.

Type of data	Collected on city level	Collected on regional level	On-line (real-time)	Off-line	Provided by	Made available to	Other comments
Long term road works, exceptional circumstances	x	x	x		Digitraffic	https://tie.digitraffic.fi/api/v3/data/traffic-messages/	
Winter maintenance		x	x		Liikennevirasto	https://vayla.fi/avoindata/tieverkko/talvikunnossapito	On regionally managed roads
Traffic numbers, cars and speed		x	x		Digitraffic	https://tie.digitraffic.fi/api/v1/data/free-flow-speeds	
Average speed and road weather		x	x		Digitraffic	https://tie.digitraffic.fi/api/v1/data/weather-data	
Road cameras		x	x		Digitraffic	https://tie.digitraffic.fi/api/v1/data/camera-data	
Road accidents	x	x	Partly	x	Finnish transport Infrastructure Agency	https://www.avoindata.fi/data/fi/dataset/tieliikenneonnettomuudet	
Public transport stops, routes, timetables, prognoses, real time busses, exceptional situations	x	x	x	x	Regional public transportation authority	http://data.foli.fi	Covers 5 FUA municipa-lities
Air pollution measurement points	x	x	x	x	Finnish Meteorological institute	https://ilmatieteenlaitos.fi/avoin-data	City of Turku provides data to it
Parking mistakes	x			x	City of Turku	https://www.avoindata.fi/data/fi/dataset/turun-kaupungin-pysakointi	
Parking zones	x			x	City of Turku	https://www.avoindata.fi/data/fi/datas	

Type of data	Collected on city level	Collected on regional level	On-line (real-time)	Off-line	Provided by	Made available to	Other comments
						et/turun-kaupungin-pysakointi	
Culture routes, walking	x			x	City of Turku	https://www.avoindata.fi/data/fi/dataset/turun-kulttuurikuntoilureitit	
Measurement points for pedestrians and cyclist, 3 bridges	x		x		City of Turku	https://www.avoindata.fi/data/fi/dataset/turun-seudun-liikennemaaria	
Bicycle parking places in the city centre	x			x	City of Turku	https://www.avoindata.fi/data/fi/dataset/turun-ja-kaarinan-yllapitamat-polkupyoraparkit	
Bicycle routes	x			x	City of Turku	https://www.avoindata.fi/data/fi/dataset/turun-seudun-opastetut-pyorareitit	
e-scooter restriction areas and speed limits	x			x	City of Turku	https://www.avoindata.fi/data/fi/dataset/turun-kaupungin-nopeusrajoitusalueet-sahkopotkulaudoille	
Altogether 36 transport related data sources (e.g. cycling routes with sweep sanded maintenance, speed limit zones, heavy traffic restriction zones, water transport specifications)	x			x	City of Turku	https://www.avoindata.fi/data/fi/organization/turku?vocab_keywords_fi=liikenne&page=1	The data sources cover Turku and Kaarina or Turku alone
Data on the number of cyclists at measurement points		x		x	Cities of Turku,	Only available as files in city systems, not open to public	

Type of data	Collected on city level	Collected on regional level	On-line (real-time)	Off-line	Provided by	Made available to	Other comments
					Naantali & Raisio		
Road maintenance data		x		x	City of Raisio	Only available as files in city systems, not open to public	
Park-and-ride stops for cars and bicycles		x		X	City of Raisio, Lieto municipality	Only available as files in city systems, not open to public	
Data on cycling routes, disabled parking		x			Lieto municipality	Only available as files in city systems, not open to public	

Current appraisal

To improve the amount, quality and variety of data, the municipalities and their decision-makers should better understand the importance of data. This could be facilitated by better demonstration of how municipalities and their citizens could benefit from the data provided. So far, it has been difficult to commit municipalities to sharing data.

When it comes to the small FUA municipalities, the only available data on their websites somehow related to mobility is often the availability of walking routes or similar, if even that. Some vital data to be made more readily available on-line and real-time is winter maintenance data, for example.

It is uncertain why the situation is as poor as it is, a good guess is that there may be fears related to General Data Protection Regulation (GDPR) involved. Partly the issue may be due to lack of resources at municipal level. Another barrier here is the fact that often it might the case that no contract has been made with the subcontractor (for e.g. road winter maintenance) on sharing and opening of data. This should already be thought through at the contracting phase. Third one is the lack of knowhow of the municipalities to ensure that the data is provided accordingly to the contracts and that the municipality is using it itself.

3.3.3.4 Level of data driven

Source/method

A review of the availability and type of data was made by interviewing SCALE-UP site coordinator Stella Aaltonen and data management experts at the regional information service, Lounaistieto, which operates under the Regional council of South-West Finland.

Observations

In early 2022, a traffic management system to streamline **the control and monitoring system of traffic lights** was taken into use in the South-West Finland region. The new smart traffic light system will enable the use of "green waves" for emergency vehicles. In addition, the new system will improve the reliability of traffic lights and help identify possible malfunctions faster.

No operational planning mechanism to manage the multi-modal mobility system exists in the city of Turku or the FUA. There is no Internet of Things (IoT)-platform or similar for this purpose available yet.

Current appraisal

The current level of data-driven processes in the city is one of needing plenty of further development work. The real-time regional mobility data platform is in the works to improve this aspect. In the official map of the city of Turku there is only a limited amount of transport-related data available: data on public transport data, speed limits and speed camera locations.

3.4. Society-People

The impact of the implemented SCALE-UP measures may have effects on society, which in turn, may have further effects on other factors such as employment opportunities, usage levels of the different modes, etc. Table 3**Error! Reference source not found.** lists the 8 FUA indicators in the impact category society-people, to be monitored by the urban nodes on FUA and city level. The data collection method of each urban node is detailed in Table 4.

Table 3: FUA indicators monitored by the urban nodes in the CIVITAS category society-people

Indicator	Definition
Awareness	Share of the target group aware of the key elements of the mobility approach in the city/FUA
Acceptance	Share of the target group favourably in receiving or approving the key elements of the mobility approach in the city/FUA
Operational accessibility to the transport network	How accessible is the PT network?
Operational accessibility to the transport network for mobility impaired people	How accessible is the PT network for mobility impaired people?
Financial accessibility (related to social cohesion)	The cost of service relative to the average personal income
Persons mobility demand	Average number of trips per person
Freight mobility demand	Number of goods movements, internal and to/from the city/FUA
Contribution of mobility on health	Average walking and cycling time per day/week

Table 4: Data collection methods of each urban node of the society-people indicators

Indicator	Data collection method on city and FUA level (*)		
	Antwerp	**Madrid**	**Turku**
Awareness	City: Survey Smart ways to Antwerp	City: Madrid Central Survey	City: No data available yet. To be reviewed in a city-wide mobility survey in April 2022.
Attitude and acceptance	City: Results campaign measurement of the Big Link	City: Madrid Central Survey	City: No data available yet. To be reviewed in a city-wide mobility survey in April 2022.
Operational accessibility to the transport network	Flanders Region: Study of the Flemish institute of technology VITO	City: The population residing <500 metres from a public transport stop (%) from on GIS data	City: Review study of 2018 on % of population at 300m and 700m distances to a bus stop
Operational accessibility to the transport network for mobility impaired people	FUA: Data provided by De Lijn, the Flemish bus/tram/metro operator	City and FUA: Data from CRTM	Review regional public transport website and interview employee
Financial accessibility (related to social cohesion)	SUMI Affordability of public transport for the poorest group indicator. Input data from Statbel.	SUMI Affordability of public transport for the poorest group indicator. Input data from Instituto Nacional de Estadística (INE).	SUMI Affordability of public transport for the poorest group indicator. Input data from Statistics Finland.
Persons mobility demand	FUA: Onderzoek Verplaatsingsgedrag Vlaanderen OVG 5 (Research travel behaviour Flanders)	Home Mobility survey of the Community of Madrid (edM2018)	Finnish National Travel Survey
Freight mobility demand	City: Freight traffic study of 2020 by Cropland	Madrid Region: data from the Observatory of the Transport of Trademarks by Road from the Ministry of Transport, Mobility and Urban Agenda of Spain	Annual statistics Finnish Transport Infrastructure Agency

Indicator	Data collection method on city and FUA level (*)		
	Antwerp	Madrid	Turku
Contribution of mobility on health	HEAT calculations. City: Input data from Survey Smart ways to Antwerp FUA: Input data from OVG 5	City: HEAT calculations. Input data from edM2018.	HEAT calculation conducted by the Regional Council of South-West Finland
(*) Unless indicated otherwise, the same data collection method is used for collecting the data on the FUA and city level.			

3.4.1. Awareness and acceptance of the key elements in the mobility approach

3.4.1.1 Antwerp

Based on the conversations, interviews and focus groups previously held with the administration of the city of Antwerp as well as the information the city provides online, some keys elements in the mobility approach in Antwerp can be listed:[8]

- Smart ways to Antwerp tries to change the mindset of the citizens of Antwerp, the employers and employees by various actions and campaigns. Sustainable travel is promoted as a positive step in their communication strategy. They focus on communication and participation with stakeholders and behavioural aspects within the mobility policy.
- The Big Link tells the story of the major, historic transformation of Antwerp's ring road in the years to come. The project will free up space aboveground, where people can enjoy life, clean air and more green space. By connecting existing and new neighbourhoods on both sides of the ring road, Antwerp will become one: thanks to the Oosterweel link, the ring road becomes a full circle, improving mobility in Antwerp, the port and Flanders. By covering the ring road, cars will be directed underground in the future, ensuring the connection of existing and new neighbourhoods on both sides of the ring road, with more green space and cleaner air.[9]
- Each 'traffic mode' - or way of moving - has its own utility and place in the city. When other, faster or more efficient modes are available, people will use the car less. The city is committed to an interplay of car traffic, public transport, safe bicycle networks and also transport over water. SCALE-UP measure A3 and the optimalisation of the mobility hubs plays into this important element in the Antwerp mobility approach.[10] Important other outcomes, apart from the hubs, of this focus on multimodality and good connections, are the Park & Rides, waterbus, shared mobility etc.
- Cycling city: Antwerp was named Flemish Bicycle City 2012, included in the Copenhagenize Index 2017 and nominated as Bicycle City 2015. The city keeps its focus on cycling and wants to further improve their cycling network.

[8] These key elements are based on the observations of the evaluators and are not an official statement of the city of Antwerp.
[9] https://www.slimnaarantwerpen.be/en/news/the-big-link-is-slowly-taking-shape
[10] https://www.antwerpenmorgen.be/nl/toekomstvisies/multimodaliteit/over

- The Scheldt is a connecting factor for the transport to the port as well as for citizens. A good example of this is the waterbus as well as infrastructural works

Awareness

Source/method

Survey Smart ways to Antwerp[11]: Every 2 years, the city of Antwerp conducts a survey among residents, visitors, employees and employers in the city of Antwerp. The city of Antwerp will organize a survey in 2022 and 2025. In 2022, this survey will run in three phases:

- Residents: April 2022 (only the city)
- Visitors: July 2022 (only the city)
- **Employees/employers: October/November 2022c (city and FUA)**

Therefore, in this baseline report finalised before April 2022, the results of an older version of the survey (2020) will be used (Figure 11).

One of the major elements of the mobility approach in Antwerp is the Smart ways to Antwerp project. A team of the city of Antwerp that dedicates itself to convincing citizens, employees and visitors to make a sustainable switch in their travel. The Survey Smart ways to Antwerp asks their citizens, visitors and employees if they know Smart ways to Antwerp. For the FUA, only the employees are queried.

An extra source is added in this field because it is the one used in measure A10. Every year, the city orders a campaign measurement. The range and the awareness are researched via market surveys. In 2021 there was market research done by Ipsos. This research also polled the awareness surrounding Smart ways to Antwerp (Figure 12).

Observations

[11] Presentation of the Smart Ways to Antwerp Survey, 2020, not publicly available.

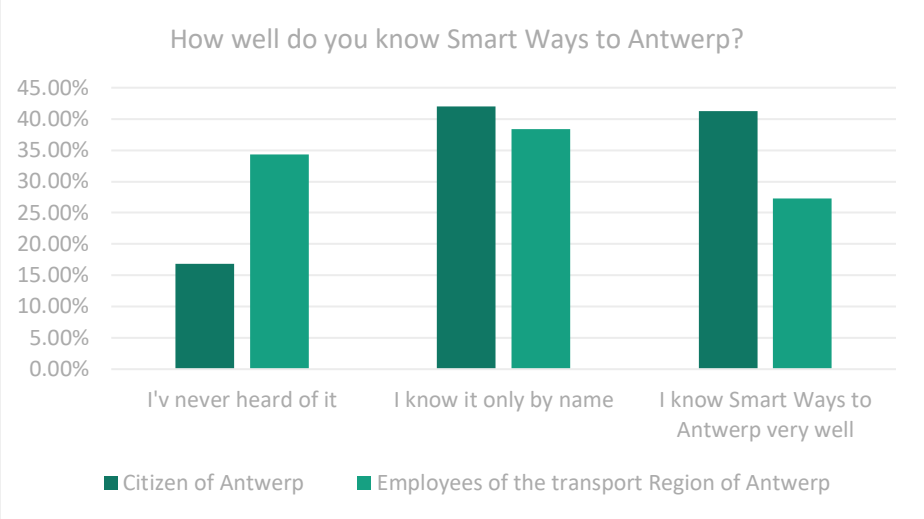


*Figure 11: Awareness Smart ways to Antwerp via **survey**, 2020*

Source: Survey Smart ways to Antwerp

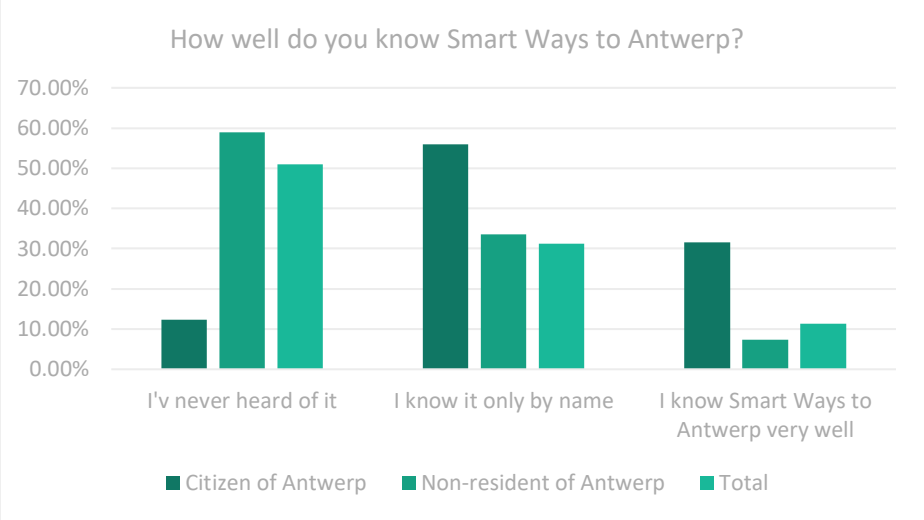


*Figure 12: Awareness Smart ways to Antwerp via **market research**, 2021*

Source: Ipsos

Current appraisal

It's clear based on both sources that most of the citizens of the city of Antwerp have already heard of the concept Smart ways to Antwerp. They have however still a hard time grasping the concrete concept, which might lead to an information barrier in their mobility decisions seeing as Smart ways to Antwerp organizes multiple projects for its citizens, e.g. the route planner.

In the Antwerp Transport Region, Smart ways to Antwerp is lesser known than in the city, which is, of course, unsurprising seeing as Smart ways to Antwerp lays its first focus on changing people's behaviour in the city. However, there are lots of people who travel to the city and therefore have an impact on the mobility of Antwerp. Improving the awareness in this group could result in a positive mobility impact as well.

Acceptance

Source/method

No recent data that could be repeated at the end of the SCALE-UP project was found for the acceptance and attitude for the whole mobility approach of the city of Antwerp or the FUA. Therefore, only data of one specific but very relevant aspect of the mobility approach and policy is assessed. In yearly campaign measurements commissioned by the city of Antwerp, the citizens are asked what their opinion is on 'De Grote Verbinding' (The Big Link). The campaign measurement is carried out by marketing agency Ipsos.[12]

This campaign measurement had the following characteristics:

- All Flemish provinces + city of Antwerp (n=1500 in total; age: 25 -64 years)
- 250 participants for the city of Antwerp (including the districts, i.e. Antwerp, Berchem, Borgerhout, Berendrecht-Zandvliet-Lillo, Deurne, Ekeren, Merksem, Hoboken and Wilrijk)
- 250 participants for the province of Antwerp (excluding the city of Antwerp)
- 250 participants per Flemish province, excluded the province of Antwerp (Flanders has a total of 5 provinces)

What is the Big Link and why is it a crucial element in the mobility approach of Antwerp?

[12] Campaign measurements performed by Ipsos, 2021, specific numbers provided by the city administration in January 2022.

In 2017, the Treaty of the Future was signed between the city, the Flemish government and the civic movements setting out the principles for the ring road project: an inner ring road for the city (local traffic), a cap on top of the ring road, a modal split of 50/50 by 2030, a more northerly located ring road for traffic related to the Antwerp port activities and/or passing through and solid cooperation between all stakeholders (local, regional, national governments, infrastructure planners, the Antwerp port, PT operators, civic movements and others) involved. The name for this project is: The Big Link. This whole process became one of the biggest examples of citizens involvement and even today, the relevant stakeholders as the civic movements (stRaten-generaal, Ademloos en Ringland) are involved.

Next to the participation process, the Big link will result in road works which will have a crucial impact on the mobility of the city of Antwerp.

Observations

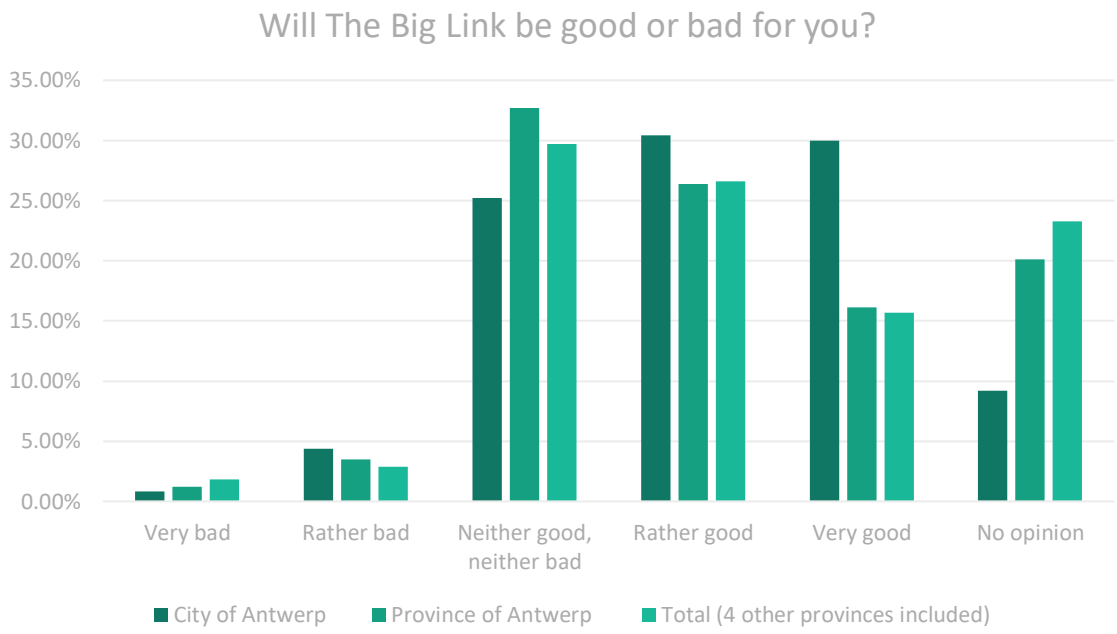


Figure 13: Is The Big Link good or bad for you?, results campaign measurement 2021

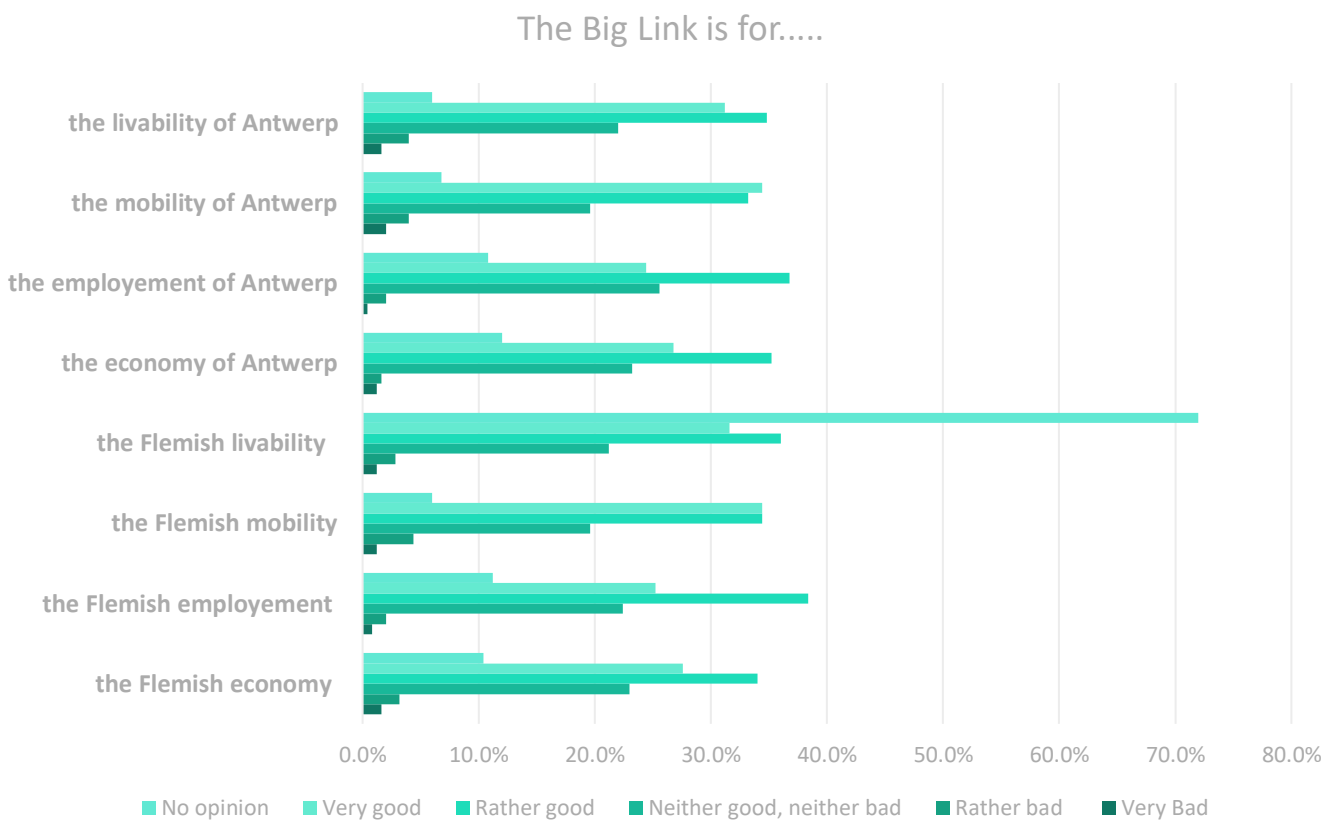


Figure 14: The Big Link is good/bad for...., results campaign measurement 2021, citizens of Antwerp

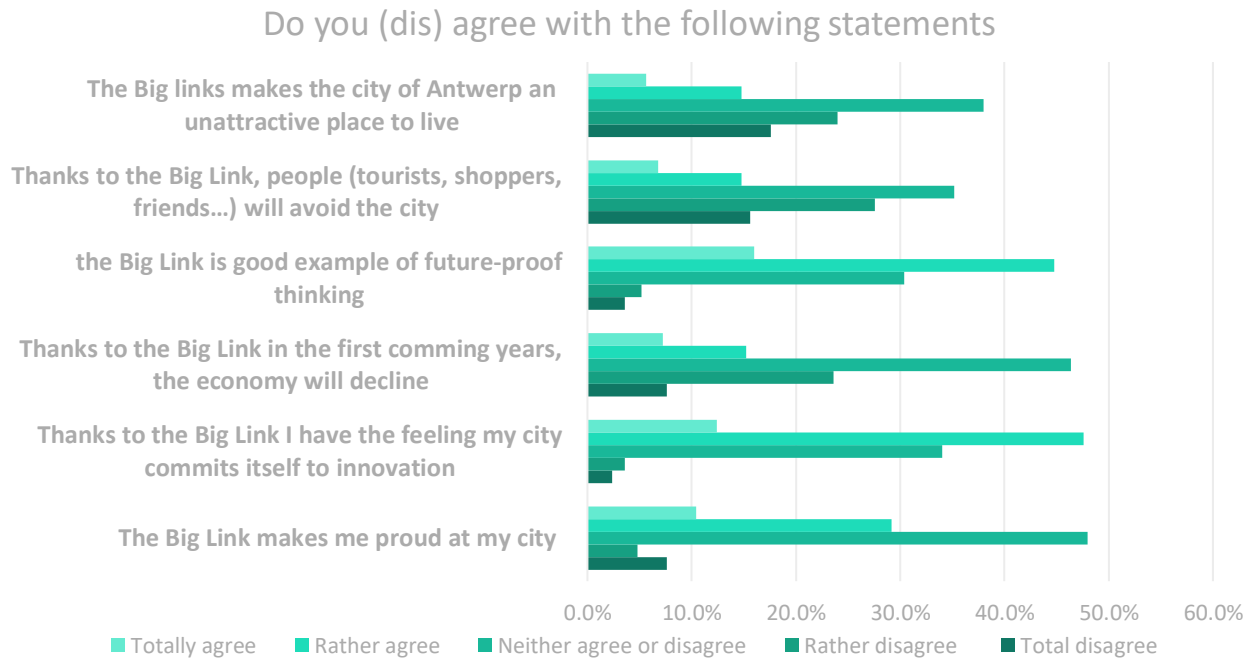


Figure 15: Opinions on The Big Link, results campaign measurement 2021, citizens of Antwerp

Current appraisal

The graphs in the previous part show that the majority of the citizens stand rather positive towards The Big Link. Seeing as the citizens themselves play an important part in it, this isn't surprising.

3.4.1.2 Madrid

Awareness

Source/method

Madrid´s City Council has always focused mainly on the satisfaction of the citizens with the different services provided. The latest available data corresponds to the survey of Quality of Life and Satisfaction from the Municipal Public Services of the city of Madrid of 2019 which is an essential perception assessment tool that began in 2006. The objective of the survey is to measure the degree of **satisfaction** of those residing in the city of Madrid with the quality of life in the city, to identify which are, in the opinion of the people interviewed, the main problems of the city and to evaluate the citizens´ satisfaction with the city government, the municipal activities, and services.

The awareness of citizens of the different key mobility objectives or strategies of the city has not been deeply evaluated. The only survey available to evaluate the awareness is related to one specific measure that was called Madrid Central, which is the creation of a Low Emissions Zone (LEZ) located in the city centre. It was established in November 2018 and establishes traffic restrictions to the most polluting vehicles. This measure has been readapted by Madrid´s City Council and now is called Distrito Centro.

This measure is part of the different actions included in the new Plan de Movilidad Sostenible Madrid 360 that sets 2030 as a horizon to reach a more sustainable, safe, healthy and smart mobility in the City of Madrid. The main mobility objectives included in the plan are: to reduce travel time on public transport by an average of 32.5%; to reduce traffic congestion by up to 10%; to reduce CO_2 emissions by 65% compared to 1990 and to reduce road fatalities and serious casualties by 50%.

Two different surveys were conducted to evaluate citizen´s perception of Madrid Central, with a sample of 400 responses in each of them. The first one was conducted in January and second in July of 2019. The evaluation of awareness could only be done at city level.

Observations

In the first question citizens were asked if they knew about Madrid Central. In the other two questions their awareness level of the scope of Madrid Central measure was assessed. In the response choices: 0= does not know it and 10nows it perfectly.

1. Do you know what is Madrid Central?

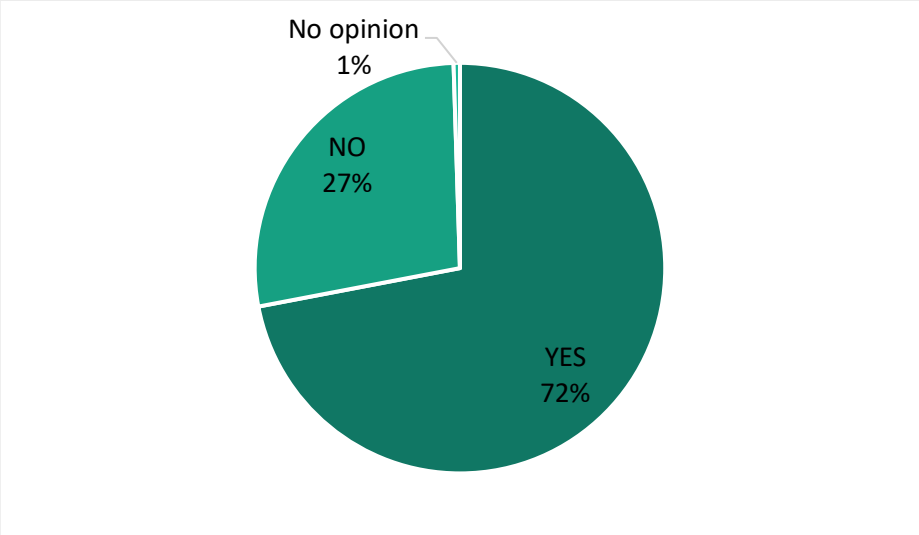


Figure 16: Citizens' awareness of Madrid Central LEZ. Source: Madrid Central Survey January 2019.

2. Do you know the criteria for access to Madrid Central based on the environmental label of your vehicle?

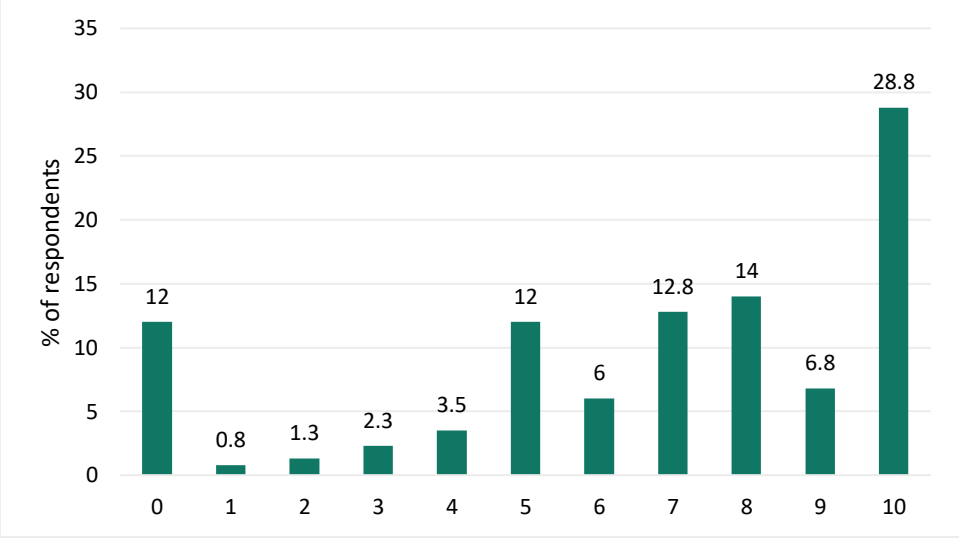


Figure 17: Citizens' awareness of Madrid Central criteria to access to the LEZ. Source: Madrid Central Survey July 2019.

3. Do you know the exceptions that exist to be able to access Madrid Central?

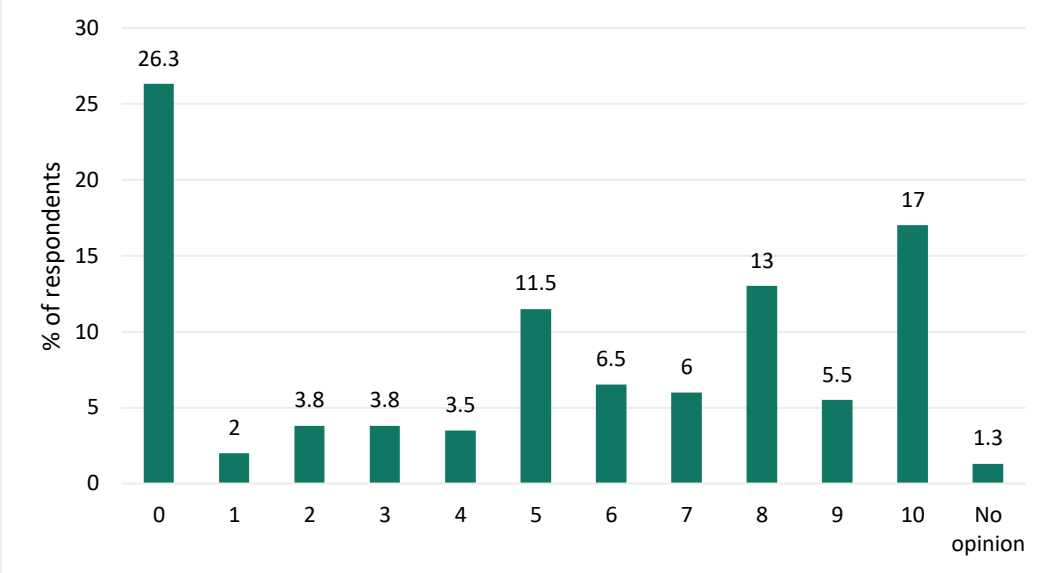


Figure 18: Citizens' awareness of Madrid Central exceptions to access to the LEZ. Source: Madrid Central Survey July 2019

Current appraisal

The available data shows that in addition to evaluating citizens' satisfaction with the services, there is a clear need to evaluate citizens' awareness of the mobility objectives and strategies of the city.

A clear example of the importance of evaluating citizens' awareness is the fact that by January 2019 there was still a 27% of the population that did not know what Madrid Central was and it was already established in November 2018.

Moreover, seven months after its implementation, by July 2019 there was 12% of people who did not know the criteria to access to the LEZ.

Acceptance

Source/method

As mentioned in the indicator awareness, in the last years Madrid's City Council has been mainly focusing on citizens' satisfaction with the services. Regarding acceptance, the only data available is related to the same measure (Madrid Central) which has been updated and became Distrito Centro. There are no acceptance focused questions, but one question in each of the surveys that could be related to acceptance was chosen to evaluate this indicator. As in awareness, the only data available is at city level.

Observations

1. In relation to your mobility, does Madrid Central affect you personally?

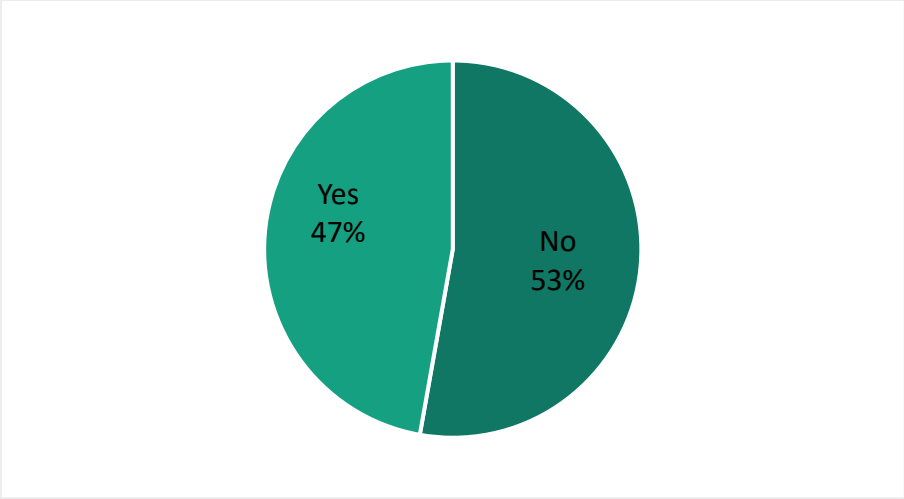


Figure 19: Citizens' opinion of the influence of Madrid Central in their mobility. Source: Madrid Central Survey January 2019

2. Does the implementation of Madrid Central represent complications on your working activities? (0= not at all, 10=yes a lot)

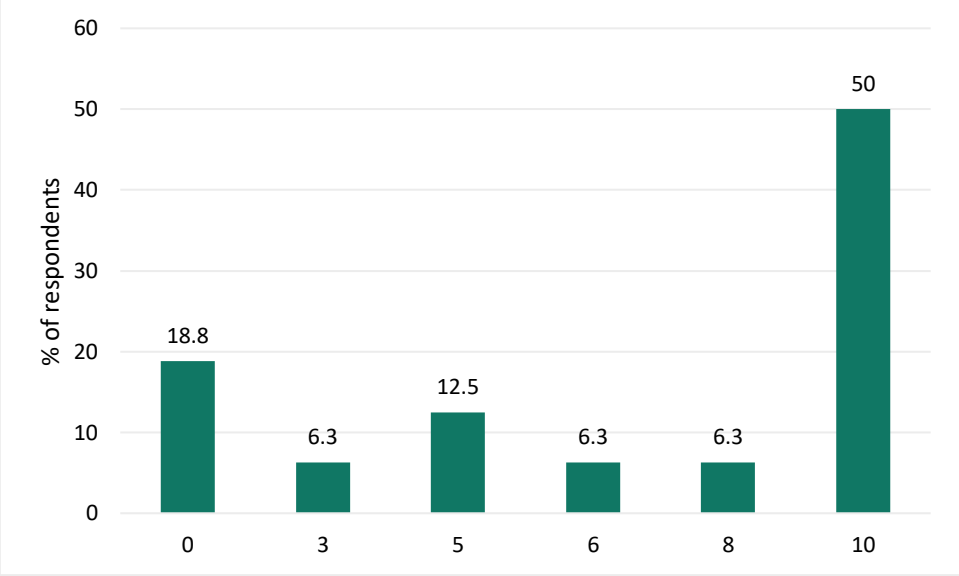


Figure 20: Madrid Central influence on citizens' working activities.

Source: Madrid Central Survey July 2019

Current appraisal

There is a clear need to evaluate citizens' acceptance of the main objectives and strategies on mobility. Very little has been done about it.

As in the survey of 2019, 50% of people considered Madrid Central would represent complications in their working activities, it can be inferred that their acceptance of the measure will be low.

3.4.1.3 Turku

Awareness and acceptance of the key elements in the mobility approach will be reviewed in a city-wide mobility survey, to be implemented in April 2022. The key mobility elements include the following:

1. Carbon-neutral transport and mobility
2. Increasing the modal share of sustainable transport modes (walking, cycling, PT)
3. Improving the year-round conditions for walking and cycling

3.4.2. Operational accessibility to the transport network

3.4.2.1 Antwerp

Overall

Source/method

For accessing the accessibility of public transport in the area of the urban node of Antwerp, this baseline report uses the research the Flemish government ordered and was performed by VITO (Flemish Institute of Technology and Research). This study[13] aimed to map the accessibility of the nodes in Flanders as well as the facilities. As part of this study, the quality of public transport is also discussed as well as how many people in Flanders each stop serves. This research was conducted in 2016.

Observations

Figure 21 shows the general quality of the public transport in Flanders. Quality is defined and calculated by multiple factors, listed below:

- The **'Closeness centrality'** indicator describes the degree of easiness of moving from any node across the network in terms of speed and frequency of service.
- The **'Degree centrality'** indicator describes the immediacy of the movements from the public transport stops.
- The **'Contour catchment'** calculates the share of residents and workers in Flanders and Brussels who live or work within walking distance of nodes/public transport stops, which can be reached in a maximum of 30 minutes travel time from the reference node.
- The **'Nodal betweenness centrality'** indicator indicates to what extent a node facilitates movements across the network.
- The '**Nodal connectivity'** indicator indicates to what extent a node is integrated into the network and how interesting it is for making transfers and travel interruptions. E.g. a negative value indicates a stop that is at the end of a line.

[13] Ontwikkelingskansen op basis van knooppuntwaarde en nabijheid voorzieningen, VITO, 2016

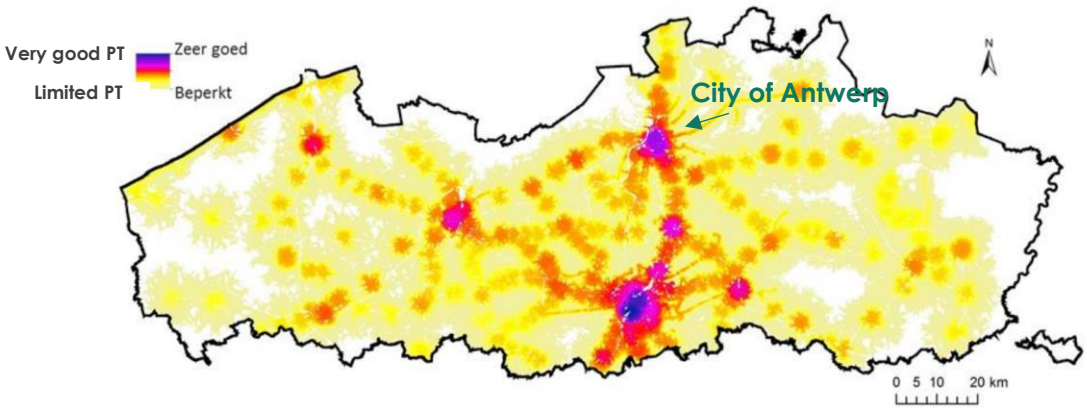


Figure 21: Quality of the public transport network in Flanders

Of all these factors, the ***Contour catchment*** is especially interesting for this FUA indicator, seeing as this gives an idea for how many people a specific stop serves. Figure 22 shows the Contour catchment or in other words, the percentage of Flemish people each train stops serves. The greater the dot, the larger the number of Flemish people served by that specific node. In the network with the bus stops, the value varies between 0.16% and 19.35% with a median value of 2.98% in Flanders.[14] The highest value of 19.35% applies to the stops in the Brussels-North

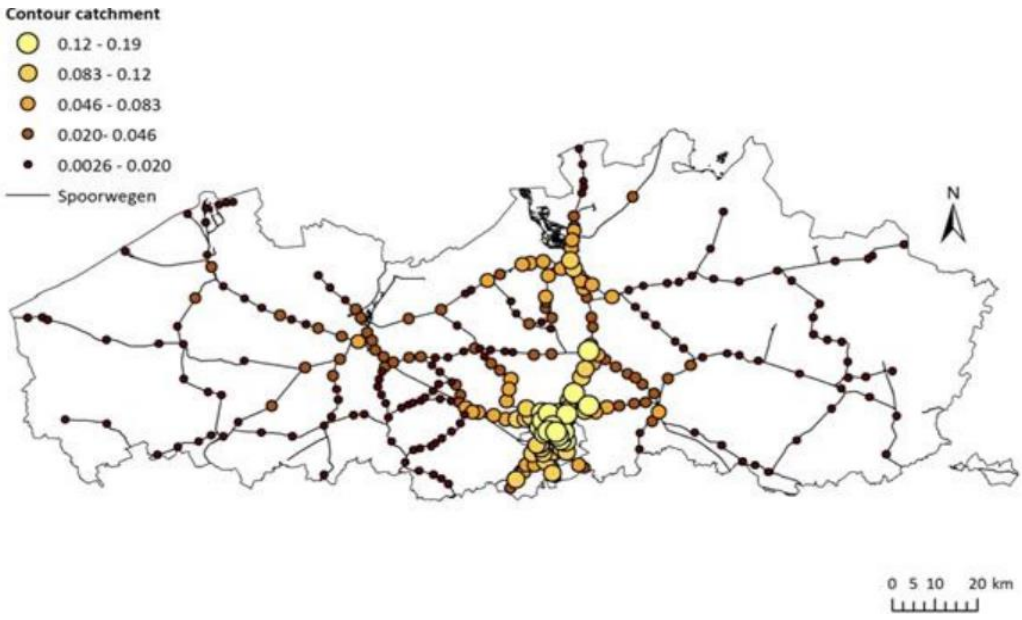


Figure 22: Degree of people served by a specific train stop

[14] No specific figure for bus stops was given in the report of VITO

junction. The median value is highest for STIB stops (provider of bus/tram/metro in Brussels), followed by those of De Lijn (Flemish provider of bus/tram/metro). The lowest median value is recorded for the train stops.

This exercise was also done for the tram stops in Antwerp (Figure 23).

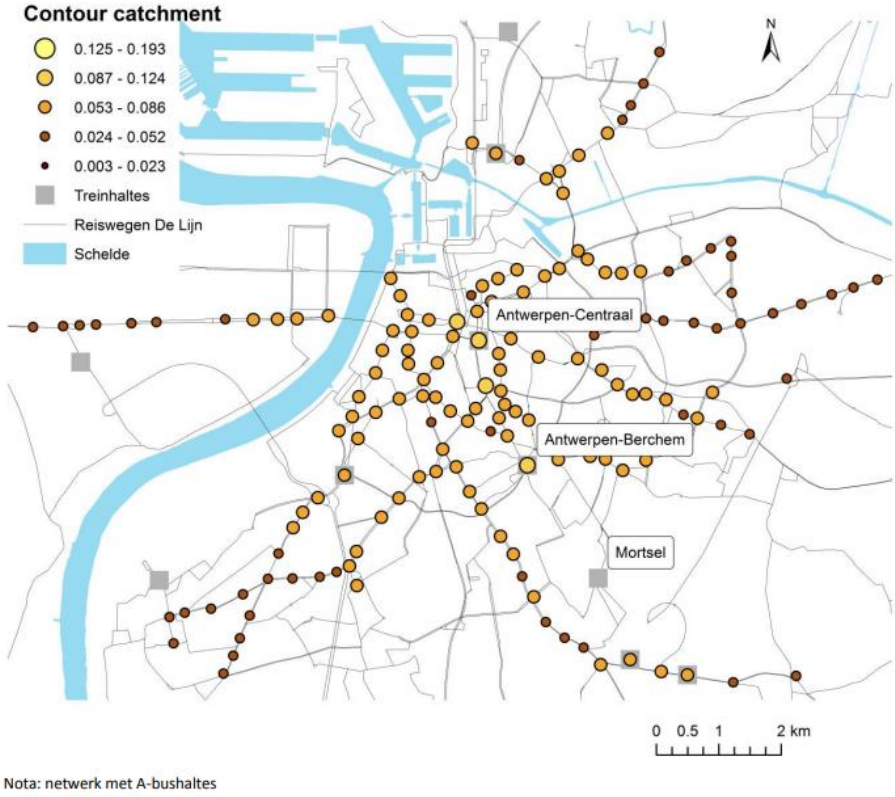


Figure 23: Percentage of people served by specific tramstop

Contour catchment forms are of course only one of the elements that define the quality of public transport.

Current appraisal

Many stops in Flanders only reach a limited number of people, which we mainly find on the edges of Flanders, e.g. the less urbanized provinces of West Flanders and Limburg. However, in the centre cities such as Brussels and Antwerp, but also near these cities, the stops reach quite a lot of people. The quality, as defined by VITO, is then quite qualitative both in the city of Antwerp and near Antwerp. Only in Brussels, a higher quality score is reached.

For mobility-impaired people

Source/method

Accessibility for mobility for the mobility impaired is a hard to define indicator, seeing as it depends on multiple factors and the group of mobility impaired people are a diverse group with different infrastructural and personal needs.

In theory, every station in a train stop in Belgium should be accessible for the mobility impaired.

For the bus stops, we look at the data that the De Lijn provided for the stops in the Antwerp Transport Region.[15] Their dataset makes note of three types of accessibility:

- Accessible for motorically impaired
- Accessible for motorically impaired if assistance is available
- Accessible for visually impaired

Observations:

Table 5: Accessibility for mobility impaired at bus stops in 2020, in the Antwerp Transport Region. Source: De Lijn.

	Yes	No
Accessible for motorically impaired	17.62%	82.38%
Accessible for motorically impaired if assistance is available	42.05%	57.95%
Accessible for visual impairment	4.53%	95.47%

Current appraisal

If we would only look at the bus stops, we could conclude that public transport in the Antwerp Transport Region is rather inaccessible for mobility impaired.

[15] Data provided by De Lijn in Excel to the Antwerp Transport Region on 07/08/2020

3.4.2.2 Madrid

Overall

Source/method

The assessment of the accessibility of public transport in the city of Madrid was done using GIS data available from the Geoportal of Madrid´s City Council. For this, the coverage of bus and metro network were evaluated together.

The percentage of population residing <500 metros from a bus stop and <700 m from a metro station was estimated in two ways. The first one considered the entire area of Madrid City. However, Fuencarral-El Pardo district (shown in Figure 24) is a big area with really low population residing in it. Since this area affects the percentage considerably, the second analysis considered the area of Madrid City minus the area of Fuencarral-El Pardo district.

The accessibility to a bicycle lane was also evaluated using the same approach. The percentage of population residing at 350 meters from a bicycle lane (exclusive, preferential or car-bike shared) was also evaluated.

Observations

Table 6 presents the public transport accessibility and the accessibility to the cycling network in the city of Madrid.

Table 6: Table 7: PT and bike accessibility in Madrid City

Area	PT accessibility	Accessibility to the cycling network
	Bus 500 m - Metro 700 m	350 m
Madrid City	43.22%	33.21%
Madrid City without Fuencarral-El Pardo district	62.69%	48.17%

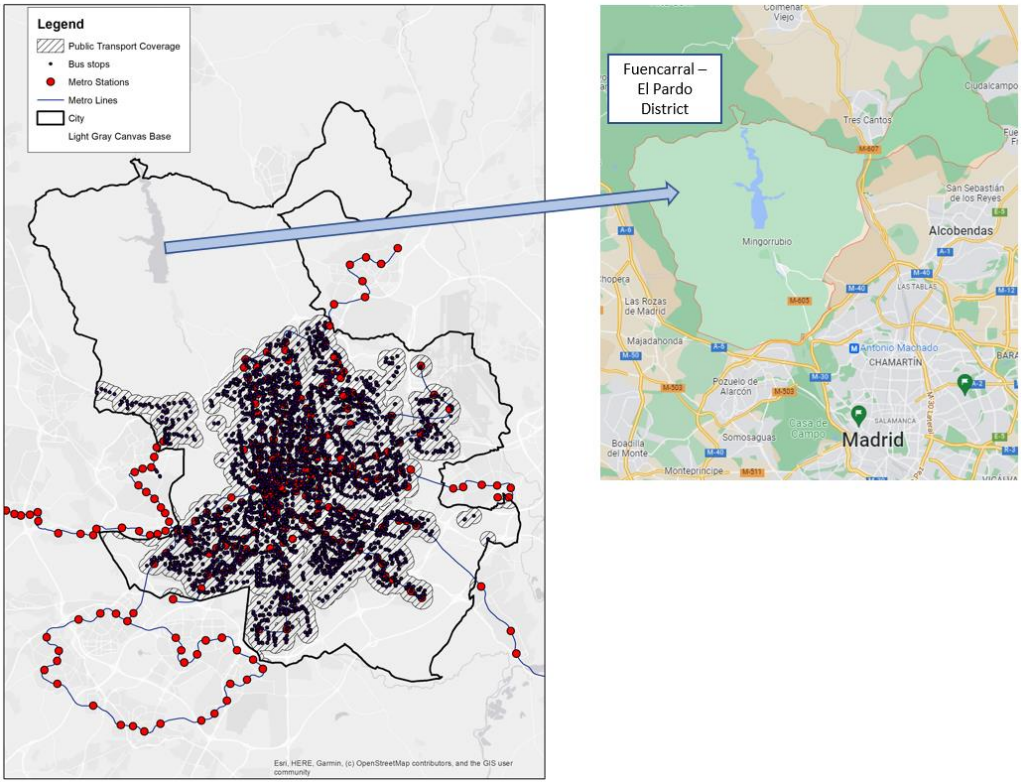


Figure 24: Public transport accessibility in Madrid City (bus and metro)

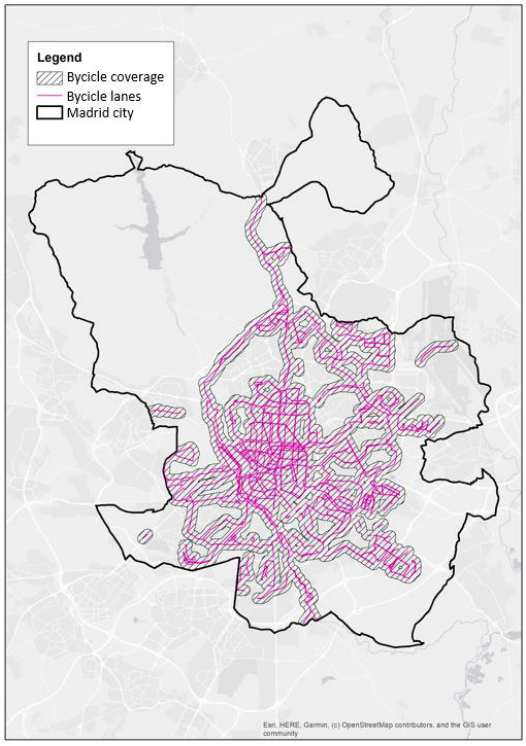


Figure 25: Accessibility to a bicycle lane in Madrid City

Current appraisal

The operational accessibility to public transport in Madrid city considering metro and bus is 62.69%, this means that 62.69% of people have a metro and/or bus station at 700-500 meters from home respectively.

Less than half of the population (48%) has a bike lane at 350 meters from their home. It is important to point out that for this estimation exclusive bike lanes, preferential lanes, car-bike shared lanes were used. The percentage would be considerably lower if exclusive cycling lanes were considered.

For mobility impaired people

Source/method

Data from the CRTM is used to evaluate the operational accessibility to the transport network for mobility impaired people (it is available at Madrid Regional Government webpage).

The accessibility of the different transport modes was analysed considering the following mobility conditioners:

Figure 26: Mobility conditions used to evaluate the accessibility in Madrid

Observations

Metro

Metro de Madrid is working on the accessibility of the different metro lines. They have a specific plan, the new "Accessibility and Inclusion Plan 2021-2028", which will allow the accessible stations of its network to be expanded from the current **67.5% to an 82%.** Metro de Madrid extends way into the FUA area, since most of the metro lines have been extended in the past decades, past the CBD or Almendra central, and connecting to key light train and inter-urban train (CERCANIAS) stops, as it can be seen in this map.

Light rail

All the light-rail cars, stations and stops are equipped with the latest innovation in accessibility, specially designed for users with reduced mobility. It is also possible to travel with dogs and bicycles.

Currently **100%** of the light rail stations are wheel accessible for mobility impaired.

EMT (urban) buses

The urban buses fleet can be considered **100%** accessible for mobility impaired people. It is possible to travel in a wheelchair, an electric wheelchair, scooter-type wheelchair, pushchair, walker, suitcases, shopping cart or folded bicycle always taking into account the access and descent regulations.

All buses also have the Acoustic Information Onboard System to provide visual and sound information on board urban buses. This system facilitates access to useful information for all customers and especially for people with visual disabilities.

Interurban buses

As urban buses, **100%** of the interurban fleet is accessible. Buses have an area reserved for wheelchairs, seats reserved for pregnant women, elderly, or mobility impaired people.

Suburban rail

In 2020, the current Renfe Accessibility Plan started, which, with a 2028 horizon, aims to provide universal accessibility to the entire travel chain from access to the station of origin to abandonment at destination looking to achieve an accessible and inclusive railway that provides personal autonomy.

Investment in the acquisition of an accessible fleet and remodelling of the oldest fleet or Cercanías stations (in which Renfe has competence) is only one of the bases of its actions in accessibility. 77% of trains and stations with more than 750 daily travellers will be accessible in 2023, and the final goal is to reach 100% by 2028.

Current appraisal

As can be seen, the accessibility to the different transport modes in Madrid City and the FUA is good, being the entire fleet of buses 100 % accessible, which means all of them have special areas for wheelchairs, reserved seats for pregnant, elderly, and mobility impaired people. All the buses also have visual and acoustic information onboard for deaf people and for people with visual disabilities.

The worst modes in terms of accessibility are the metro and suburban trains, however, both of them have plans to improve it and have set 2028 as a horizon to reach certain goals.

3.4.2.3 Turku

Overall

Source/method

The operational accessibility of the transport network (in addition to other services) has last been reviewed in the scope of reviewing the ecological sustainability indicators in the six biggest cities in Finland (Espoo, Helsinki, Oulu, Tampere, Turku and Vantaa). The last review was made in 2018, mapping the development in terms of these indicators between 2015 and 2018. The operational accessibility to the public transport in Turku is one of the indicators, reviewing the geographical accessibility of buses operating in the Turku city area.

Observations

Below are represented data on the operational accessibility to the transport network at 300m and 700m distances to a bus stop by % of the population.

		2006	2010	2014	2016
Turku	**300m**	95%	94%	94%	-
	700m	100%	100%	100%	-

Current appraisal

Unfortunately, for some reason no data has been collected on the operational accessibility to the transport network since 2014. The graph above does demonstrate the trend, however, and one can observe that the accessibility rate is high at both distances from the bus stop. Compared to the other five cities, Turku has the best accessibility rate for the 700m distance. It is unlikely that these figures would have changed greatly within the last years.

For mobility impaired people

Source/method

To review the operational accessibility to transport network for mobility impaired people, the regional public transport website was reviewed for information on accessibility and an employee interviewed on the issue.

Observations

It should be noted that buses are basically the only public transport mode in the FUA and in the city of Turku. Therefore, there are no mobility hubs in the city. Rail is mainly used for long-distance travel and no local train connections exist in the region, although there are ongoing plans to bring back a local train network to the city sometime in the future. Föli has an electric year-round city ferry "Föri" and a water bus operating during the summer season. Accessibility as such has not been the focus of recent customer service surveys which are conducted by FÖLI 3 times per year.

Operational accessibility for mobility impaired people is on a good level in the Föli region. Almost all Föli buses are low-floor, and the chauffeur can tilt the bus if customers require this for ascending with prams or otherwise. In addition, most buses have a bridge in the middle section, which can be used to ensure safe wheelchair access. As there are no mobility hubs in the city or the FUA, there is no need for escalators or similar features. Bus stops are generally accessible, although there is some variation especially when it comes to older or less frequently used bus stops. It should be noted that winter does cause problems for mobility impaired people; winter maintenance of bus stops is sometimes inadequate especially if there is a lot of snow, sleet, or ice, making it challenging for mobility impaired people to access and exit buses during the winter season. The electric year-round city ferry "Föri" and the water bus operating during the summer season are accessible for mobility impaired people.

Current appraisal

The operational accessibility is on a good level in the city and in the FUA. The main accessibility challenges are related to older, less frequently used bus stops and bus stops located in sparsely populated areas. The winter season is a major challenge for bus stop maintenance. Although accessibility related issues are not regularly evaluated in the Föli customer service surveys, Föli is generally willing to add questions related specifically to accessibility if needed.

3.4.3. Financial accessibility

3.4.3.1 Antwerp

Source/method

The SUMI methodology of the SUMI Affordability of public transport for the poorest group indicator[16] was followed for this indicator. The SUMI Affordability score is defined as the share of the poorest quartile of the population's household budget required to hold public transport (PT) passes (unlimited monthly travel or equivalent) in the urban area of residence was used.

The necessary data was provided by Statbel, the official Belgian institute for data acquisition in various themes. This exercise was done for the year 2019, as the most recent data on the average income of the 25% poorest was of this year.

There are 2 types of public transport providers in Antwerp: De Lijn, the Flemish provider of bus and tram public transport and the National Railway Company of Belgium (NMBS). Only the price of a monthly subscription to De Lijn was included as the subscriptions of NMBS strongly depend on your travel distance. As for the De Lijn, you could choose a subscription for the whole network at the same price. One has to keep in mind that cheaper tickets are available for multiple groups of people with a lower income: seniors, youngsters, low income, big families, etc.

Observations

City of Antwerp:

Table 7: The SUMI Affordability score of the city of Antwerp in 2019

Affordability	
Affordability score	1.7%

[16] https://transport.ec.europa.eu/other-pages/transport-basic-page/affordability-public-transport-poorest-group-indicator_en

Antwerp Transport Region

Table 8: The SUMI Affordability score of the Antwerp Transport Region in 2019

Affordability	
Affordability score	1.6%

Current appraisal

The Antwerp Transport Region and the city of Antwerp have a low affordability score, meaning the public transport passes are quite affordable and don't take in a large chunk of the household budget. Although the average household size and the average income of the poorest 25% are different, the difference in affordability score stays small. This is probably due to the fact that prices of subscriptions are the same and the differences in household size and average income are not great enough.

3.4.3.2 Madrid

Source/method

The SUMI methodology of the SUMI Affordability of public transport for the poorest group indicator[17] was followed for this indicator. The SUMI Affordability score is defined as the share of the poorest quartile of the population's household budget required to hold public transport (PT) passes (unlimited monthly travel or equivalent) in the urban area of residence was used.

As shown in Figure 27, in the PT system there are 8 fare zones, 6 of them for the Madrid Region and two of them correspond to the provinces of Toledo and Guadalajara of the Autonomous Community of Castilla-La Mancha.

Fare zones A and B1 are in the city of Madrid, so for the estimation of the affordability on city level fare B1 was used since it covers the whole city.

Using the same criteria, fare zone B3 was used to estimate the affordability at FUA level since it covers all the areas in the FUA. Finally, fare zone C2 was used for the Region.

Community of Madrid

There are three main user profiles:

- Regular Pass: Between 26 and 64 years old
- Youth Pass: Until 26 years old
- Senior Pass: From 65 years old

As the youth and senior passes have special prices, the financial accessibility was estimated using the regular pass price.

For estimating the affordability of PT for the poorest group in the city, the CRTM regular pass was used which includes EMT buses, metro, light train, and interurban buses. The average monthly income of the 25% poorest inhabitants (P25%) is 2 080€ (Instituto Nacional de Estadística; INE) and the monthly transport expenditure P25% is 102€ estimated based on P20% and P40% (INE).

The average household size is 2.4 persons in the city area and 2.8 in the FUA and regional area.

[17] https://transport.ec.europa.eu/other-pages/transport-basic-page/affordability-public-transport-poorest-group-indicator_en

Three different estimations were made, using tariff B1 for city trips, C1 for FUA area, and E1 zone for the region.

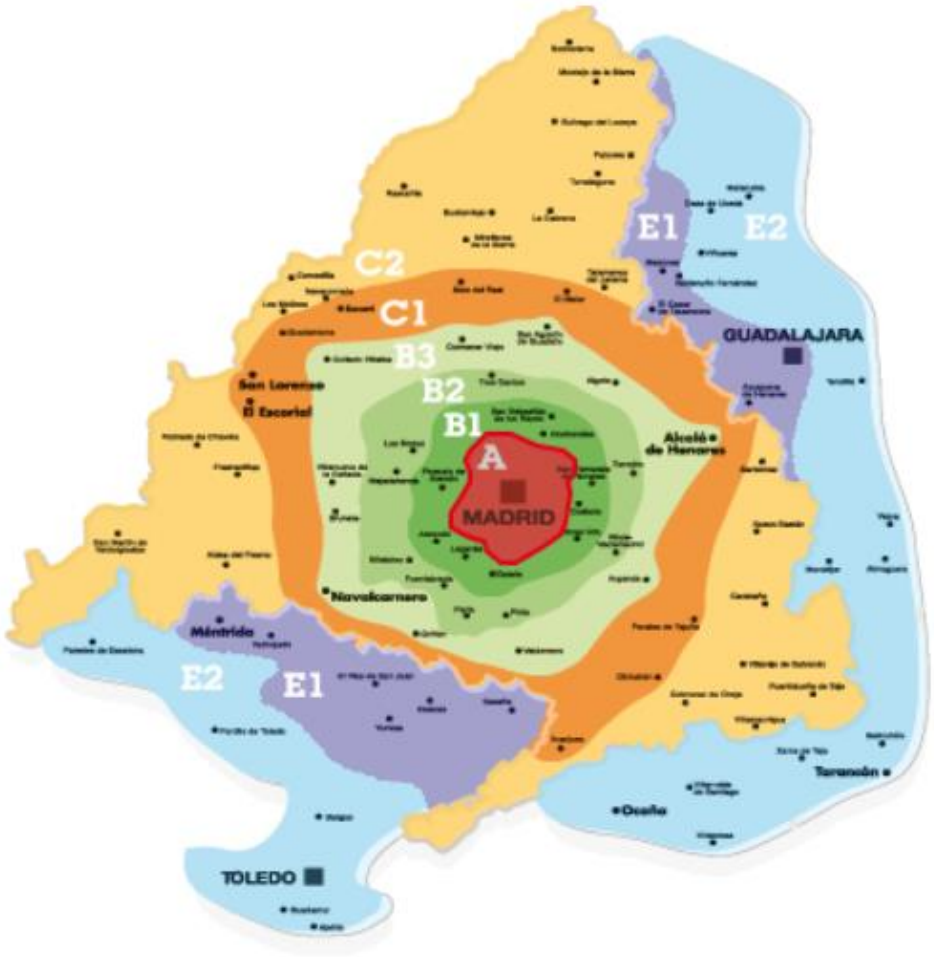


Figure 27: PT tariff zones managed by CRTM including the entire Region of in Madrid and two provinces of Castilla-La Mancha (Guadalajara and Toledo)

Observations

City Level (B1 zone, regular price: 63.7 €)

Affordability of public transport for the poorest group in 2022	
Affordability score	7.4%
Public transport expenditure ratio	149.8%

FUA Level (B3 zone, regular price: 82.0 €)

Affordability of public transport for the poorest group in 2022	
Affordability score	9.5%
Public transport expenditure ratio	192.9%

Regional Level (C2 zone, regular price: 82.0 €)

Affordability of public transport for the poorest group in 2022	
Affordability score	11.0%
Public transport expenditure ratio	225%

Current appraisal

The current financial accessibility of PT in the city and the FUA of Madrid is 7.4% and 9.5 % respectively, of the monthly income of the 25% poorest inhabitants.

3.4.3.3 Turku

Source/method

The SUMI methodology of the SUMI Affordability of public transport for the poorest group indicator[18] was followed for this indicator. Financial accessibility refers here to the average travel cost (for the PT or other service) as a percentage of the average personal available income of the lowest quartile in both the city of Turku and the FUA. Data for the income level was provided by Statistics Finland by request of the LEM. Bus ticket prices in the regional public transport Föli (operating in Turku + 4 FUA municipalities) were derived from the Föli website (https://www.foli.fi/en/tickets). The only mode of transport addressed is the regional bus service since no other forms of local public transport, e.g. trams, local trains or bike share, are available. A new bike share system will however be implemented in the city in May 2022.

In 2019, the average earned yearly income per household in the lowest quartile was 16 279€/year. Per month, that makes 1 357€. In the FUA, the average earned yearly income per household in the lowest quartile was 17 410€/year. Per month, that makes 1451€.

The average size of a household in 2019 was 1.73 persons.

Observations

The pricing of the regional bus ticket per month is 55€. Below are presented the affordability scores for the city of Turku and the FUA. It should be noted that the Föli region does not cover the whole FUA, only five of the 13 FUA municipalities.

	City of Turku	FUA
Affordability score	7.0%	6.6%

There was no data available for the perception of the affordability of the PT network for the poorest quartile of the population. The perception of affordability can be reviewed in the Föli satisfaction surveys implemented three times a year. The next survey is upcoming in May 2022.

[18] https://transport.ec.europa.eu/other-pages/transport-basic-page/affordability-public-transport-poorest-group-indicator_en

Current appraisal

The financial accessibility of public transport in the city/FUA is 7%/6.6%, respectively. There is no data available on the perception of affordability.

3.4.4. Persons mobility demand

3.4.4.1 Antwerp

Source/method

The average number of trips per person for the Antwerp Transport Region (FUA) is reported based on the OVG 5 or Onderzoek Verplaatsingsgedrag Vlaanderen[19]. Since 1994, the Flemish government has been investigating the travel behaviour of the Flemish people every year. For this purpose, Flemish people aged 6 years and older are asked about their travel and mobility behaviour. For OVG 5, a survey was conducted on a sample of at least 8 000 people that are drawn from the National Register via a stratified cluster sample. The contact procedure was face-to-face or by post (if no face-to-face contact was reached). Recently, these results were summarized for the transport regions. OVG is the most preferred method when analysing travel behaviour in Flanders. OVG is normally organized on the level of Flanders but has a smaller sample size if you narrow it down to smaller regions. The smaller the region, the smaller the representativity.

To arrive at a sufficiently large sample for the individual transport regions, the Flemish Mobility Departement (MOW) decided to use the aggregated data from OVG 5.1., 5.2., 5.3., 5.4. and 5.5 (2015-2019) as a first baseline measurement.

OVG asks their participants to record *all* their movements during a certain period. Seeing as those participants fill this in every day, this gives a very exact view of their average trips per day.

Observations

On average, a resident in the Antwerp Transport Region **takes 3.1 trips per day per person (2015-2019 average)**. These trips are on **average 10.7 km** and on average these trips take **22 minutes** per trip.

[19] OVG 5.5., Flemish Government, 2015-2019, report delivered by the Antwerp Transport Region.

3.4.4.2 Madrid

Source/method

The average number of trips per person was extracted from the Home Mobility survey of the Community of Madrid (edM2018).

The main objective of this survey was to study the mobility of the population of the Madrid Region (Community of Madrid) on a working day. For this, more than 85 000 people have been interviewed on a pre-selected sample, with an exhaustive record of the trips made, either by collective public transport or by any other means of transport.

The survey was carried out during the months of February to June 2018, with two alternative methods of collecting information:

- Face-to-face interview with all members of families residing in the Madrid Region (up to 13 000 households)
- Individual telephone interview with residents of the Madrid Region (up to 50 000 people)

The demand for the different transport modes was obtained from the Annual Report of CRTM from 2019.

Observations

Table 9 lists the number of trips per person in different areas of the Madrid Region. The population residing in the Madrid Region makes a total of 15 847 266 trips on an average working day, which gives rise to 2.44 trips per person. This value remains constant throughout the city, the FUA, and the Madrid Region.

It is important to point out that the city is made up of the Central Business District (CBD) and "Madrid Periphery", and that Madrid´s FUA includes the CBD, Madrid Periphery and the Metropolitan ring.

Table 9: Number of trips per person and area in the Madrid Region (2018). Source: edM2018.

Area	Number of trips	Total population	Number of trips/person
CBD-Madrid	2 402 684	981 044	2.45
Madrid Periphery	5 325 948	2 201 937	2.42
Metropolitan ring	6 957 688	2 847 633	2.44
Regional Ring	1 160 947	476 570	2.44
Madrid Region	15 847 267	6 507 184	2.44

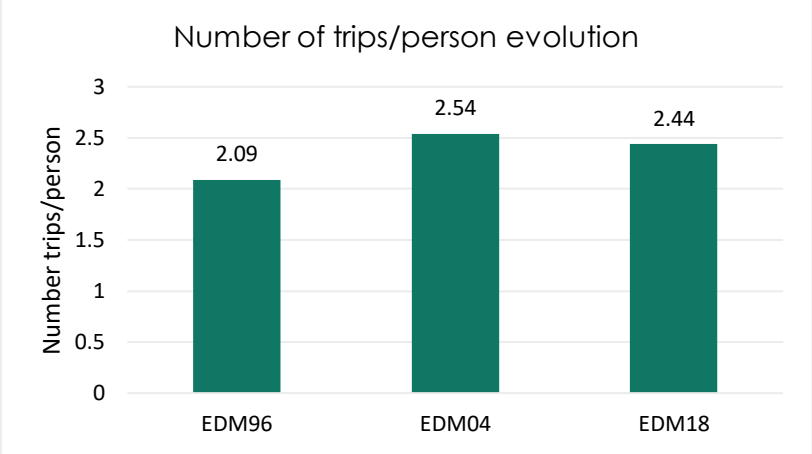


Figure 28: Evolution of the number of trips per person in the Madrid Region in 1996, 2004 and 2018. Source: edM.

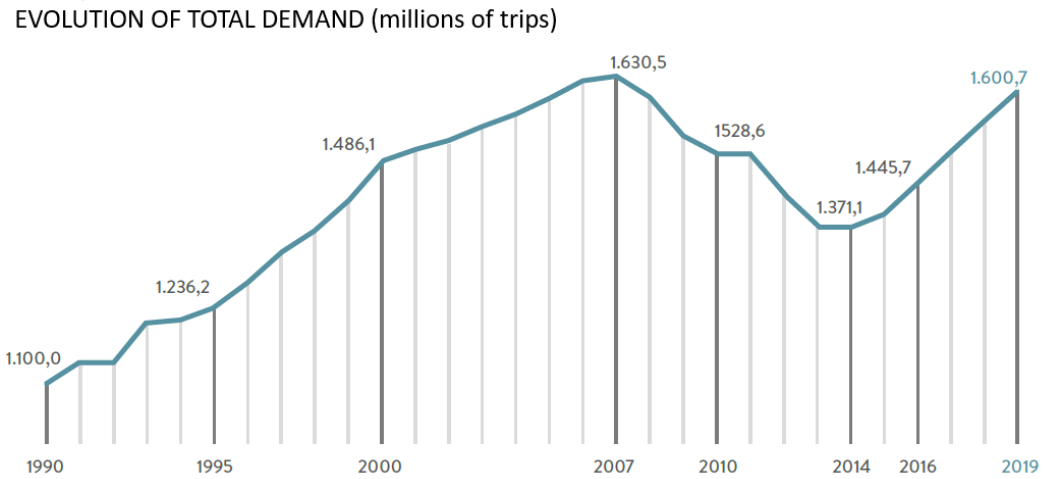


Figure 29: Evolution of the total demand (millions of trips). Source: CRTM annual report (2019).

EVOLUTION OF DEMAND BY OPERATORS (millions)

Year	Metro Madrid	EMT	Road concessions	Suburban rail	Light train	Other railway concessions	TOTAL
1990	416,3	433,3	154,1	96,3	-	-	1.100,0
% VAR 90/89	5,5%	-4,7%	10,5%		-	-	2,8%
1995	397,2	521,5	191,6	126,0	-	-	1.236,2
% VAR 95/90	-4,6%	20,3%	24,4%	30,8%	-	-	12,4%
2000	518,9	531,2	270,1	161,2	-	4,7	1.486,1
% VAR 00/95	30,7%	1,9%	40,9%	28,0%	-	-	20,2%
2005	643,6	470,2	275,6	199,0	-	6,7	1.595,1
% VAR 05/00	24,0%	-11,5%	2,0%	23,5%	-	42,9%	7,3%
2010	627,1	423,4	235,8	181,6	17,3	6,4	1.491,6
% VAR 10/05	-2,6%	-10,0%	-14,4%	-8,8%	-	-4,8%	-6,5%
2015	569,7	405,9	207,3	182,2	14,7	5,9	1.385,8
% VAR 15/10	-9,2%	-4,1%	-12,1%	0,3%	-15,0%	-7,8%	-7,1%
2016	584,8	430,1	224,1	184,6	15,8	6,2	1.445,7
% VAR 16/15	2,7%	6,0%	8,1%	1,3%	7,5%	5,3%	4,3%
2017	626,4	427,9	232,7	192,5	16,9	6,5	1.503,0
% VAR 17/16	7,1%	-0,5%	3,8%	4,3%	6,8%	4,7%	4,0%
2018	657,2	420,2	242,8	203,4	18,2	6,6	1.548,4
% VAR 18/16	4,9%	-1,8%	4,3%	5,6%	7,8%	1,5%	3,0%
2019	677,5	439,8	254,7	203,0	18,8	6,9	1.600,7
% VAR 19/18	3,1%	4,7%	4,9%	-0,2%	3,3%	4,5%	3,4%

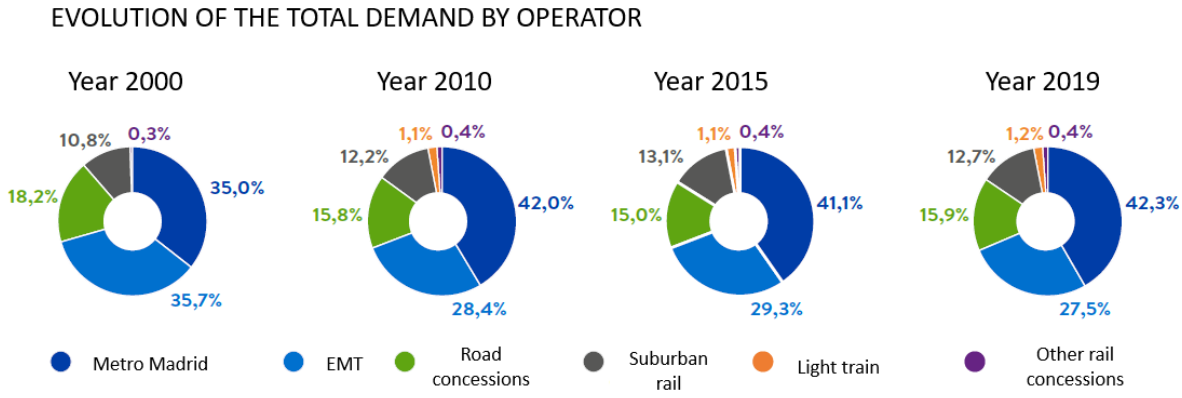


Figure 30: Evolution of the total demand by operator. Source: CRTM annual report (2019).

Current appraisal

The number of trips per person in 2018 has experienced a 5% reduction compared to 2004.

Regarding the total demand, it has registered an increasing trend since 2013, getting to levels similar to the ones registered in 2007 which was the highest one in the last 30 years.

No considerable changes have been observed in the evolution of the demand by operator between 2015 and 2019.

On average, a resident of Madrid city takes 2.44 trips per day per person. The highest value corresponds to people between 40 and 50 years who make 2.86 trips/day and the lowest value corresponds to people older than 74 who on average make 1.56 trips/day.

3.4.4.3 Turku

Source/method

The main data source is the Finnish National Travel Survey (https://www.traficom.fi/en/news/publications/finnish-national-travel-survey) , which has been conducted about every six years since 1974. The survey provides an overview of the mobility of Finns and demographic, regional and temporal variations of passenger trips. The data for the 2018 survey was collected during 2016 using a multi-mode method. The respondents were able to give their answers by phone, online or by post. A number of urban regions took part in the survey with their own additional samples. More than 30 000 Finns submitted answers to the survey. The results were published in March 2018 (in Finnish).

Observations

Number of trips per mode in the city of Turku, FUA and in Finland (2016)

Transport mode	Turku city (trips/person/day)	FUA (trips/person/day)	Finland (trips/person/day)
Walking	0.84	0.69	0.59
Cycling	0.28	0.23	0.22
Bus	0.30*	0.20	0.13
Rail		0.01	0.07
Private car (driver)	1.06	1.3	1.24
Private car (passenger)	0.39	0.45	0.42
Other	0.07	0.08	0.07
Total		2.96	2.73

** includes all PT (also rail)*

Current appraisal

In the whole country the modal share of sustainable modes (here walking and other pedestrian modes, cycling and public transport) on domestic trips was 15% of travel distance, and 37% of trips. Compared to the previous survey in 2010–2011 sustainable modes' modal share of trips has grown by 1 percentage point, but there is no indication of the same happening with travel distance.

The current mobility demand for sustainable mobility is higher than the national average both in the Turku region and in the city of Turku. This may be explained by the favourable circumstances for sustainable mobility and the relatively short distances. The same explanation applies for the lower number of trips by private cars in the city of Turku, but for the region the higher number may be due to the predominant private car culture and daily commuting from the region to the city of Turku. The use of rail is very low in comparison to the Finnish average because rail is mainly used for long distance travelling in the region, not for daily commuting.

3.4.5. Freight mobility demand

3.4.5.1 Antwerp

Source/method

The freight mobility demand in the city of Antwerp is estimated based on subscriber identification module (SIM) card data of the number of freight movements, as was published in the *freight traffic study* of 2020 by Cropland[20]. This study indicates how much freight traffic enters and leaves the city. The study only analysed the movements in the city of Antwerp.

Observations

On an average weekday, **3 964 trucks drive into the city**. Borgerhout and Berchem are the most used entrance gates for incoming freight traffic, Antwerp-North is most often used to leave the city. Figure 31 gives the average movements per day in 2020.

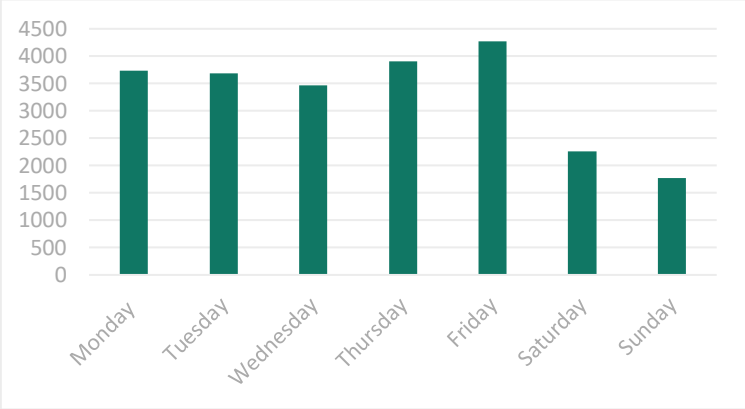


Figure 31: Freight movements in the city of Antwerp (2020). Source: CROP-land study of 2020.

These figures are however strongly influenced by the COVID-19 pandemic, with the closure of restaurants and cafés in Belgium. Therefore the study also looked in detail at the freight movements of a period in 2020 when the corona rules were less present and the restaurants and cafés could work in a relatively normal way

[20] Vrachtverkeerstudie, City of Antwerp and https://www.cropland.be/ , 1/09/2020 – 30/11/2020

(1/09/2020 – 18/10/2020), to have a more representative image of the number of freight movements. During that period, on a normal weekday, 6 945 trucks visited the city.

Current appraisal

The city of Antwerp has an economic position and a high number of inhabitants, a relatively high number of trucks per day using its roads in and out of the city.

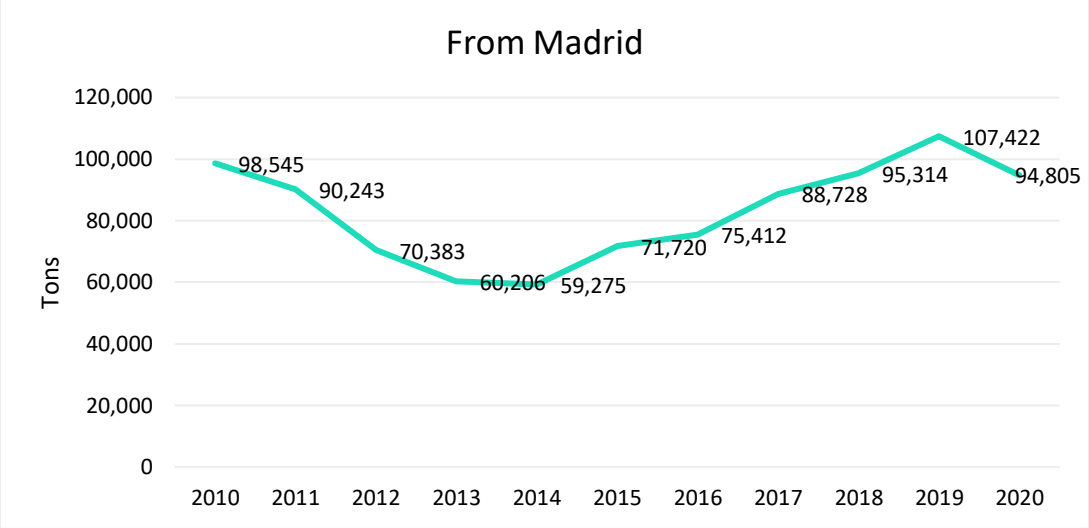
3.4.5.2 Madrid

Source/method

Since there is no freight mobility data disaggregated at city or FUA level available, data from the Observatory of the Transport of Trademarks by Road from the Ministry of Transport, Mobility and Urban Agenda of Spain (Observatorio del transporte de mercancías por Carretera Oferta y demanda (MITMA, 2021)) was used to extract some general statistics for the whole Madrid Region.

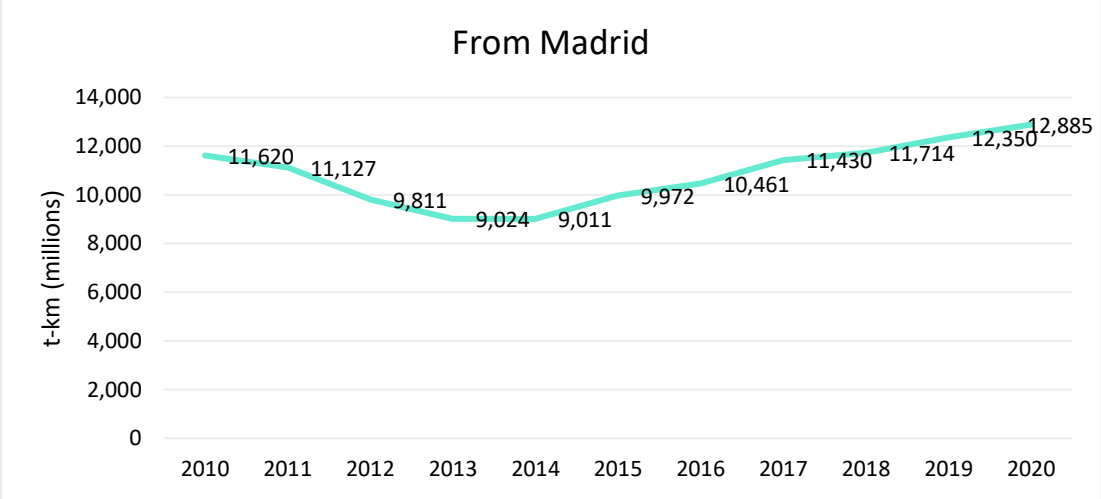
Observations

- Tons transported by road from the region of Madrid



Source: Observatorio del transporte de mercancías por Carretera Oferta y demanda (MITMA, 2021)

- Tonne-km (millions) transported by road from the region of Madrid

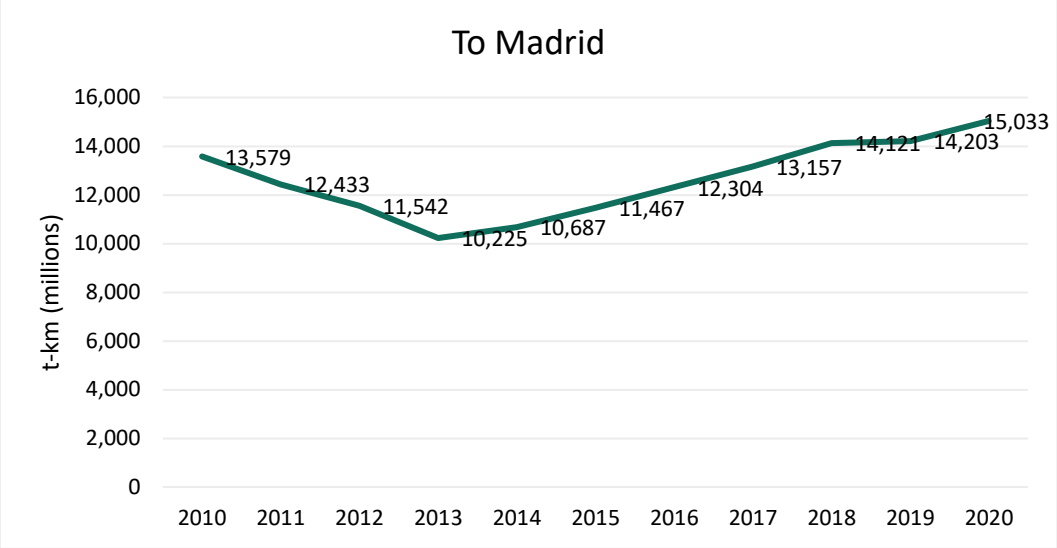


Source: Observatorio del transporte de mercancías por Carretera Oferta y demanda (MITMA,2021)

- Tons transported by road to the region of Madrid

Source: Observatorio del transporte de mercancías por Carretera Oferta y demanda (MITMA,2021)

- Tonne-km (millions) transported by road to the region of Madrid



Source: Observatorio del transporte de mercancías por Carretera Oferta y demanda (MITMA,2021)

Current appraisal

The only data available on freight mobility demand is for the whole region of Madrid. The figures present the tons and tonne-km transported from and to Madrid between 2010 and 2020.

The millions of tonne-km transported from and to Madrid have reported a growing trend since 2013.

In terms of tons transported, the effect of COVID-19 is clearly seen with a reduction of 10% in the tons transported from and to Madrid between 2019 and 2020.

3.4.5.3 Turku

Source/method

The Finnish Transport Infrastructure Agency (FTIA) is responsible for the state transport network, e.g. planning, developing, and maintaining road, rail, and maritime transport infrastructure and the coordination of transport and land-use. The Finnish Road Statistics, provided by FTIA, are annually published basic statistics including time-series data on the state of roads and traffic in the public road network by region (https://vayla.fi/en/transport-network/data/statistics/road-statistics).

Open data on traffic volumes can be located via the FTIA map service: https://paikkatieto.vaylapilvi.fi/arcgis/apps/webappviewer/index.html?id=9303658f44134d5bb82d7e7d55e11644

Observations

Traffic volumes for heavy traffic on the Turku/FUA main roads in 2020 can be observed in the map below, derived from the open data map service. The data in the map is derived from FTIA traffic measurement system stations, which are composed of data collection units and induction loops embedded in roads, accessible via Digitraffic https://www.digitraffic.fi/tieliikenne/lam/. It should be noted that it is forbidden for heavy-duty vehicles (15 m or more in length) to enter the western part of the Turku city centre without a special permit.

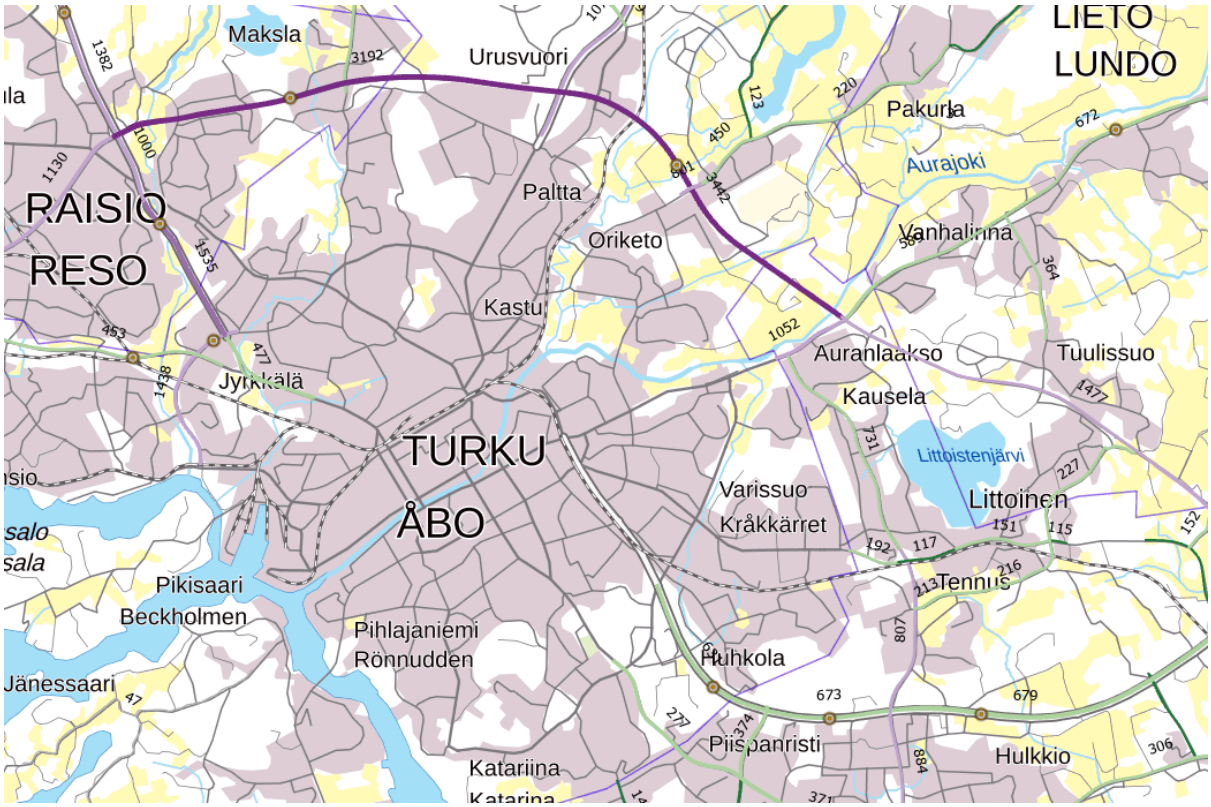


Figure 32: Freight volumes in Turku in 2020

In 2020, volumes of heavy traffic decreased significantly in the South-West Finland region (covering the FUA + cities of Loimaa & Salo). Between January and December of 2020, heavy traffic volumes decreased by 5.38% in the region. Below is presented the change in volume of heavy traffic in the past three years:

	2019	2020	2021
Observed change in 12 months	-1.4 %	-5.38 %	4.05 %

Figure 33: Freight volumes in the FUA in 2020

Current appraisal

A marked decrease in traffic volumes in all transport modes was observed in the South-West Finland region in 2020. Overall in Finland, the volume of heavy traffic decreased by 4% in 2020, reflecting the pandemic impacts. In 2021, the volumes increased again in the region and nationally.

3.4.6. Contribution of mobility on health

3.4.6.1 Antwerp

Source/method

Two sources are used:

- City: Survey Smart ways to Antwerp (see Section 3.4.1.1)
- FUA: OVG 5 or Onderzoek Verplaatsingsgedrag Vlaanderen (see Section 3.4.4.1)

This report uses the number of kilometres travelled by walking and cycling as a proxy for the contribution of mobility to health. This information is used as input in the WHO Health Economic Assessment Tool (HEAT).[21] By providing input on the average amount of (increased) walking or cycling per person per day, and the number of people in a population to which the walking or cycling data refer, HEAT estimates: the number of prevented premature deaths, the reduced carbon emissions in tons of CO_2 equivalent and the economic valuation of the results. By default, assessments are made over a 10-year period from the current year, but this can be adjusted.

Observations

City of Antwerp

Figure 34: Travel time for citizens of Antwerp, all modes, 2020. Source: Survey Smart ways to Antwerp 2020

[21] https://www.who.int/data/gho/health-equity/assessment_toolkit

On average an outward trip takes 37.5 minutes, a return trip 38.8 (Survey Smart ways to Antwerp citizens). This average covers all travel modes.

In the Survey Smart ways to Antwerp, the number of kilometres travelled, is mostly asked for commuting. Therefore, we only use the employees survey of the Survey Smart ways to Antwerp (Figure 33 and Figure 34).

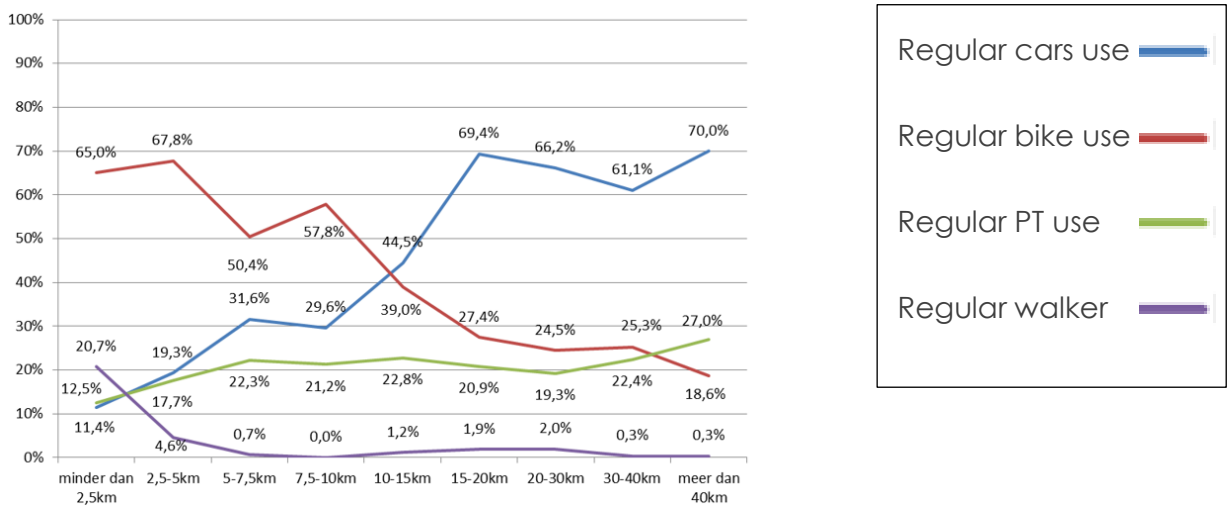


Figure 35: Percentage of commuter trips travelled per distance, per type of vehicle, city of Antwerp, 2020. Source: Survey Smart ways to Antwerp.

Antwerp Transport Region

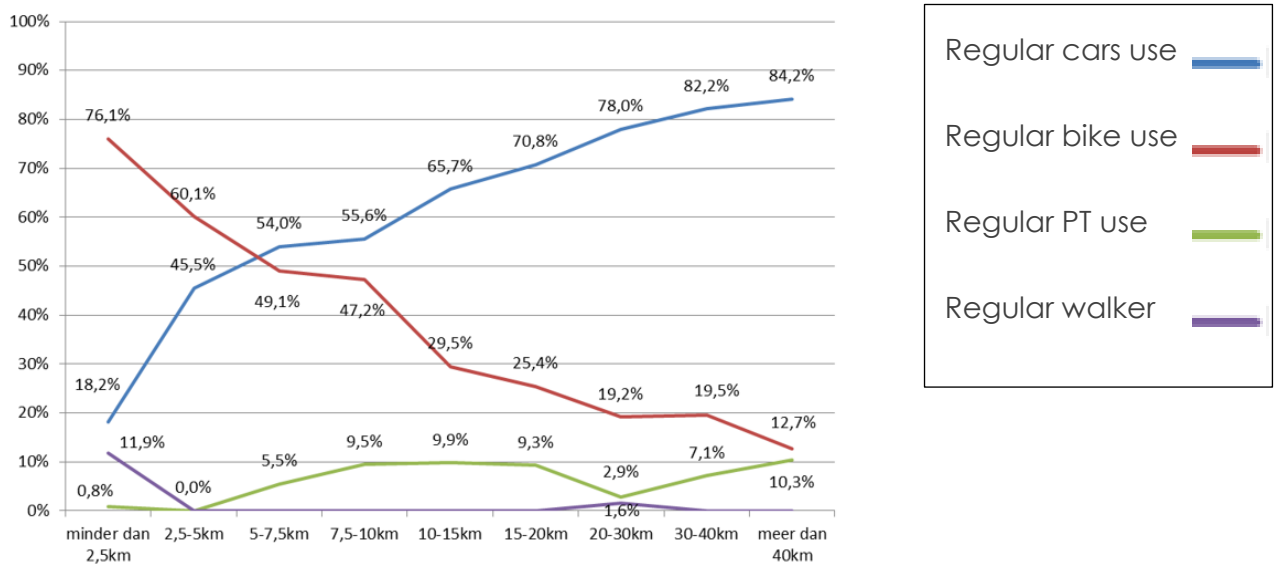


Figure 36: Percentage of commuter trips travelled per distance, per type of vehicle, Antwerp Transport Region, 2020. Source: Survey Smart ways to Antwerp.

For the Antwerp Transport Region, we use the same graph of the Survey Smart ways to Antwerp, seeing as the survey for employees was conducted for the employees of Antwerp and the Antwerp Transport Region. This means that for example for the distances between 2.5 and 5 km, 50.4% is travelled by bike, 31.6% by car, 22.3% by public transport and 0.7% by walking.

We also use the OVG, as the OVG-report also reports an average distance, which is reported in the table below. The number of people who recorded their movements and their total amount of trips are also given. The average time for all types of vehicles is **24.2 minutes for one trip.**

Table 10: Average distances per mode per trip in the Antwerp Transport Region in 2019. Source: OVG 5.5

Type of vehicle	The total amount of trips	Average distance per trip (km)	Number of people in the survey
Walking	**715**	**1.3**	**299**
Cycling	**530**	**3.3**	**212**
Motorbike	20	4.0	6
Motor	6	21.0	3
Car driver	1332	15.4	446
Car passenger	482	16.4	205
Bus	134	13.4	71
Tram or (pre)Metro	140	7.7	76
Train	44	47.9	27
Autocar	22	29.9	12
Another way of travelling	21	7.8	14
E-bike	**87**	**5.2**	**32**
Distances unknown	20	0.0	13

Current appraisal

The two sources provide a very different view as reporting is very different. Long distances are travelled by non-sustainable non-active modes in the city of Antwerp as well as the Antwerp Transport Region. This is visible in both data sources. The graphs of the Survey Smart ways to Antwerp show however that up until 5-7.5/10-15 km distances, cycling takes up the lion's share of trips. On average, however, as shown in Table 10, the distances travelled by active modes (walking/bike/e-bike) are limited. Especially if we look at the e-bike, which is used for cycling larger distances, there is still potential for improvement.

3.4.6.2 Madrid

Source/method

The health economic assessment tool (HEAT) for cycling and walking from the World Health Organization (WHO) was used to evaluate the contribution of mobility on health.

The input data needed (population, average amount of walking and cycling, the duration of the trip, distance, steps etc.) was extracted from the Home Mobility survey of the Community of Madrid from 2018 (edM2018).

HEAT estimates the value of reduced mortality that results from specified amounts of walking or cycling, answering the following question: *If x people regularly walk or cycle an amount of y, what are the health impacts on premature mortality and their economic value?*

Observations

The assessment was done at **city level.** Data available from the Home Mobility Survey was used. The walking (0.72 km) and cycling (1.7 km) distances from that year were used as the basis.

The evaluation of the reduction in mortality keeping the same walking and cycling levels was done for an assessment period of 10 years. The results presented a total of 3 085 premature deaths prevented for the whole period. Table 11 presents the main results.

Table 11: HEAT results for contribution of mobility on health. Given is the number of premature deaths prevented per year or per 10 years thanks to walking and cycling in Madrid city.

	Walking		Cycling		Total	
Madrid City	Premature deaths/year	Premature deaths/ 10 years	Premature deaths/year	Premature deaths/ 10 years	Premature deaths/year	Premature deaths/ 10 years
	309	3 085	210	2 103	519	5 188

The economic impact of sustainable mobility in Madrid City was also estimated using HEAT:

Table 12: Economic impact of sustainable mobility in Madrid City

Types of economic impact	Euros / Year
Economic impact Physical Activity	1 019 360 000
Economic impact Air pollution	30 636 000
Economic impact Crash risk	22 110 813
Economic impact Carbon emissions	1 392 162
Total economic Value of impact:	1 073 498 975

Current appraisal

Both HEAT calculations show the positive impact of walking and cycling on health and economy for Madrid City with the levels of 2018. It shows the importance of increasing them to reach even higher benefits for Madrid City.

3.4.6.3 Turku

Source/method

A HEAT calculation for the FUA was conducted by the Regional Council of South-West Finland in 2020. For the city, a HEAT calculation was made by a consultant in 2021. The methodology is based on WHO's HEAT-calculation which is freely available at: https://www.heatwalkingcycling.org/#homepage. HEAT estimates the value of reduced mortality that results from specified amounts of walking or cycling, answering the following question: *If x people regularly walk or cycle an amount of y, what are the health impacts on premature mortality and their economic value?*

For both HEAT calculations data from the Finnish National Travel Survey (2018), data and data from Statistics Finland for population forecasts (2015) was used. For the FUA, also data and forecasts from the Regional Transport System Plan 2035 were used.

Observations

It has been estimated that traffic related primary particulate emissions caused approximately 177 years of life lost (YLL)[22] and 13 premature deaths in Turku in 2015. Current levels of walking and cycling have already resulted in positive health benefits in years of lives saved and avoided premature deaths (negative YLL). However, the potential benefits of increased physical activity resulted by higher shares of daily walking and cycling are considerable.

The estimated benefits of physical activity with current levels of walking and cycling in Turku in 2015 based on the avoided premature deaths and life years saved (negative YLL):

	Walking		Cycling		Total	
	YLL	Premature deaths	YLL	Premature deaths	YLL	Premature deaths
Turku	-898	-59	-343	-12	-1242	-71

[22] Years of life lost (YLL) is a measure of premature mortality that takes into account both the frequency of deaths and the age at which it occurs. YLLs are calculated from the number of deaths multiplied by a global standard life expectancy at the age at which death occurs. Source: https://www.who.int/data/gho/indicator-metadata-registry/imr-details/159

To decrease the direct and indirect negative health impacts and to argue the case for the benefits of higher shares of daily walking and cycling, the city and the FUA have decided to emphasise sustainable *and healthy* transport in current strategies. As a result, HEAT calculations have been carried out in Turku city and the FUA.

The HEAT calculation for FUA had three alternatives for the geographical scope: a) included all 13 municipalities, b) included all municipalities expect Turku c) included the Turku core area (Turku, Kaarina, Lieto, Raisio and Naantali). The aim of the FUA HEAT calculation was to examine the health-related benefits and the economic impact of sustainable mobility based on the following projections: *The modal share of sustainable modes in the city of Turku will be 66% by 2030 and the modal share of sustainable modes in the FUA will be over 40%.*

The results of the **FUA HEAT** were based on alternative C, which covers Turku core area (Turku, Kaarina, Lieto, Raisio, Naantali). The main reason for using alternative c was reliability.

Estimated economic impacts of sustainable mobility in FUA using alternative c (Turku, Kaarina, Lieto, Raisio, Naantali)

Types of economic impact	Euros / year
Economic impact Physical Activity	19 400 000
Economic impact Air pollution	-307 000
Economic impact Crash risk	-162 000
Economic impact Carbon emissions	2 010 000
Total economic impact	20 941 000

The recent **city of Turku HEAT** calculation examined the potential economic impacts of cycling if the share of cycling would grow to 30% by 2030. The calculation had two main projection paths based on the Finnish National Travel survey and data from Statistics Finland. Projection path 1 (with a base value of 3%), would result in almost 4 M€ yearly economic benefits from lives saved from premature deaths amounting to a total value of over 38 M€ by 2030. Projection path 2 (with a base value of 9%), would result in 2.6 M€ yearly economic benefits from lives saved from premature deaths amounting to a total value of almost 20 M€ by 2030. Walking was excluded from this HEAT calculation.

Current appraisal

Both HEAT calculations show that increasing the share of walking and cycling would have not only positive health impacts but also considerable economic benefits for Turku city and the FUA. However, using HEAT calculations requires a lot of data and the results vary based on the quality of the data, choices made when choosing the data for the calculation and the formulation of the research questions. Still, with the right mix of data and a well-formulated research question, the calculations are an impressive tool for arguing the case for walking and cycling to politicians and other officials.

3.5. Transport system

The CIVITAS impact category transport system focuses on the performance of the mobility system in terms of usage and its technical characteristics. The main objective is to understand the evolution of the performance of the different modes of the mobility system. The different selected indicators in this impact category are listed in Table 13. Details on the data collection methods are shown in Table 14.

Table 13: FUA indicators monitored by each of the urban nodes in the CIVITAS category transport system

Indicator	Definition
Modal split persons	Percentage of trips in the city/FUA for each mode during a day (overall or for a specific target group)
Modal split goods	Percentage of goods using each mode during a day
Road safety	• Number of collisions with seriously injured and deaths per trip or distance driven for each mode or per inhabitant • Number of road deaths and seriously injured
Multimodal integration of transport offer for persons	Number and quality of multi-modal hubs in the city/FUA (SUMI definition)
Multimodal integration of freight transport	• Number and quality of multi-modal freight hubs in the city/FUA • Number of freight movements combing different modes
Congestion levels	Delays in road traffic during peak hours versus free flow traffic
Quality of cycling network	• Quality score of the cycling infrastructure • User satisfaction of the cycling network

Table 14: Data collection methods of each urban node of the transport system indicators

Indicator	Data collection method on city and FUA level (*)		
	Antwerp	**Madrid**	**Turku**
Modal split persons	City: Survey Smart ways to Antwerp FUA: OVG 5	edM2018	Finnish National Travel Survey 2016
Model split goods	Port of Antwerp: Annual report of the port of Antwerp	National level: 2020 annual report of the Transport and Logistic observatory Observatorio del Transporte y la Logística en España (MITMA,2020)	No data available
Road safety	Data statistics from provincie.incijfers.be	City: Data from Madrid´s city Council FUA: Data from the General Direction of Traffic (DGT)	Data from Statistics Finland
Multimodal integration of transport offer for persons	FUA: SUMI Multimodal integration indicator	City: SUMI Multimodal integration indicator	City: SUMI Multimodal integration indicator
Multimodal integration of freight transport	City: Qualitative description 4 important transport nodes	3 Qualitative description 3 important transport nodes	City: Qualitative description important transport nodes
Congestion levels	City: congestion barometer and TomTom Traffic Index	City: TomTom Traffic Index	City: TomTom Traffic Index
Quality of cycling network	FUA: provincial Cycle barometer	City: Survey on Quality of Life and Satisfaction with Public Services	City: Cycling Barometer survey
(*) Unless indicated otherwise, the same data collection method is used for collecting the data on the FUA and city level.			

3.5.1. Modal split people

3.5.1.1 Antwerp

Source/method

Two sources are used:

- City: Survey Smart ways to Antwerp (see Section 3.4.1.1)
- FUA: OVG 5 or Onderzoek Verplaatsingsgedrag Vlaanderen (see Section 3.4.4.1)

These are however two different sources with different methods of measure, therefore the modal split of the city and the FUA can't be simply compared.

OVG asks their participants to record *all* their movements. This is a detailed but also more time-intensive method. The number of participants in the OVG is therefore rather low. **In the modal split in the OVG the movements of respondents are grouped based on the origin and final destination of the journey**. This defines the modal split.

Observations

City of Antwerp

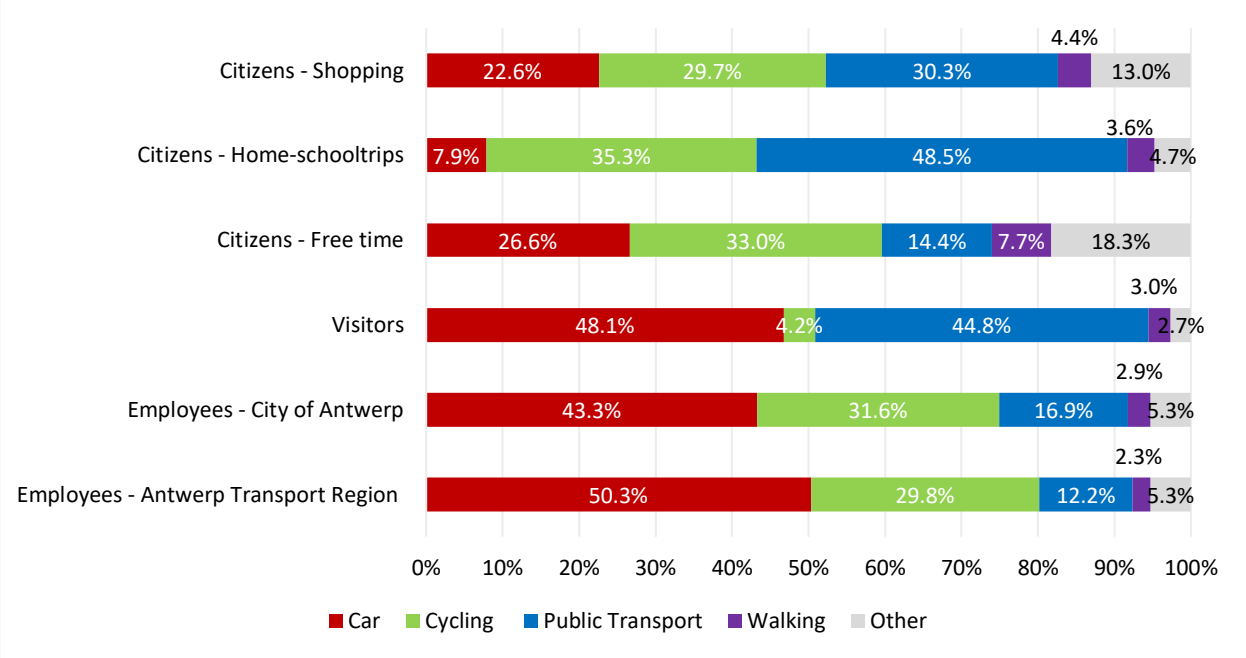


Figure 37: Modal split in Antwerp city in 2020 per type trip. Source: Survey Smart ways to Antwerp.

Antwerp Transport Region

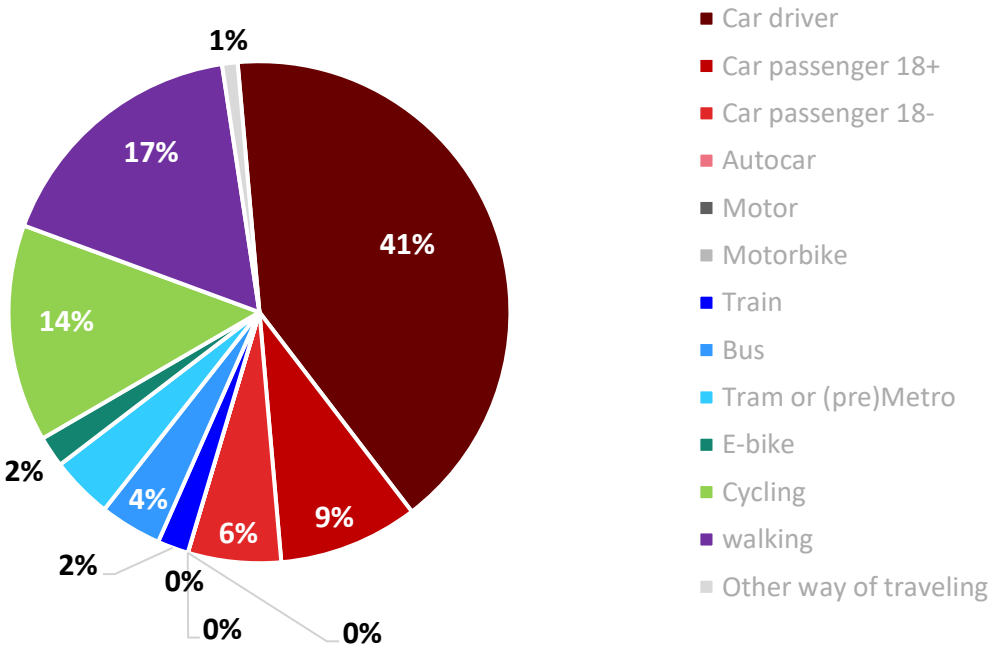


Figure 38: Modal split in the Antwerp Transport Region in 2020. Source: OVG 5.

Current appraisal

When investigating the modal split data provided by the mobility survey of Smart ways to Antwerp for Antwerp city, it's clear that most trips by car are made by the employees and that there is potential to reduce it. However, even with the group of employees, the car-use is never larger than 51%. For free time, it's even 26.6% while cycling is 33.3%. In other words, Antwerp has some already strong modal split numbers and overall improvement might be a challenge.

The same can be said for the Antwerp Transport Region: the Antwerp Transport Region almost reaches its goal of 50% sustainable travel with 51% travelling by car (car passengers below 18 years are not included).

3.5.1.2 Madrid

Source/method

The public transport offer of the Madrid Region and the limitation of parking spaces in the municipality of Madrid (especially in Madrid CBD) have a direct impact on the distribution of trips to the capital, for which the competitiveness of the public transportation is very high. On the contrary, the private vehicle has a greater presence in more peripheral areas where many factors are combined, such as a less massive offer, dispersed in the territory and with greater parking facilities.

The latest data available corresponds to the Home Mobility Survey from 2018 (edM2018).

Observations

The modal split in the four different areas of Madrid: Madrid Almendra (CBD), Madrid Periphery, Madrid Metropolitan ring, and Madrid's regional ring (see Figure 39) is presented in Figure 40. This data is available from the Home Mobility Survey from 2018.

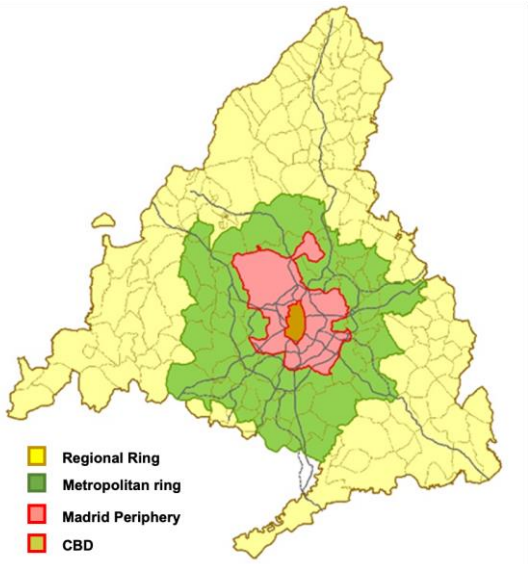


Figure 39: Madrid´s areas

Figure 40 shows the modal split depending on the area, from the inner M30 to the whole of the region of Madrid. Green represents pedestrians; red, public transport; blue, private vehicle (either as a driver or as a passenger), and yellow other modes of transport.

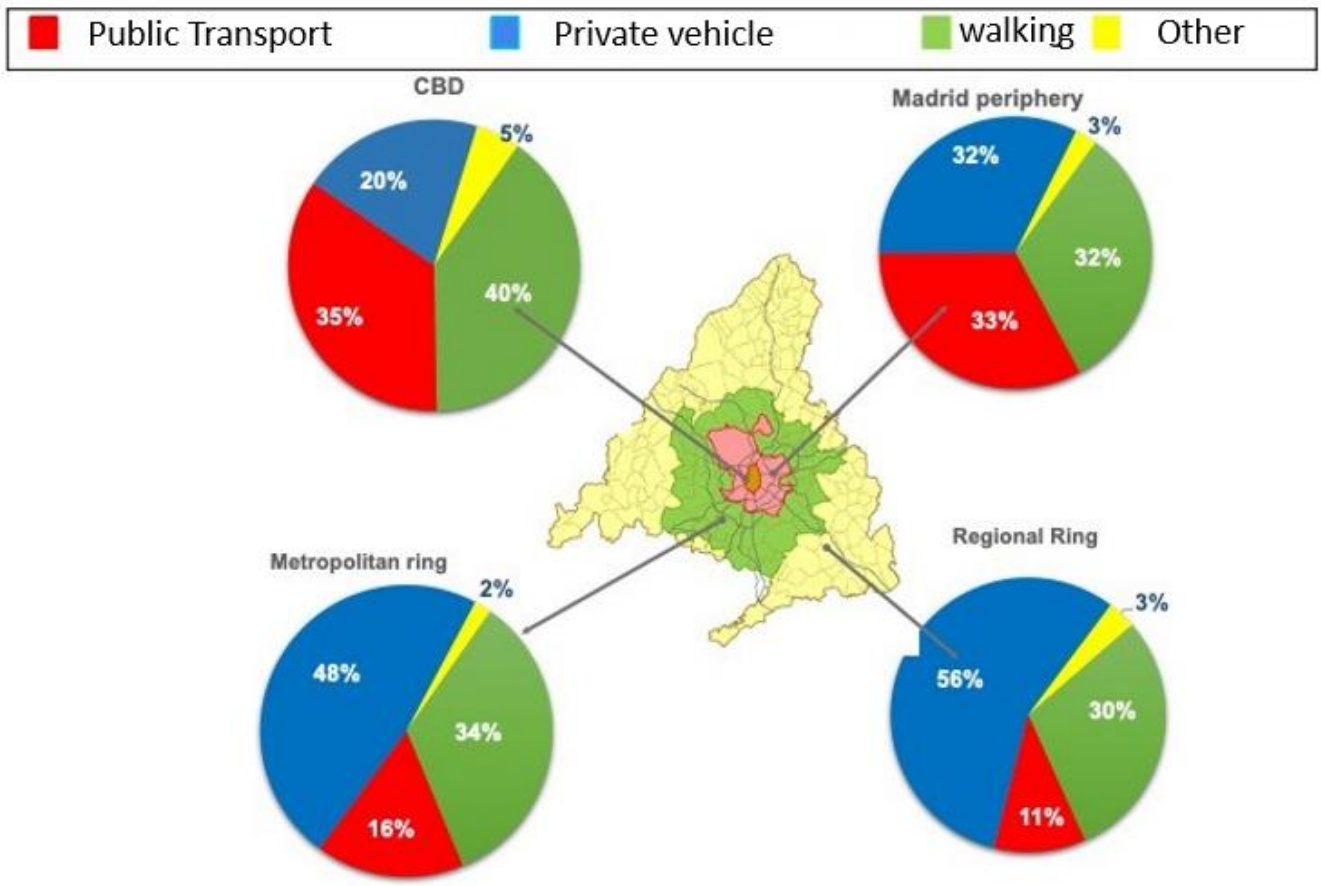


Figure 40: Madrid´s modal split in 2018

Area	Walking	Public transport	Private vehicle	Other
CBD	40.0%	34.8%	20.3%	4.9%
Madrid Periphery	32.2%	32.8%	32.4%	2.6%
Metropolitan ring	34.0%	16.4%	47.7%	1.9%
Regional Ring	29.6%	10.8%	56.2%	3.4%
Madrid Region	**34.0%**	**24.3%**	**39.0%**	**2.7%**

Trips with other modes of transport account for 2.7% of the total trips on an average working day (427 436 trips). Among the different modes considered, trips by motorcycle, taxi or rental vehicles with driver (VTC) and bicycle are the ones with the highest proportion. Figure 41 presents the modal split among them:

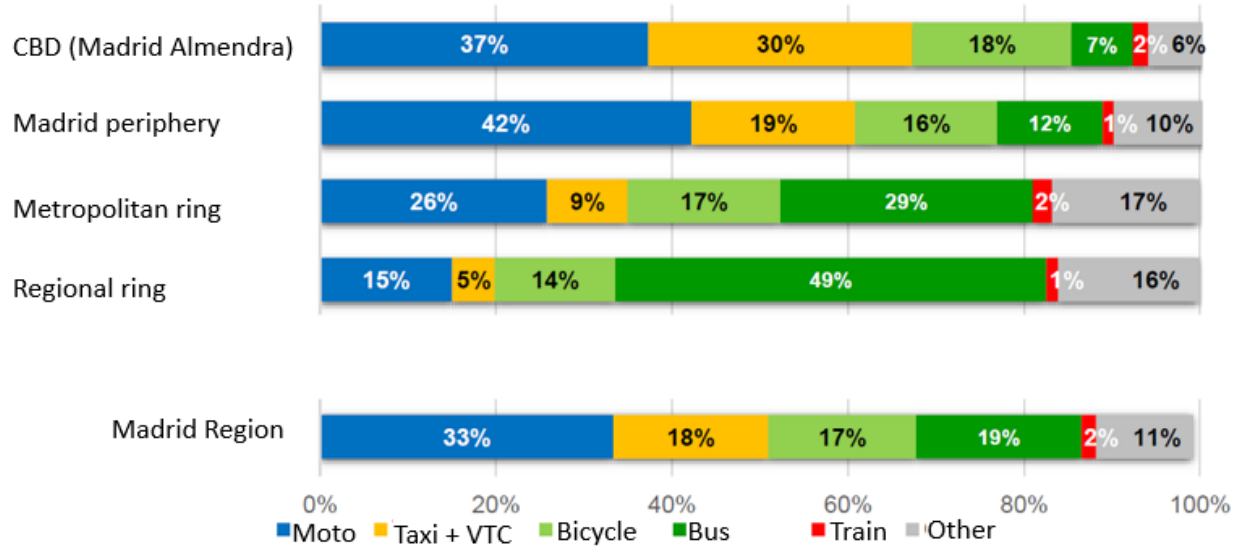


Figure 41: Detailed modal split of other modes of transport[23] in the different areas of Madrid in 2018. Source: edM2018

The evolution in the modal share of public transport and private car use in the Madrid Region, from the results of the surveys from 1996, 2004 and 2018, is presented in Figure 42. It is possible to observe an increased share of private vehicle use (from 45% to 60%) from 1996 to 2018.

[23] The category "bus" here refers to travels made by long-distance or discretionary bus (not regular PT buses), and the category "train" refers here to long-distance trains, not the regular PT light-train or inter-urban train.

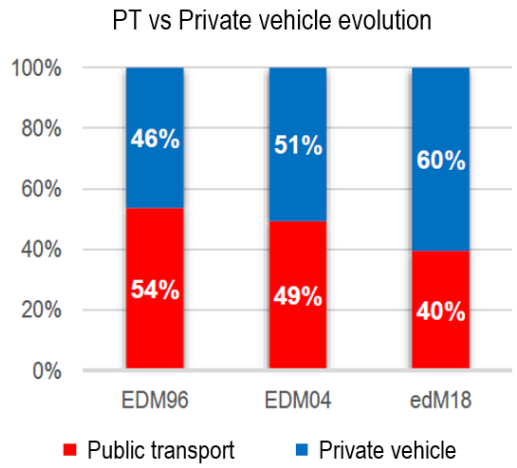


Figure 42: PT vs private vehicle evolution

Current appraisal

In summary, historically there have been mainly two options, either a private vehicle (car, motorcycle) or public transport (buses, suburban trains, metro, taxi). This urban mobility model has remained fundamentally unchanged for almost 100 years. The increase in population has been reflected in the growth of the private car fleet and in the enlargement of the public transport system.

New digital technologies and the digitization of society have come into play, as well as new social trends in how we understand and consume mobility. These diverse forces are together driving a momentous shift in the paradigm of sustainable urban mobility by fostering the use of shared mobility. In the last five years alone, shared mobility services without a fixed base have proliferated in the city. Now, in addition to traditional options, everyone has available a broad range of possibilities for moving around the city: car sharing (Car2Go, Emov, Zity, Wible), ridesharing cars (Cabify, Uber, Bolt), motorcycle sharing (eCooltra, Muving, Movo, IoScoot, COUP), BiciMAD public service bicycles or shared bicycle companies (Ofo, oBike, Donkey Republic, Mobike), scooters from among the 18 companies to which licences have been granted. The impact of these services in the modal split might be seen in the results of the next Home Mobility Survey.

3.5.1.3 Turku

Source/method

The main data source is the Finnish National Travel Survey, which has been conducted about every six years since 1974. The survey provides an overview of the mobility of Finns and demographic, regional and temporal variations of passenger trips. The data for the 2018 survey was collected during 2016 using a multi-mode method. The respondents were able to give their answers by phone, online or by post. A number of urban regions took part in the survey with their own additional samples. More than 30 000 Finns submitted answers to the survey. The results were published in March 2018 (in Finnish).

Observations

Table 15: Split of number of trips per mode in the city of Turku, FUA and in Finland (2016)

Transport mode	Turku city (split of trips/person/day)	FUA (split of trips/person/day)	Finland (split of trips/person/day)
Walking	29%	23%	30%*
Cycling	10%	8%	
PT	10%	7%	8%
Private car (driver)	36%	44%	59%**
Private car (passenger)	13%	15%	
Other	2%	3%	4%
Total	100%	100%	100%

** includes walking & cycling*
*** includes both driver & passenger*

Table 16: Split of number of trips per motive in the city of Turku, FUA and in Finland (2016)

Motive	Turku city (split of trips per motive/person/day)	FUA (split of trips per motive/person/day)	Finland (split of trips/person/day)
Work	14%	15%	25%*
Business	3%	4%	
Education	6%	6%	
Recreation	36%	35%	35%
Giving a ride / escorting	9%	11%	10%
Shopping	20%	19%	30%**
Other errands	10%	11%	
Total	100%	100%	100%

** includes work, business and education related travel*
*** includes shopping & other errands*

Table 17: Split in distance of people moved per mode in the city of Turku, FUA and in Finland (2016)

Transport mode	Turku city (split kms/person/day)	FUA (split kms/person/day)	Finland (split kms/person/day)
Walking	1.2	1.1	1.7*
Cycling	0.9	0.8	
PT	7.2**	5.6**	5.7**
Private car (driver)	15.0	19.8	31.1***
Private car (passenger)	6.4	8.2	
Other	1.2.	1.6	2.3
Total	31.97	37.13	41.0

** includes walking & cycling*
*** includes all PT (also rail)*
**** includes both driver & passenger*

Table 18: Number of trips from/to the city/FUA (trips/person/day)

Mode of transport	Municipality	Turku	Kaarina	Lieto	Naantali	Raisio	Rest of the FUA municipalities
Walking and cycling	Turku	185 920	1 690	190		970	160
	Kaarina	1 950	17 430				
	Lieto	130		9720			
	Naantali				1 220	190	
	Raisio	970			190	10 880	
	Rest of the FUA municipalities	210					30 500
	Total	**189 180**	**19 120**	**9 910**	**12 440**	**12 040**	**30 660**
PT	Turku	41 500	1 730	980	980	1440	1 310
	Kaarina	1 660	240				210
	Lieto	640		1080			
	Naantali	1 060			200	140	
	Raisio	1 230			130	340	
	Rest of the FUA municipalities	1 130	240				1 180
	Total	**47 220**	**2 210**	**2 060**	**1 310**	**1 920**	**2 700**
Car	Turku	174 820	18 280	9 040	6 640	18 610	16 040
	Kaarina	18 980	24 030	2 160	760	1 450	4 130
	Lieto	9 560	1 870	15 100	430	1 110	2 010
	Naantali	7 430	950	540	18 720	3 760	1 160
	Raisio	18 250	1 160	760	4 060	21 170	5 510
	Rest of the FUA municipalities	15 520	3 870	2 210	1 360	4 740	61 370
	Total	**244 560**	**50 160**	**29 810**	**31 970**	**50 840**	**90 220**

Current appraisal

The Finnish domestic travel has remained more or less unchanged compared to the previous survey done in 2010/2011. The per-capita travel distance has remained virtually unchanged. There is a shift in the use of transport modes compared to the situation six years ago. Passenger car trips are longer than before, and public transport trips are shorter. The per-capita number of public transport trips has not changed, but the per-capita distance travelled by public transport has decreased.

3.5.2. Modal split goods

3.5.2.1 Antwerp

Source/method

This study uses the modal split the port of Antwerp reports in its annual reports. The port of Antwerp forms a key aspect in the economic activity of Antwerp as well as the region of Flanders as a whole. This modal split gives in other words a rather complete image of the modal split of goods. However, the freight traffic in the city is not reported. The data is not available.

Observations and current appraisal

By 2030, the port of Antwerp is aiming to bring about a modal shift from road transport to modes of transport that put less strain on the roads. With a modal shift in favour of rail, inland navigation and pipelines, among others, they can avoid increasing road congestion. The further expansion of night logistics is one of the solutions for coping with peaks in container transport at terminals and by road. The port of Antwerp also encourages parties in the hinterland to introduce night-time opening and make maximum use of the opportunities created in the port area. Figure 43 represents the modal split and modal split ambitions of the port of Antwerp.

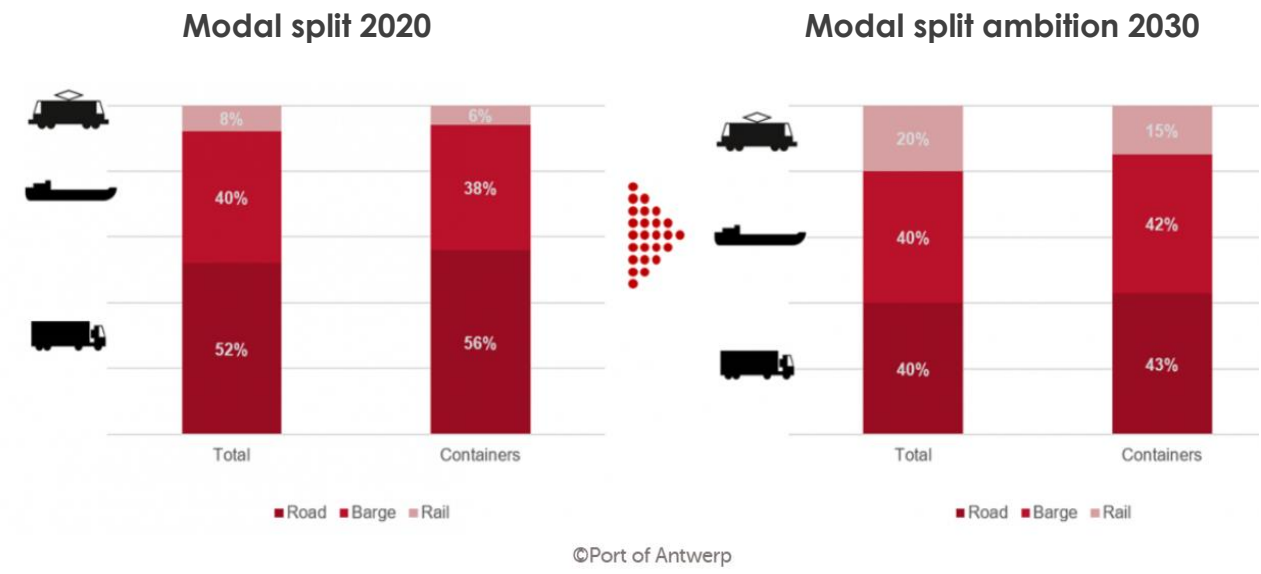


Figure 43 : Modal split and modal split ambitions of freight transport in the port of Antwerp. Source: https://www.provincieantwerpen.be, consulted 03/11/2021

3.5.2.2 Madrid

Source/method

The modal split of goods is only available at national level. It was extracted from the annual report 2020 of the Transport and Logistic observatory (Observatorio del Transporte y la Logística en España (MITMA,2020)). To at least have a global context, the data for Spain is presented below.

Observations

National scope

- Modal shares of freight transport (tonnes transported) at the national level, taking into account air transport and maritime cabotage

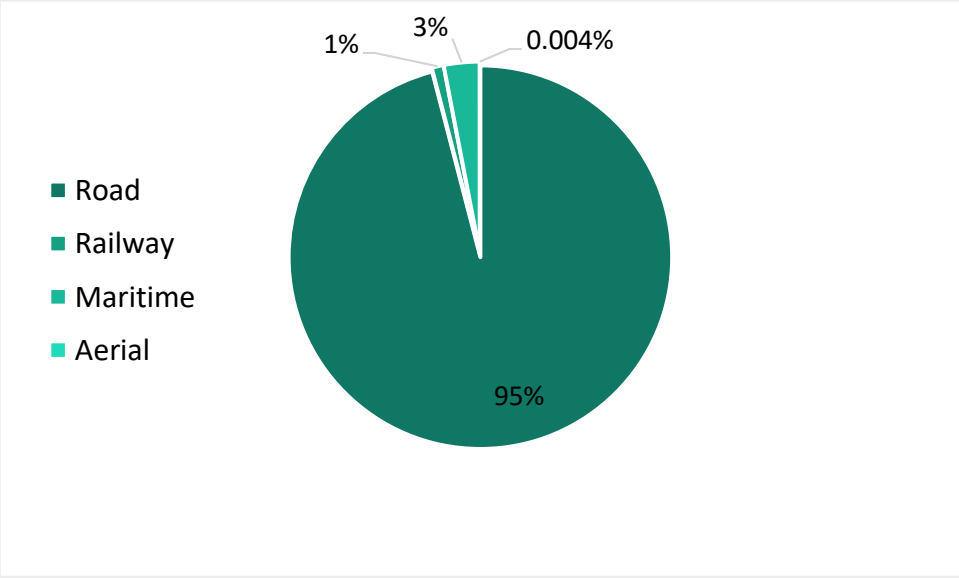


Figure 44: Modal share of freight transport in Spain in 2020. Source: Transport and logistic observatory Annual Report (2020).

Current appraisal

According to data from the Permanent Survey of the Transport of Goods by Road (EPTMC) reported in the Annual report of the Transport and logistic observatory, road transport reached a modal share of 95.0% in terms of t-km in 2019 in Spain. Maritime transport, with its more than 50 million tons transported, is positioned as the second most important mode with a 3% share and rail transport is barely 1.0%.

3.5.3. Road safety

3.5.3.1 Antwerp

Source/method

One source was used for the FUA as well as for the city of Antwerp: https://provincies.incijfers.be/databank

Observations

Figure 45 presents the number of 'deaths after 30 days' from traffic accidents respectively in the city of Antwerp or the FUA. This indicator includes people that immediately die in a traffic accident as well as people that die of their injuries within 30 days after the accident. The number of seriously injured in the city and FUA, for the years 2016 to 2020, is shown in Figure 46.

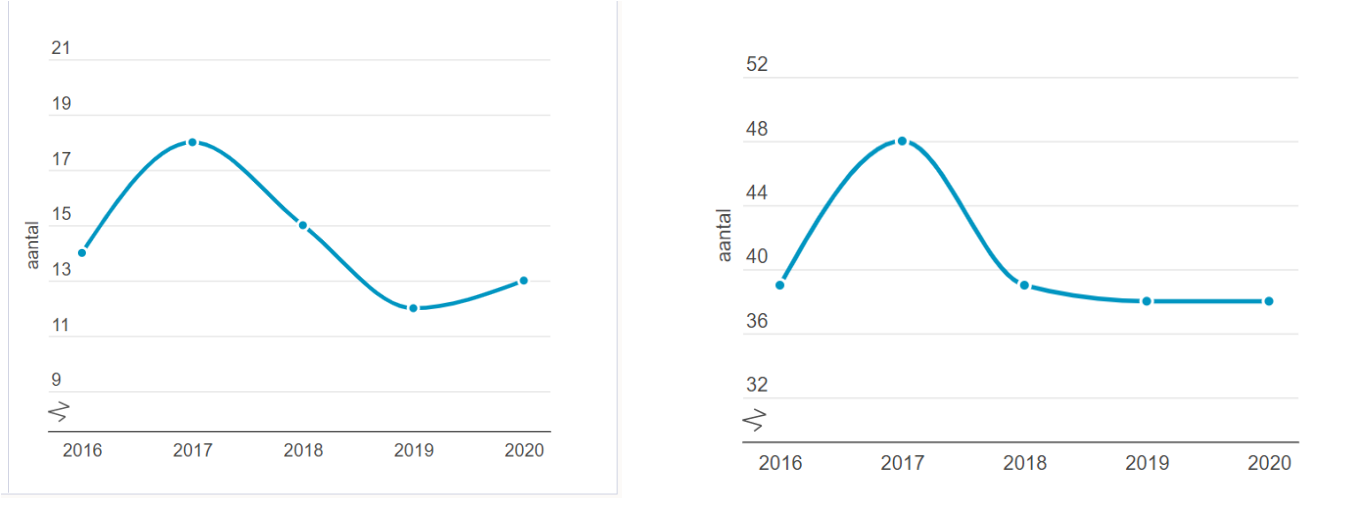


Figure 45: Deaths after 30 days evolution in time, respectively in the city of Antwerp and the Antwerp Transport Region.

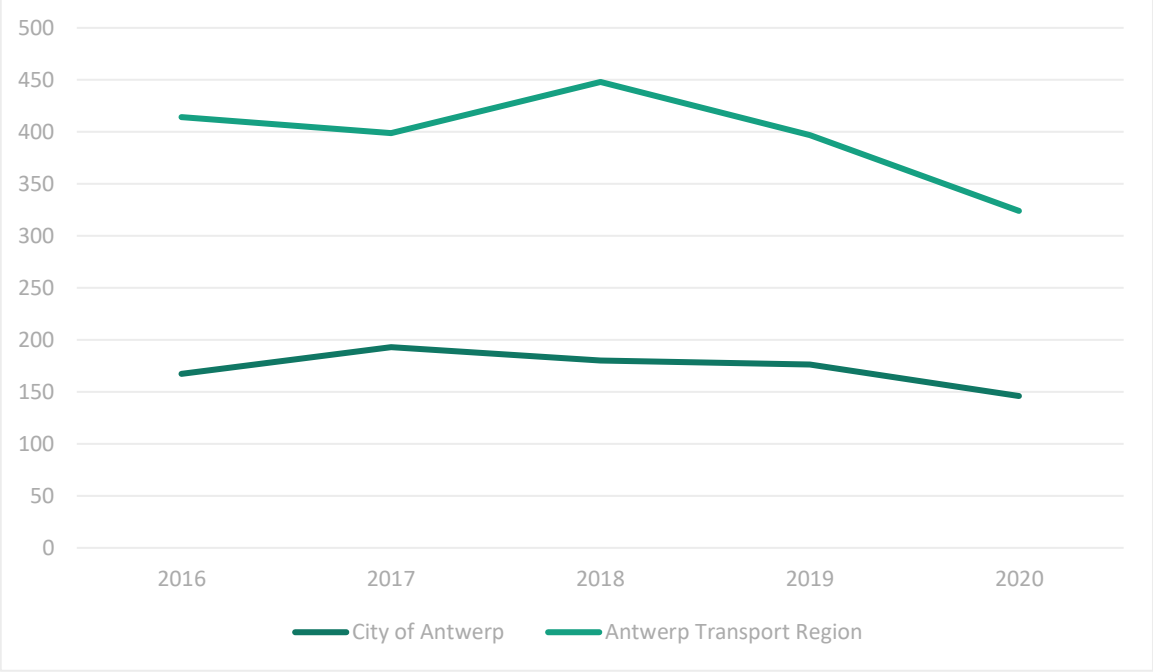


Figure 46: Seriously injured in the city of Antwerp and the Antwerp Transport Region

The following data were found based on data of the year 2020:

- The city of Antwerp counts 13 deaths after 30 days
- The city of Antwerp counts 146 seriously injured
- The Antwerp Transport Region counts 38 deaths after 30 days
- The Antwerp Transport Region counts 324 seriously injured

Current appraisal

When assessing the evolution throughout the years, this number doesn't seem to show a trend. However, we see the last two years (2019, 2020) produced fewer deaths than the years before that (2016, 2017 and 2018) in the city and the FUA. The seriously injured seem to stay however steady.

3.5.3.2 *Madrid*

Source/method

On city level

The open data of the City Council was used to evaluate the road safety in the city of Madrid through the Visualization Portal "Visualize Madrid with Open Data" which includes open data of traffic accidents. The number of collisions was extracted from the Portal while the number of deaths was obtained from the City Council Platform.

On FUA level

The General Direction of Traffic (DGT) is the entity responsible for coordinating the statistics and investigation of traffic accidents. It provides data related to accidents with victims, both on interurban and urban roads. These data will serve to estimate the indicators on FUA level. The data used was obtained from the Accident Statistics yearbook 2019 of DGT.

Observations

City of Madrid

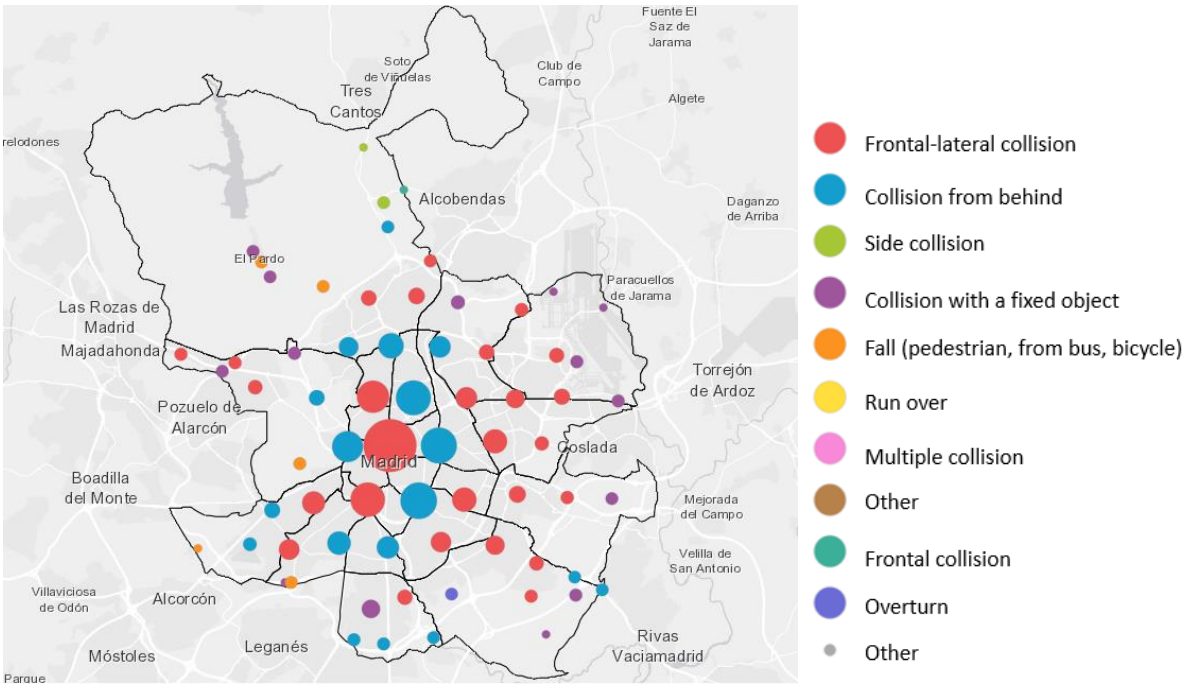


Figure 47: Collisions in Madrid city, years 2019 - 2020

- Number of collisions registered

Total number of collisions registered in Madrid city by year:

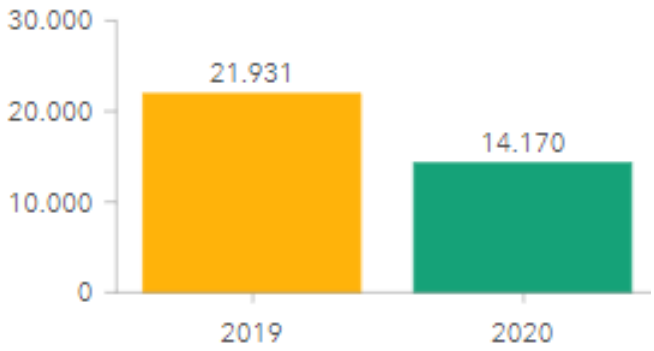


Figure 48: Collisions in Madrid City in 2019, 2020 and 2021

- Number of people seriously injured and deaths in collisions in Madrid city:

Year	Collisions	Deaths in collisions	Deaths in collisions/inhabitant
2019	21 931	33	1.03E-05
2020	14 170	34	1.05E-05

Current appraisal

The most frequent traffic accidents in the city of Madrid involve front-lateral and back collisions. It is possible to observe a reduction of 35% in the number of collisions registered between 2019 and 2020 but it might be attributed to mobility restrictions caused by COVID-19.

On FUA level

There is no disaggregated data. For illustration purposes, the values at Madrid Region level are presented in the table below.

Observations

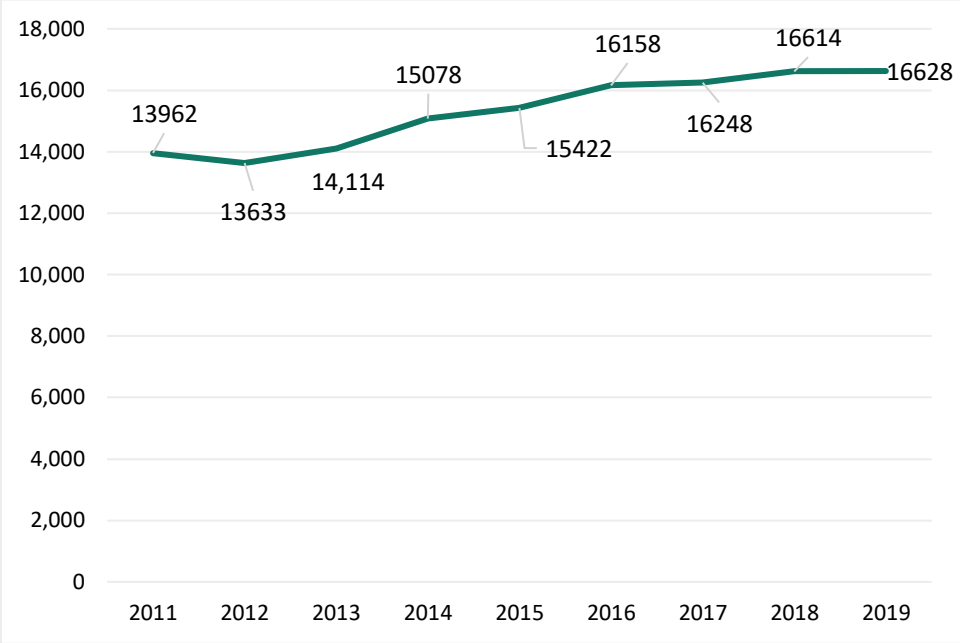


Figure 49: Evolution in the number of collisions in Madrid Region

Table 19: Accident rate in Madrid Region

	Collisions with victims	Mortal collisions	Deaths	Hospitalized injured	Non-hospitalized injured
2019	16 628	151	159	864	20 268
2018	16 614	110	114	1 185	20 100

Current appraisal

Since the number of collisions on FUA level is not available, the data of Madrid Region was used to assess the baseline for this indicator. In 2019, 16 628 collisions with victims were registered with a total of 159 deaths. The number of deaths in 2019 was 40% higher than in 2018.

3.5.3.3 Turku

Source/method

Number of fatalities and seriously injured refers to road transport related serious accidents leading to fatalities or serious injuries. These are reported to Statistics Finland on a regular basis by Finnish municipalities.

Observations

Number of road deaths and seriously injured in the Turku, FUA and Finland in 2020 (persons/year):

Types of accidents	Turku city (persons per year)	FUA (persons per year)	Finland (persons per year)
Fatalities	2	8	223
Seriously injured	4	9	408

Fatalities and seriously injured per road used group in Turku 2018-2020:

Road user group	Fatalities			Seriously injured		
	2018	2019	2020	2018	2019	2020
Pedestrian	3		1	2	2	3
Cyclist		3				
Moped				1		
Motorcycle				1		
Passenger car	1	4	1	1	1	1
Bus						
Van						
Truck						
Other						

Fatalities and seriously injured per road used group in the FUA 2018-2020

Road user group	Fatalities			Seriously injured		
	2018	2019	2020	2018	2019	2020
Pedestrian	1	1	1	1		1
Cyclist		1				
Moped		3				
Motorcycle			1	1	1	
Passenger car	1	5	1	3	3	3
Bus						
Van					1	
Truck						
Other				1		

Current appraisal

According to Statistics Finland (Figure 50) fatalities in road transport show a steadily declining trend. Most of the accidents involve passenger cars. The number of pedestrians and cyclists involved in fatal accidents are declining, although the trend has remained stable in the recent years.

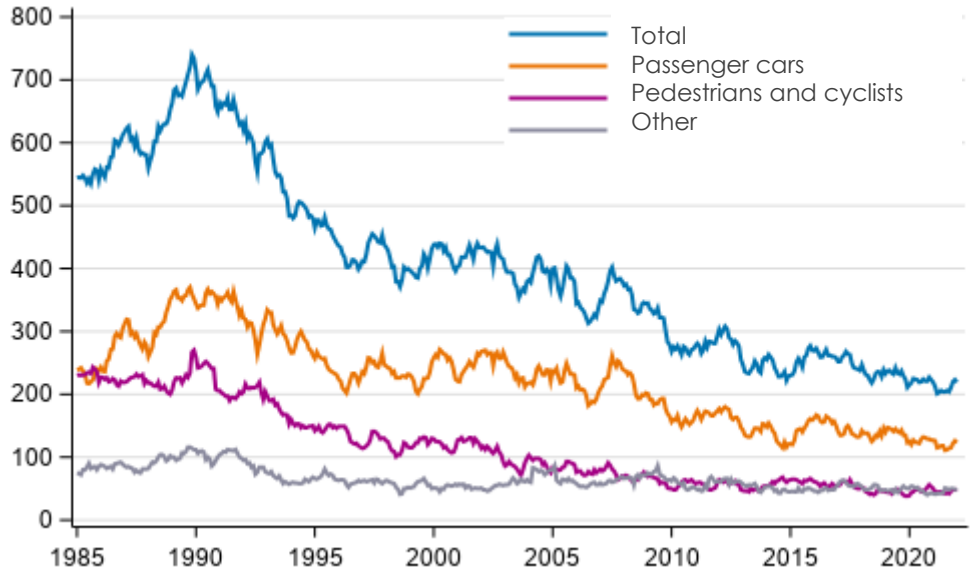


Figure 50: Fatalities in road transport in Finland, 1/1985 – 1/2021. Statistics Finland.

3.5.4. Multimodal integration of transport offer for persons

3.5.4.1 Antwerp

Source/method

The SUMI methodology of the SUMI Multimodal integration indicator[24] was followed to estimate this indicator. The SUMI Multimodal integration indicator gives an index between 0 and 1 showing the average level of multimodal connection of the interchange points within an urban transport network. For the Antwerp Transport Region, 28 points were selected in cooperation with the Antwerp Transport Region. They choose points that they currently see as important interchange points or want to transform those points in the future.

Table 20: Interchange points used for toto calculate the SUMI Multimodal integration indicator of the Antwerp Transport Region (2022)

	Interchange point
1	station Antwerpen centraal
2	station Antwerpen Berchem
3	station Antwerpen Zuid
4	station Antwerpen Kiel
5	station Ekeren
6	Franklin Rooseveltplaats
7	Steenplein
8	P&R Linkeroever Blancefloer
9	P&R Kleine Bareel
10	Lier NMBS Station
11	Brecht NMBS Noorderkempen – Brecht Hoek
12	Kapellen NMBS Station
13	Brasschaat Kerk
14	Mortsel NMBS Oude God
15	Beveren NMBS Station Beveren
16	Stabroek P+R Havenhub LPS
17	Boechout P+R Boechout Capenberg +
18	Kontich P+R Kontich
19	Brasschaat / Brecht P+R St Job+
20	Lier Veemarkt
21	Wijnegem Shoppingscenter
22	Schoten Zeurt
23	Brasschaat/Merksem NMBS Kleine Bareel

[24] https://transport.ec.europa .eu/other-pages/transport-basic-page/multimodal-integration-indicator_en

	Interchange point
24	Malle Oostmalle Dorp
25	Ranst Broechem Van Den Nestlaan
26	Mortsel Gemeenteplein
27	Merksem Oudebarreel
28	Rumst N171xN177 Reet

Observations

The SUMI Multimodal integration index in the Antwerp Transport Region in 2022 is shown in Table 21. The Index is given for 3 options:

- Option a): including all 28 interchange points
- Option b): including 16 long-distance hubs
- Option c): including 7 large intermodal hubs, where over half of the modal options in the city are available or in close/immediate proximity

Table 21: The SUMI Multimodal integration index in the Antwerp Transport Region for 3 options (2022)

		Index	Number of interchanges concerned
Option a): All interchanges		0.41	28
Option b): Long-distance interchanges		0.45	16
Option c): "Large" intermodal hubs	Hubs where over half of the modal options in the city are available in close/immediate proximity	0.67	7

Current appraisal

Seven hubs count as large intermodal hubs and 16 hubs as long-distance hubs. The index of all the chosen hubs together is only 0.41.

3.5.4.2 Madrid

Source/method

The SUMI methodology of the SUMI Multimodal integration indicator[25] was followed to estimate this indicator. For this, two different analyses were made. The first one included the analysis of 6 from the most representative interchanges in the city of Madrid: Avenida de América, Moncloa, Atocha, Méndez Álvaro, Chamartín and Principe Pío.

The second analysis included the evaluation of 9 P&R facilities, with some of them included in SCALE-UP.

Observations

- Six most representative interchanges in the city of Madrid:

Multimodal integration	
Index	0.68

Interchange name	Avenida de América	Moncloa	Atocha	Méndez Álvaro	Chamartín	Principe Pío
1. Long-distance bus	x	x		x		x
2. Railway			x	x	x	x
3. Metro	x	x	x	x	x	x
4. LRT/tram						
5. Local bus	x	x	x	x	x	x
6. Bicycle	x	x	x	x	x	x
7. Car sharing	x		x		x	
8. Bicycle parking facilities	x	x	x	x	x	x
9. Park&Ride						
10. Reserved taxi rank	x	x	x	x	x	x
11. Ferry						
Number of modes available	**7**	**6**	**7**	**7**	**7**	**7**
Multimodality (share of the number of modes)	**0.7**	**0.6**	**0.7**	**0.7**	**0.7**	**0.7**
Long-distance interchange?	**x**	**x**	**x**	**x**	**x**	**x**

[25] https://transport.ec.europa.eu/other-pages/transport-basic-page/multimodal-integration-indicator_en

- Nine P&R facilities in the city of Madrid:

Multimodal integration	
Index	0.52

Interchange name	Pitis	Aviación Española	Fuente de la Mora	Avenida de Portugal	Nuestra Señora del Recuerdo	Wanda Metropolita	Islazul	C1 Colmenar	C2 Ciudad Universitaria
1. Long-distance bus									
2. Railway	x	x	x		x			x	
3. Metro	x	x	x	x	x	x			x
4. LRT/tram									
5. Local bus	x	x	x	x	x	x	x	x	x
6. Bike sharing				x	x				x
7. Car sharing	x	x	x		x				
8. Bicycle parking facilities	x	x	x	x	x	x			x
9. Park&Ride	x	x	x	x	x	x	x	x	x
10. Reserved taxi rank		x			x		x		
11. Ferry									
Number of modes available	**6**	**7**	**6**	**5**	**8**	**4**	**3**	**3**	**5**
Multimodality	**0.6**	**0.7**	**0.6**	**0.5**	**0.8**	**0.4**	**0.3**	**0.3**	**0.5**
Long-distance interchange	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**

Current appraisal

The number of modes available in the 6 most representative interchanges in the city of Madrid is similar ranging from 6 to 7 in all the cases, leading to a Multimodal integration index of 0.68. Four of interchanges have long-distance buses, 4 have railways and none of them has Park & Ride (P&R) facilities. Moreover, all of them have reserved taxi ranks, and bicycle parking facilities, but only 3 have reserved parking places.

Regarding the P&R facilities, they have a lower Multimodal integration Index (0.52) which is understandable since most of them are in the implementation phase or at the beginning of the operational phase. They have a wider multimodal integration range, between 3 (Islazul and Colmenar) to 7 in the most integrated one (Aviación Española). None of them have long-distance buses, but all of them have local ones. Seven have metro and all have P&R facilities, which allow commuters to leave their cars there and choose between buses or metro.

3.5.4.3 Turku

Source/method

The SUMI methodology of the SUMI Multimodal integration indicator[26] was followed to estimate this indicator. In the SUMI toolset, multimodal integration is defined as "an interchange is any place where a traveller can switch from one mode of travel to another, with a minimum/ reasonable amount of walking or waiting. The more modes available at an interchange, the higher the level of multimodal integration." Data for the multimodal offer was derived from the Turku city websites and the offer was calculated with the SUMI indicator spreadsheet.

Observations

Below is presented the multimodal offer in the city of Turku. Data on the number of trips combining different modes is not collected in the city or the FUA.

Interchange name	Turku harbour	Turku airport	Turku bus station	Turku railway station
Long-distance bus	x	x	x	
0.5	x			x
Metro				
LRT / tram				
Bike sharing station				
Car sharing station				
Bicycle parking facilities				
Park & Ride				
Reserved taxi rank	x	x	x	x
Ferry	x			
No of modes available	5	3	3	3
Multimodality (share of no. of modes)	0.834	0.5	0.5	0.5

[26] https://transport.ec.europa.eu/other-pages/transport-basic-page/multimodal-integration-indicator_en

Current appraisal

In the city of Turku, multimodal offer and integration is rather low. The Multimodal integration index for all interchanges is 0.58 with four interchanges. The situation will improve though in spring 2022 when the new bike sharing service is implemented. The multimodal offer in the rest of the FUA is not worth calculating since the only offer of modes in all the FUA municipalities is some form of bus service – the regional public transport in five of the FUA municipalities and some sort of long-distance bus service in the rest.

3.5.5. Multimodal integration of transport offer for freight transportation

3.5.5.1 *Antwerp*

Source/method

We will be describing 4 important transport nodes in the city of Antwerp where freight and logistic movements come together. The city of Antwerp chose these nodes and provided the information, based on their experience.

Observations and current appraisal

1. **Citydepot**: a hub operated by a neutral private player. Goods destined for the city are delivered here by large trucks and bundled for last-mile delivery. This last mile is optimally loaded and is done by bicycle couriers or electric or CNG vans depending on the size of the packages. City depot is located in the Spitsenstraat.
2. **Blue Gate:** a climate-neutral business park in the south of the city that is strategically located in terms of (city) logistics, partly due to its location and the loading/unloading facilities on the water. Concessionaires for this site must also make a sustainability plan. Some companies near this hub perform a hub function. A construction company consolidates building materials for yards in the centre and transports them to the site on demand. The German logistics company DHL has a new distribution centre here from which the city is supplied with electric vans or cargo bikes. In both cases, in Blue Gate, only the goods of the companies themselves are sent. Blue Gate is the former Petroleum Zuid between the Hobokense Polder, Scheldt, Ring and railway line Antwerp – Boom.
3. **Thomas More micro hub:** Pilot project in which a micro hub in the city centre was opened in collaboration with Thomas More University of Applied Sciences. The goods for a (limited) number of shops in the Sint-Andries district, especially in the Kammenstraat, were delivered here. A bicycle courier then took care of the (last) last mile to the shops. The traders were satisfied, fewer vans had to drive to their shops and the pedestrians, therefore, had a quieter shopping experience. The financing of this hub proved to be a challenge. The pilot project has not been continued.
4. **AMB Bouwhub**: From 1 July 2019 to 1 July 2020, a pilot project around a water-related construction hub ran. Building materials were delivered and stored here via the water, after which the last mile was then done by road to shipyards in Antwerp centre and districts. The main aim of this project was to explore the potential of water-related logistics and provided the city of Antwerp with several learning lessons. For example, it became clear that a neutral operator is important, that economies of scale are necessary for economic feasibility, and that construction sites are often determined one or two years in advance. This hub was located on Asia Island.

3.5.5.2 Madrid

Source/method

Three logistic centres in Madrid City and the Madrid FUA are described.

Observations

There are 15 railroad logistical facilities in the Madrid area, including two of the largest five in the country: Abroñigal and Vicálvaro, which operate 11 000 goods trains per year. Moreover, Mercamadrid is the largest food distribution centre in Spain, and the biggest perishable food market in Europe, supplying 12 million people within a 500 km range.

The Madrid area is the second-largest logistical cluster in Spain. For example, in Spain, 14% of the road transport surface is concentrated around Madrid (Observatorio del Transporte y la Logística), and there is over 4 million m² of the covered logistical surface.

Madrid Abroñigal

Adif (Administrador de Infraestructuras Ferroviarias) makes its network of Freight Transport Terminals available to its customers (railway companies, candidates, shippers, combined transport operators and other transport agents).
These railway infrastructures connected to a line (track) enable starting, complementing or concluding the rail transport of goods by executing a series of operations on the train and on the goods it transports.

Service facilities available in the centre according to their functionality:

- Intermodal transport
- Loading point for goods
- Marshalling yards and train formation facilities including shunting facilities
- Service facilities for the depot/parking of railway stock
- Maintenance, cleaning, washing, etc.
- Refuelling

Centro de Transportes de Madrid

It is one of the main logistics centres in Madrid, located in the first ring road, just 10 minutes from the city centre. Has a surface area of 338 000 m², distributed between the Logistics Centre, the Vehicle Service Centre, the Administrative and Commercial Centre and large green areas.

As an integrated logistics platform, the Centro de Transportes de Madrid was designed to house warehouses for storage and logistics, vehicle services, workshops, parking for industrial vehicles, offices, banks, restaurants, hotels, etc.

The centre has the following services and areas:

Table 22: CTM centre areas and services

	m²
Loading and Storage	71 500
Loading and Unloading Area	70 000
Heavy Vehicle Parking	27 500
Service Station	3 000
Area for other vehicle services	15 500
Administrative-Commercial Building and Hotel	18 000
Car Parking Area	17 000
Roadway	51 500
Green areas	64 500
Total surface area	**338 500**

Figure 51: CTM Logistic Centre

Plaza Mayor last-mile distribution hub

It is a pilot part of the European project LEAD located in the city centre of Madrid. Its ambitions are:

- Demonstrate the better efficiencies in using an urban consolidation centre (UCC) connected to the TEN-T to transfer cargo with Electric Delivery Vehicles (EDVs) and deliver to the city centre
- Assess the impact on vehicle flows and congestion before and after introducing the UCC
- Explore alternative(and sustainable) business models
- Develop public-private cooperation mechanisms
- Explore potential incentives and data management opportunities

3.5.5.3 Turku

Source/method

To map the multimodal integration of freight transport, a report made on the Turku region transport and logistics functions from 2020 was reviewed.

Observations

Multimodal interchanges for freight transport in the city of Turku take place at the harbour and the airport. In the FUA, the only major freight hub is the port in the city of Naantali.

Freight movements at the port of Turku come from the cargo and passenger ferries operating between Finland and Baltic Sea countries. The total volume of traffic reached 2.2 Mt in 2019. The port is accessible via a railway. The port is an integral part of the European TEN-T transport network and the core route system of the European cargo transports.

The port at the city of Naantali is the leading hub for Scandinavian freight traffic in Finland. The port does not have a railway connection, though, and is connected only via road transport. The total volume of traffic reached 7.5 Mt in 2019.

The Turku airport is located 13 km from the city centre, accessible via a single road. In 2019, total volume of cargo traffic at the airport was 4225 tonnes. The airport is accessible also via regional public transport and long-distance public transport.

Last mile multimodal hubs were piloted in the scope of a nationally funded project, New Solutions in City Logistics, between 2018-2020. The hubs were located in the Turku city centre and the Kupittaa area. The hubs provided a temporary storage facility for packages, carried by freight transport, and then distributed via light electric vehicles to their destinations.

Data on the freight movements combining different modes is unfortunately not available, neither for the city nor the FUA.

Current appraisal

Apart from the multimodal freight hubs listed above, multimodal freight offer and integration is rather low. Connectivity of the hubs to the transport network is mostly reliant on the road network. Only the port of Turku is also accessible via a railway line.

3.5.6. Congestion levels

3.5.6.1 Antwerp

Source/method

For the congestion level, in collaboration with the city administration, we decided to use the congestion barometer.[27] This is a barometer that shows the average number of kilometres of traffic jams per minute. This means that, for example, in 2020 there was an average of 100 km of traffic jams between 3 pm and 4 pm. The measurement is done using floating car data from Be-Mobile, so every minute the traffic jam is measured on *all roads on* ***the territory of the city of Antwerp***. An important point of attention: these are relative figures since the floating car data are based on 10-15% of the fleet and then extrapolation in a model. This means there is a certain margin of error, but the general patterns are clearly visible.

In addition, the congestion levels and the time lost in rush hour, in Antwerp city from the TomTom Traffic Index, is reported. The TomTom Traffic Index is an annual report detailing traffic trends seen in 404 cities in 58 countries based on real-time and historical anonymized traffic data from GPS devices, mobile phone signals, and sensors.

Observations

Figure 52 presents the average number of kilometres of traffic jam in Antwerp city, for the years 2019 to 2021, as reported by the congestion barometer.

Figure 53 and Figure 54 presents the congestion levels and extra time spent in traffic in Antwerp city for the years 2019 to 2021, from the TomTom Traffic Index.

The overall congestion levels in Antwerp city were 32% in 2019 and dropped during the first COVID-19 pandemic year in 2020 to 24% (Figure 53). They have increased by 2 percentage points in 2021, to 26%. This means that in 2019, for a 30-minute trip, on average, 9.5 minutes of extra time were spent in traffic. In 2021, that was almost 8 minutes.

The congestion levels during morning and evening rush were respectively 56% and 62% in 2019 and have decreased to 37% and 50% in 2021 (Figure 53). This

[27] Congestion barometer presented by the city administration-based car floating data, made especially for SCALE-UP, not publicly available.

corresponds to an extra 11 minutes per 30-minute trip spent in traffic during the morning rush, and an extra 15 minutes per 30-minute trip during the evening rush, in 2021 (Figure 54).

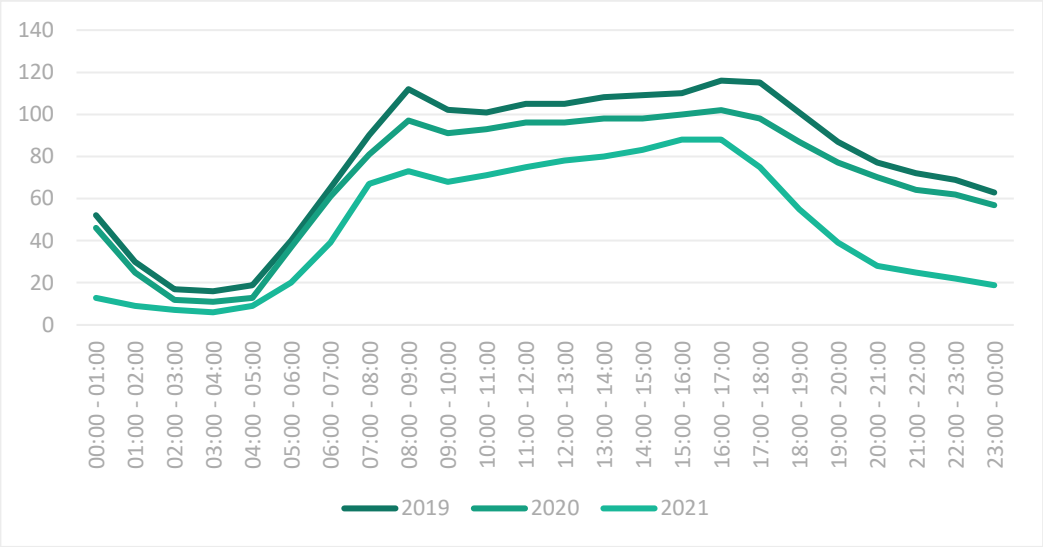


Figure 52: Average number of kilometres of traffic jams in Antwerp city for every hour of the day. Source: congestion barometer, 2019-2021.

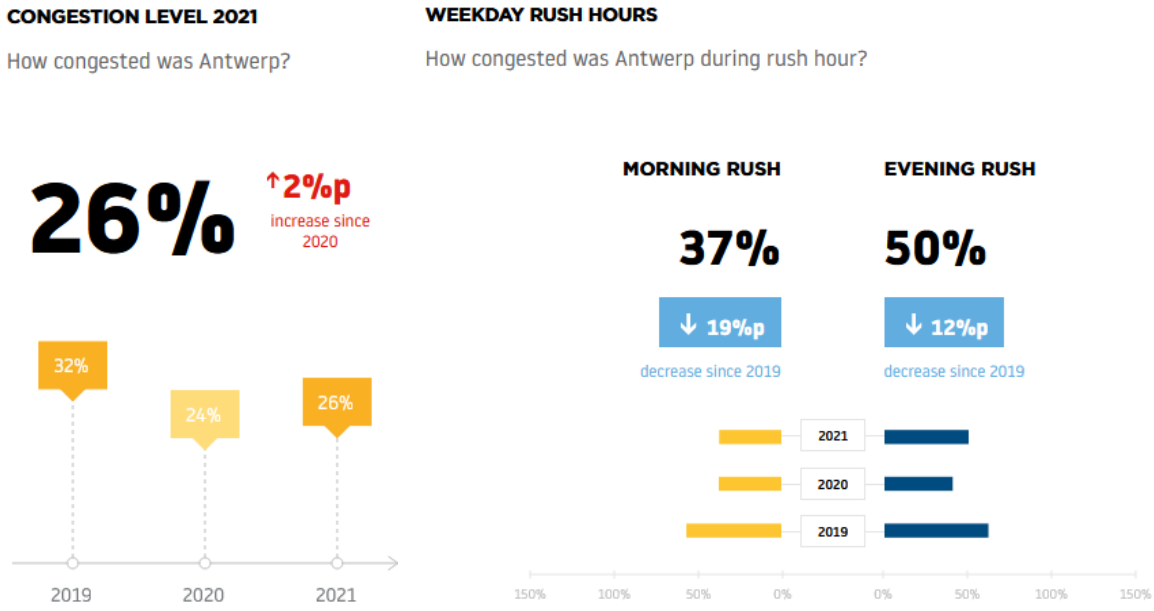


Figure 53: Overall congestion levels in Antwerp city in 2019, 2020 and 2021. Source: TomTom (https://www.tomtom.com/en_gb/traffic-index/antwerp-traffic/)

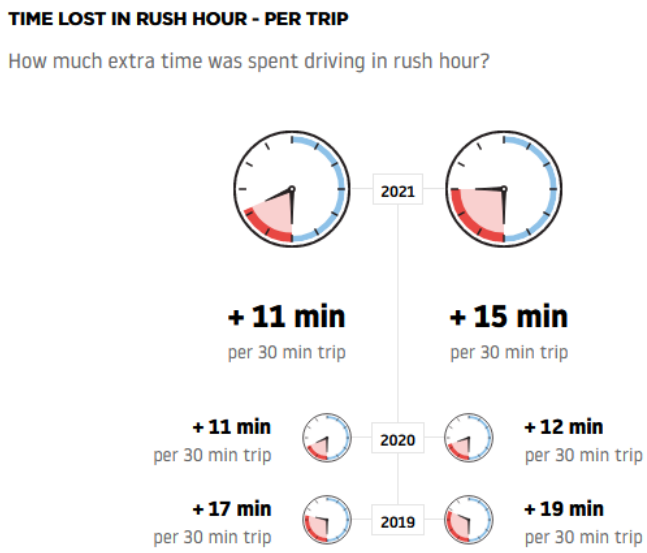


Figure 54: Extra time spent in traffic per trip in Antwerp city during the morning and evening rush in 2019, 2020 and 2021. Source: TomTom (https://www.tomtom.com/en_gb/traffic-index/antwerp-traffic/)

Current appraisal

We can see some clear patterns: short morning rush hour, long evening rush hour, corona in 2020 and 2021.

During rush hour the pressure on the road seems to be quite high. For example, in the morning rush, there was in pre-corona times almost 120 kilometres of congestion (congestion barometer) and up to 17 minutes extra per 30-minute trip were spent (TomTom). It will be interesting to see which effect the post-covid times, as well as the coming road works on the ring road of Antwerp, will bring.

3.5.6.2 Madrid

Source/method

The level of congestion of the city of Madrid was obtained from the data available in TomTom (https://www.tomtom.com/en_gb/traffic-index/madrid-traffic/) that estimates the delay in road traffic.

TomTom calculates the baseline per city by analysing free-flow travel times for all vehicles on the entire road network recorded 24/7, 365 days a year. Based on this information it calculates how much extra time a driver will spend in traffic at a certain hour. TomTom performs calculations for all hours of each day, so it is possible to evaluate the congestion levels at any time in any city, including morning and peak hours.

The traffic index estimated by TomTom presents the congestion level as a percentage of free-flow condition.

Observations

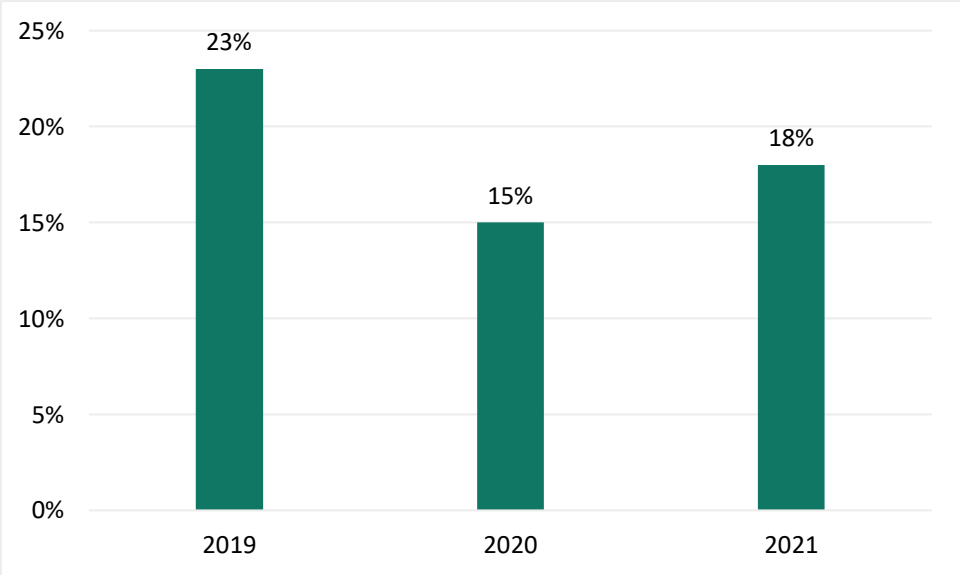


Figure 55: Evolution of congestion level in the city of Madrid. Source: TomTom.

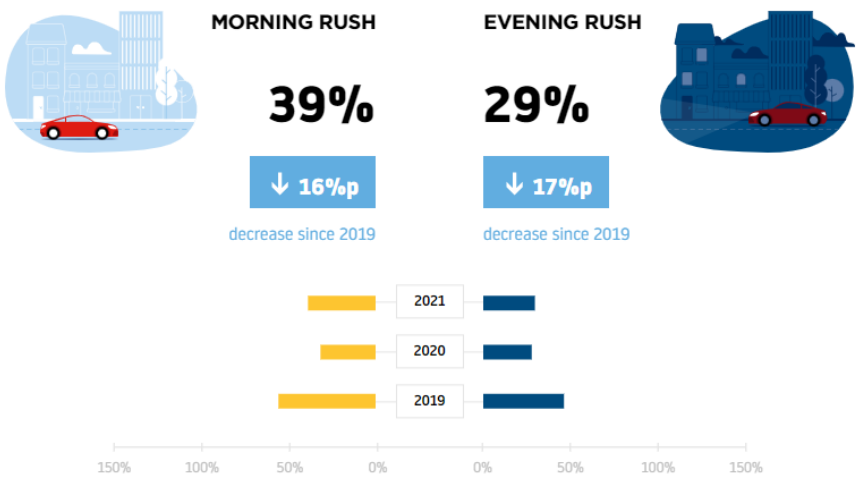


Figure 56: Congestion levels during weekday rush hours in Madrid city. Source: TomTom.

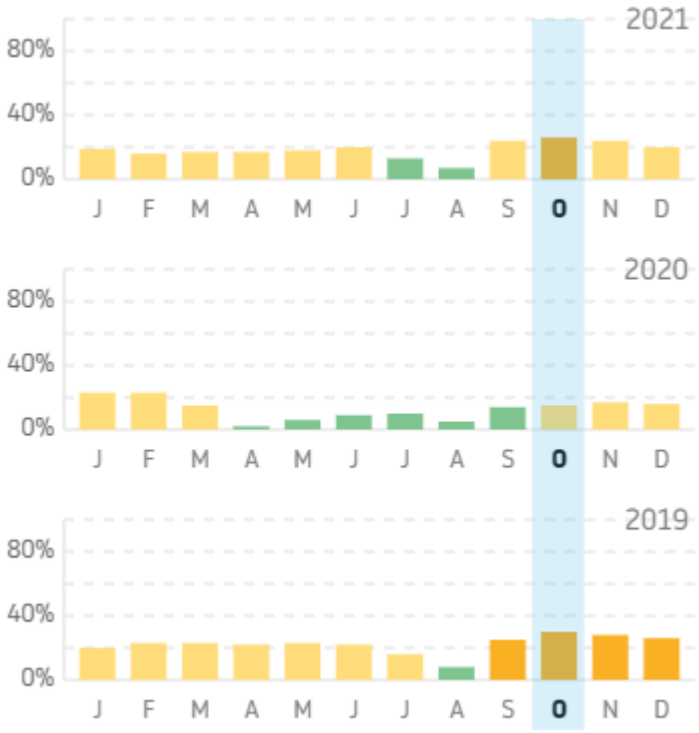


Figure 57: Average congestion level evolution per month in Madrid city. Source: TomTom.

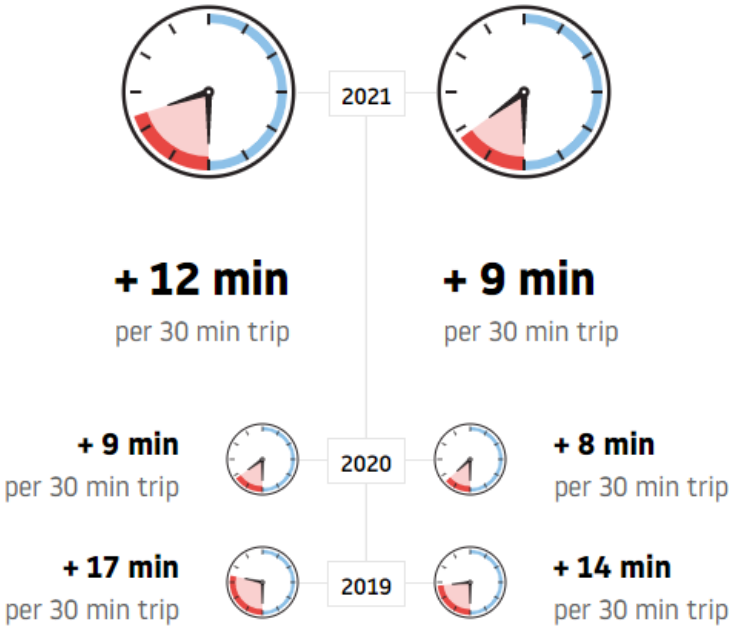


Figure 58: Time lost in rush hour - per trip in Madrid city. Source: TomTom.

Current appraisal

The 18% congestion level means that on average, travel times were 18% longer than during the baseline non-congested conditions. Despite the fact that it is 3% higher than 2020, it represents a 5% decrease compared to 2019 (pre pandemic levels).

The highest congestion levels registered in the last 3 years were in October, while the lowest ones are in August (holiday season).

The total time lost in rush hour in Madrid per year in 2021 is 78 hours, which is 1 day and 14 hours less than in 2019.

3.5.6.3 Turku

Source/method

The indicator "congestion levels" is defined in the following manner:

- Congestion level in the city of Turku
- Time lost in rush hour
- Decrease of speed in rush hour

The TomTom Traffic Index 2021gives the best view on city congestion levels (https://www.tomtom.com/en_gb/traffic-index/turku-traffic/). The data was applied e.g. on the Turku region traffic model scenarios, devised in 2020.

Data for congestion levels was not readily available for the rest of the FUA municipalities. The TomTom Index includes data only for three Finnish cities (Turku, Tampere and Helsinki).

Observations

In 2021, a slight increase in congestion levels was seen in Turku as compared to the previous year. When in the first pandemic year of 2020 the congestion level was 18%, in 2021 it was 19%. According to the TomTom Index, a 19% congestion level means that on average, travel times were 19% longer than during the baseline non-congested conditions. This means that a 30-minute trip driven in free-flow condition will take 6 minutes longer when the congestion level is at 19%.

During 2021, there were 11 days of high traffic when the congestion was two times higher in comparison with respective days in 2019. When it comes to low traffic, there were five such days in 2021 when the congestion was more than two times lower in comparison with respective days in 2019.

Time lost in rush hour per trip, in other words how much extra time was spent driving during rush hour is shown below. For the morning rush hour, +7min per 30-minute trip was spent driving in comparison to 2020. For the afternoon rush hour, the extra time was + 10min per 30-minute trip.

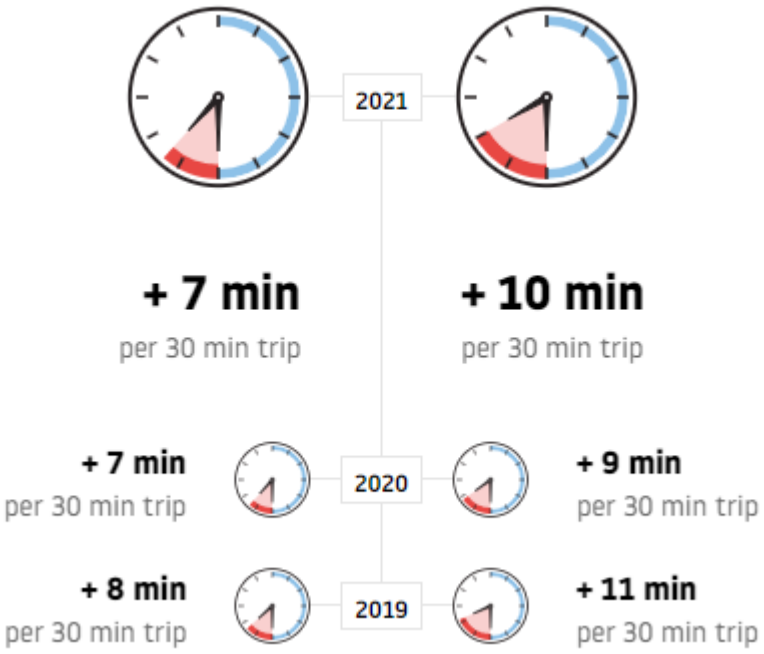


Figure 59: Time lost in rush hour - per trip in Turku city. Source: TomTom

Some scenarios have been devised in the city based on the 2016 TomTom speed data during afternoon peak hours (see Figure 60). In 2016, on most city roads the decrease of speed was less than 10% (the green lines), with some city centre showing decrease of speed by 10-30% (yellow lines), and only a few minor spots where decrease of speed was 30-50%.

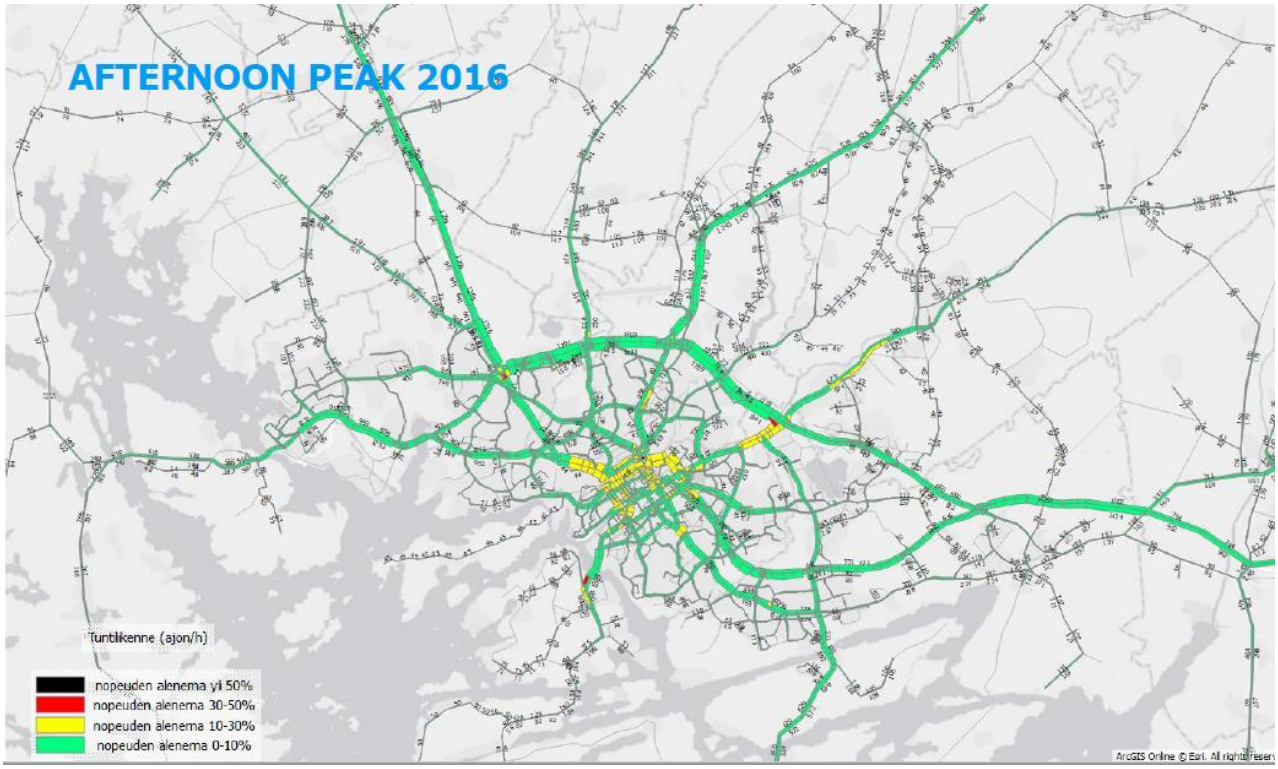


Figure 60: Decrease in speed in Turku city during afternoon rush hour in 2016. Source: Turku traffic model based on TomTom data.

Current appraisal

According to TomTom data, Turku is the fifth most congested city in the Nordic countries. Overall, however, the share of congestion time is small and mostly car traffic flows without major issues.

3.5.7. Quality of the cycling network

3.5.7.1 Antwerp

Source/method

Data is collected from the provincial Cycle Barometer[28]. The province of Antwerp developed this tool to assist local governments in their cycling policy. In this way, the safety, comfort and use of approximately 4 000 km of cycling routes come into focus with:

- Measurement bike data is used to evaluate the existing infrastructure
- The bicycle movements and their evolution are monitored
- The number of bicycle accidents is monitored to analyse the cycling behaviour and infrastructure
- Surveys to analyse the experiences and profiles of cyclists.

The Antwerp Transport Region already performed an exercise of analysing all the cycle routes in the Antwerp Transport Region. They had critical reservations about using all the data of the provincial Cycle Barometer when assessing the quality of the cycling network. Therefore, they decided to use mainly vibration comfort in future analyses as this is a more quantitative parameter.[29]

Important note, the municipality of Beveren is not included in these analyses as Beveren is part of the province of East-Flanders. The construction of the transport regions was not bound by the barriers of provinces. This exercise was done in 2021.

Observations

The Antwerp Transport Region made the following general observations about their cycling network, using the provincial Cycle Barometer:

- About 130 km (8%) of the cycling network still consists of mixed traffic or murder strips[30] at a speed regime of 70 km/h or more, of which about five km of cycling highway.[31] Sometimes it concerns roads where rarely or never more than 50

[28] https://fietsbarometer.provincieantwerpen.be/geoloketten/?viewer=fietsbarometer
[29] Vibration comfort is one small part of the provincial Cycle Barometer.
[30] In Flemish, the word "moordstrookje" (translated as "murder strip") is used to designate a non-separate narrow strip adjacent to the road for motorised vehicles, marked as a cycling path, making it very dangerous for cyclists (especially if high speed limits of up to 70 km/h are allowed for motorised vehicles).
[31] https://fietssnelwegen.be/en/

km/h is driven, but where it is not prohibited to drive 70 km/h. Sometimes it concerns busy traffic roads.
- About 50 km (3%) of the cycling network are missing links which results in redirections of 85 km of routes of varying quality.
- About 260 km (16%) of the cycling network in the Antwerp Transport Region scores less than 2.5/10 for vibration comfort.

Table 23 gives a more detailed overview. The cycle network in the Antwerp Transport Region is 1 625 km long.

Table 23: Indicators of the provincial Cycle Barometer to monitor the quality of the cycling network in the Antwerp Transport Region. Data from 2021.

Indicator	Cycle highway	Rest of the cycle network	Parameter
Mixed traffic >50km/h	3	61	kilometre
Murder strips single direction < 1m20; >50km/h	0	46	kilometre
Murder strips in two directions <2m50; >50km/u	2	11	kilometre
1m20 < Murder strips single direction < 1m75 ; >50km/u	0	9	kilometre
Intersections of cycle network with more than 4 injury accidents (2014 – 2017)	9	260	intersections
Segments with very low vibration comfort (<2,5 / 10)	17	250	kilometre
Segments with low to moderate vibration comfort (2,5-7,5 / 10)	90	858	kilometre
Segments with good vibration comfort > 7,5/10	96	336	kilometre
Missing segments of cycle network	26	25	kilometre

Current appraisal

There is still a lot of potential for improving the cycle network in the Antwerp Transport Region. This is also a very concrete output in SCALE-UP measure A3.

3.5.7.2 Madrid

Source/method

Data from the Mobility Planning and Infrastructures Department of Madrid´s city Council was used to evaluate the opportunity for cycling and the bicycle lane density.

Regarding citizens' perception, data from the Survey on Quality of Life and Satisfaction with Public Services of the city of Madrid was used. Specifically the responses to questions 13 and 21 from the block of Mobility, related to:

- Opportunity for cycling: quality of the cycling infrastructure (percentage of the total distance of the city's streets (including squares) with a good quality for cycling versus the total length of the city road network (excluding motorways))
- Bicycle lane density (km cycling lane/million inhabitants)
- Cycling infrastructure usage: percentage of people who have used at least once the cycling infrastructure
- Cycling perception: image on the cycling conditions (subjective), attitude towards cycling conditions based on the answers of a survey among citizens and visitors or cyclists on the street

It was only possible to evaluate the quality of the cycling network at city level since there is not data available at FUA level.

Observations

- Opportunity for cycling

Type of lane	Length (km)	km cycling lane/1.000000 inhabitants
Cycling green ring	68	21.1
Bicycle exclusive lane	288	87.3
Preferential bike route	4	1.24
Car-bike shared lane	354	107.1

- Bicycle lane density

Considering only the green ring, the preferential and bicycle exclusive lane a comparison with the total road network of Madrid was done:

Cycling lanes		City road network (CRN)	Cycling lanes/city road network
Type	Length (km)	Length (km)	
Cycling green ring	68	8973	0.04
Bicycle exclusive lane	288		
Preferential bike route	4		
Total	361	8973	

- Cycling network usage ("Have you ever used the cycling lanes available in the city?")

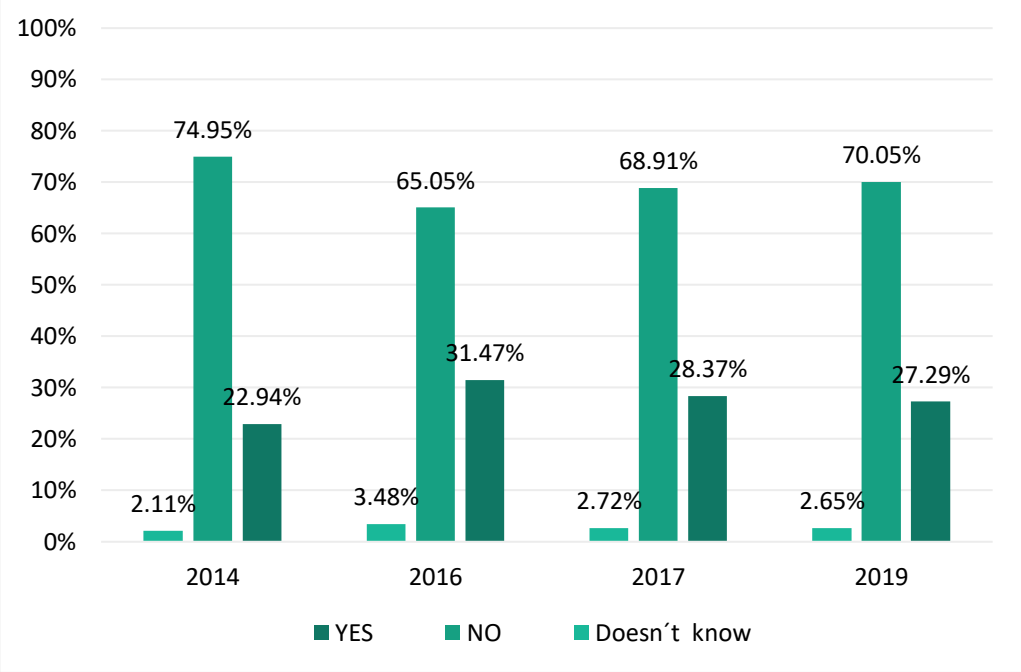


Figure 61: Citizen's usage of the cycling network. Source: Quality of Life Survey.

- Cycling perception

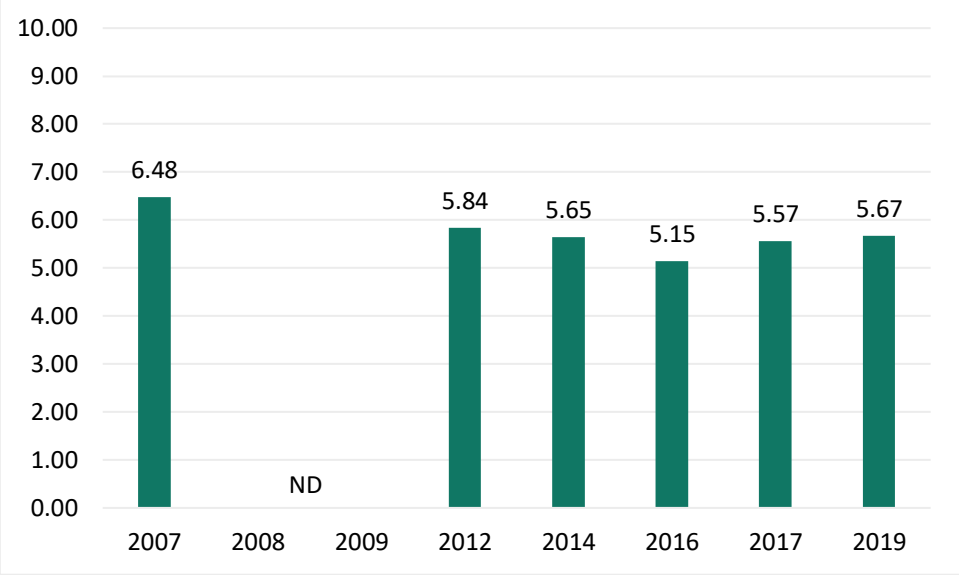


Figure 62: Citizen's perception of the cycling network. ND= No data available. Source: Quality of Life Survey.

Current appraisal

To date, there are not enough cycling lanes in Madrid to support the use of bikes as the main transport mode. Only 4% of the total road network of the city has a cycling lane, which shows that despite the efforts of the last years to promote the use of bicycles, there is still a lot of work to do.

In the last two years there was a reduction in the usage of the cycling lanes, showing that only 27% of the interviewed people has used them at least once. Finally, citizens' perception of the quality of the cycling network remains the same since 2017 with no considerable changes between 2012 and 2019, rating around 5.67/10 in all these years with exception of 2016 when it rated the lowest 5.15/10.

3.5.7.3 Turku

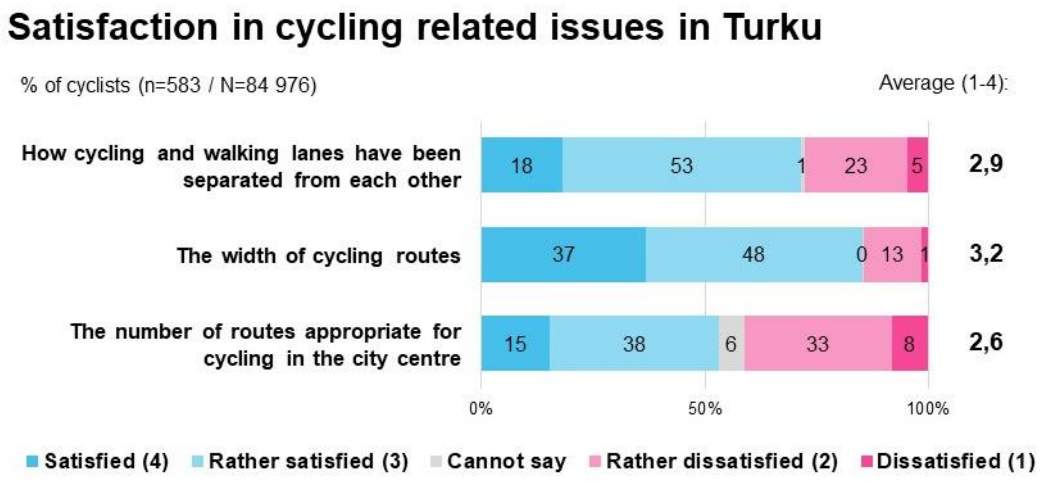
Source/method

Unfortunately, data for the quality of the cycling network based on e.g. a general quality index is not collected in Turku or any of the FUA municipalities. This was recognized as a clear shortcoming in the region both by the city and regional officials. The views of Turku citizens on the quality of overall cycling conditions have however been reviewed in a survey, the Cycling Barometer, which was performed in 2016 and 2019. Data from the survey is hence presented here on the following aspects:

1. How cycling and walking lanes have been separated from each other
2. The width of cycling routes
3. The number of routes appropriate for cycling in the city centre

Observations

Based on the 2019 survey, citizens in Turku are quite satisfied with the width of the cycling lanes (3.2/4 average) as well as with the way cycling and walking lanes have been separated from each other (2.9/4 average). The number of cycling routes appropriate for cycling scored lowest here (2.6/4).



Current appraisal

Due to the lack of GIS analysis of the network no far-reaching conclusions can be drawn on the quality of the cycling network in the city of Turku or the FUA.

3.6. Energy

3.6.1. Share of renewables

In the CIVITAS impact category *energy*, the **share of renewables** indicator is monitored. This is the percentage of electric vehicles and hybrid vehicles in the car, bus and trucks fleet operating in the city and/or FUA. Table 24 details the data collection method of these indicators for each urban node. The baseline results for Antwerp, Madrid and Turku are presented in the following section.

Table 24: Data collection methods of each urban node of the share of renewables indicator.

Indicator	Data collection method on city and FUA level (*)		
	Antwerp	Madrid	Turku
Share of renewables	Car statistics from the Vehicle Registration Service (DIV)	edM2018	Registration data from Statistics Finland and personal exchange with Turku city Environmental Protection office

(*) Unless indicated otherwise, the same data collection method is used for collecting the data on the FUA and city level.

3.6.1.1 Antwerp

Source/method

In Belgium, every vehicle with a license plate needs to be registered at the Vehicle Registration Service (DIV). The DIV is responsible for the registration of cars, motorbikes and trailers over 750 kg. It keeps a database for numerous organisations such as the police, the Finance Federal Public Service, insurance companies and so on.[32] The data represented below presents the complete fleet in the city of Antwerp and the Antwerp Transport Region at a specific point in time, namely 1/8/2021.

Observations

The percentage of electric vehicles and hybrid vehicles in the vehicle fleet of the city of Antwerp and the Antwerp Transport Region can be found in Figure 63. For this figure, the cars that are registered in Antwerp and the municipalities in the Antwerp Transport Region, are used. Only 5.5% of the registered cars is a plug-in hybrid vehicle (PHEV) and only 0.9% is a fully electric vehicle (EV) in the Antwerp Transport Region. These numbers are comparable to the numbers in Flanders. In Flanders only 4.4% of the registered cars are PHEV and only 0.7% of the vehicles drive fully electric.

[32] Info on DIV: https://www.belgium.be/nl/mobiliteit/Voertuigen/inschrijving. Info was provided in Excel-format in January 2022 by Statbel.

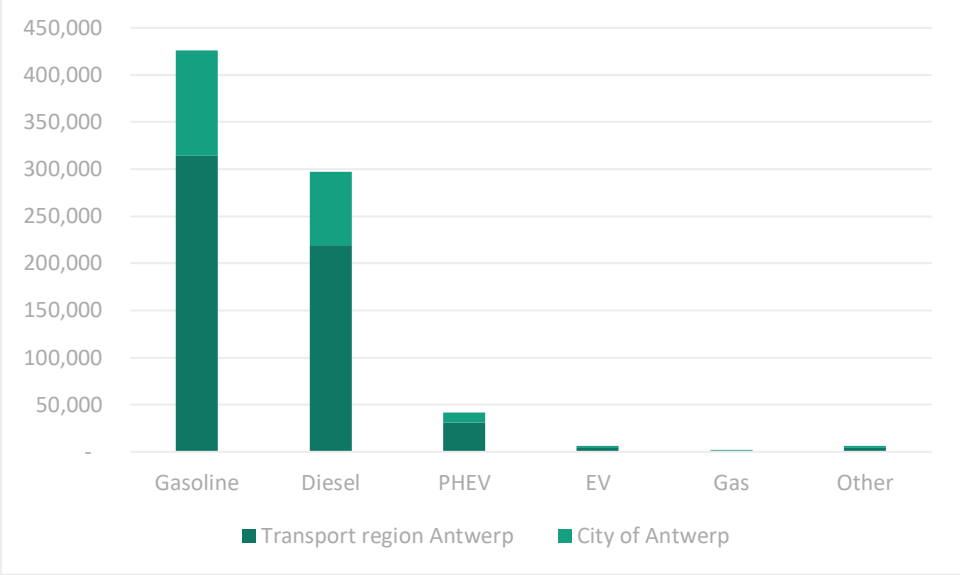


Figure 63: Fleet composition in 2021 in the Antwerp Transport Region.

Current appraisal

The majority in the region still drives gasoline or diesel cars. PHEV and EV are only a small fraction of the fleet in the Antwerp Transport Region.

3.6.1.2 Madrid

Source/method

The percentage of electric and hybrid vehicles of Madrid city and the FUA was extracted from the Home Mobility survey of the Community of Madrid of 2018 (edM2018) since it is the latest available data that allows to analyse city and FUA separately.

Observations

City level

All vehicles

Table 25: Share of electric and hybrid vehicles in Madrid City in 2018. Source: edM2018

City	Full Electric	Hybrid
	0.129%	0.84%

Taxi

Table 26: Share of electric and hybrid vehicles in the taxi fleet of Madrid City. Source: City Council Portal

Taxi Total fleet	Electric	Hybrid diesel	Hybrid petrol	PHEV Hybrid diesel
	179	3	4 085	5
17 228	1.04%	0.02%	23.71%	0.03%

EMT buses

Table 27: Share of low emissions of EMT buses fleet. Source: EMT

EMT Bus fleet	Electric	Hybrid diesel	CNG* hybrid	CNG	Diesel
	111	30	14	1571	352
2 078	5.34%	1.44%	0.67%	75.6%	16.9%

* compressed natural gas

FUA level

Based on the data available from the Home Mobility Survey of 2018 (edM2018), the low-emission fleet of the FUA area in Madrid is less than 1% of the entire vehicle fleet, as can be seen in Table 28.

Table 28: Share of electric and hybrid vehicles at FUA level Madrid in 2018. Source: edM2018

FUA	Electric	Hybrid
	0.114%	0.72%

Current appraisal

Based on the available data (edM2018) only 1% of the vehicle fleet in the city of Madrid is low-emission, which is a low percentage. However, it is important to point out that during the last years there has been a considerable increase in the acquisition of low-emission vehicles thanks to the different economic incentives and to the new restrictions to certain city areas for most polluting vehicles.

With respect to public transport, more than 75% of EMT´s **bus fleet** uses CNG, more than 5% is fully electric and more than 2% is CNG hybrid.

Also at FUA level, less than 1% of the vehicle fleet is low-emission, which supports the need to foster a change from combustion to zero-emissions vehicles.

3.6.1.3 Turku

Source/method

The share of renewables in the municipal fleet was derived from data provided by Statistics Finland[33].

The number and type of vehicles in the city fleet was derived via a personal exchange with senior advisor Miikka Meretoja at the Turku city Environmental Protection office. Data for the total fleet composition in the FUA by motive power was also derived from Statistics Finland[34].

Observations

Based on the data available, 12.3% of the Turku bus fleet (covering the Föli area of Turku + four FUA municipalities) was zero-emission in 2021:

	Electric	Hybrid	Plug-in hybrid
Buses (total fleet size 497)	61	0	0
	12.3%	0%	0%

Based on the data available, the low-emission municipal fleet (excluding buses) in the city of Turku was 6.2% in total in 2021:

	Electric	Hybrid	Plug-in hybrid
Passenger cars & vans (e.g. police, maintenance, social services, total fleet size 260)	7	7	2
	2.7%	2.7%	0.8%

There is no data available on the electric/hybrid vehicles for the other FUA municipalities' fleets.

[33] https://pxnet2.stat.fi/PXWeb/pxweb/en/StatFin/StatFin__lii__mkan/
[34] https://trafi2.stat.fi/PXWeb/pxweb/fi/TraFi/TraFi__Liikennekaytossa_olevat_ajoneuvot/010_kanta_tau_101.px/

Below is presented the total fleet composition in the FUA by motive power in the FUA. The data is derived from Statistics Finland.

	Total	Gasoline	Diesel	Gasoline/ Ethanol	Gas	EV	Hybrid	% of low-emission
Aura	2417	1 563	778	10	13	8	45	2.40 %
Kaarina	19 682	14 215	4 295	34	92	237	808	5.30 %
Lieto	117 30	8 121	2 999	18	63	119	410	4.50 %
Masku	5 820	4 017	1 533	8	30	45	187	3.90 %
Mynämäki	4 838	3 370	1 358	8	18	13	71	1.70 %
Naantali	11 170	7 897	2 625	22	43	121	462	5.20 %
Nousiainen	2 915	1 992	838	3	17	12	53	2.20 %
Paimio	6 694	4 579	1 785	7	48	78	197	4.10 %
Parainen	8 751	64 58	1 971	16	39	64	213	3.20 %
Raisio	14 483	10 770	2 947	32	68	132	534	4.60 %
Rusko	3 834	2 650	985	5	22	40	132	4.50 %
Sauvo	1 792	1 161	570	3	15	14	29	2.40 %
Turku	81 448	61 192	16 170	135	420	762	2 767	4.30 %

Current appraisal

The share of electric or hybrid vehicles in the Turku fleet is still relatively low. With the city buses, the situation has however improved greatly as the number of electric buses increased from the 6 buses in 2016 to the 61 buses in 2021. It should be noted, however, that the municipal fleet also includes some natural gas vehicles, e.g. in the home care unit there are eight such vehicles – a better option to combustion engine vehicles especially when using renewable biogas. There are two compressed natural gas/compressed biogas (CNG/CBG) stations in the city area and one in the neighbouring municipality of Lieto.

The share of low-emission fleets is still rather low in the FUA municipalities. The highest percentage of such vehicles is found in the city of Kaarina (5.3% of the entire fleet) and the lowest in the municipality of Mynämäki (1.7% of the fleet).

3.7. Economy

In the CIVITAS impact category *economy*, the indicator **the number of jobs** is monitored. Starting from the idea that "good mobility helps our economy", a positive evolution in the number of jobs is expected. The overall number of jobs is monitored, not only transport related activities. The data collection method for this indicator for each urban node is given in Table 29, the baseline results for each urban node are given in the following sections.

Table 29: Data collection methods of each urban node of the economy indicators.

Indicator	Data collection method on city and FUA level (*)		
	Antwerp	**Madrid**	**Turku**
Number of jobs	Statistics from provincies.incijfers.be	Labour Market Statistics from the Madrid Region	FUA: Statistics Finland
(*) unless indicated otherwise, the same data collection method is used for collecting the data on the FUA and city level.			

3.7.1. Number of jobs and businesses

3.7.1.1 Antwerp

Source/method

This data is collected by *Steunpunt Werk* (Employment support centre) in Belgium and summarized on various levels, e.g. the transport regions and cities.

The data was accessed via https://provincies.incijfers.be/databank

Observations

Number of jobs: The Antwerp Transport Region is an economically strong region, responsible for a large number of jobs in Flanders. In 2019, the Antwerp Transport Region had **526 374 jobs** available, the majority of those jobs can be found in the city of Antwerp (**289 159 jobs**). Figure 64 shows wherein the Antwerp Transport Region these jobs are situated. Although there are a lot of job opportunities within the region, the employment rate in the region is lower compared to the other transport regions. The Antwerp Transport Region has an employment rate of 71.5%. In 2019, only the transport region of Oostende has a lower rate.[35]

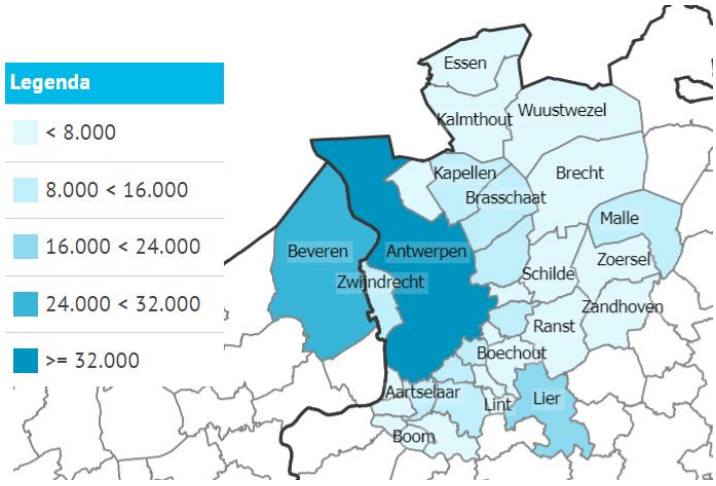


Figure 64: Distribution of jobs in the region.

Source: https://provincies.incijfers.be/databank

[35] The employment rate, as defined by OECD, is the employment-to-population ratio: the number of people of working age in the population who are employed. In this case, the working age is defined between 20 and 65 years.

Number of businesses: The Antwerp Transport Region proves its strong economic position within Flanders with its number of businesses.[36] With 106 062 businesses, Antwerp has the largest amount of businesses in the Flemish transport regions. The second-largest is the transport region of Ghent with 'only' 68 241 businesses. Note that the capital of Belgium, Brussels, is not included in this division in transport regions as Flanders and Brussels are two different administrative regions. The majority of these businesses are again located within the city of Antwerp, 46 380 businesses.

Current appraisal

The Antwerp Transport Region is already a strong economic region, with a strong emphasis on the city of Antwerp. It will be a challenge to significantly increase the number of jobs and companies here.

[36] Businesses are defined as VAT-registered companies

3.7.1.2 Madrid

Source/method

On FUA level

Labour Market Statistics from the Madrid Region (Community of Madrid) offers periodic information from the Active Population Survey, job seekers and registered unemployment, employment contracts, and Social Security affiliation regarding the Madrid Region, according to different variables and special groups: foreigners, young people, people with disabilities, etc.

On city level

Using the same information, Madrid´s City Council has open access data with information regarding the Social Security affiliations of workers registered in contribution accounts domiciled in the city, as well as of workers residing in the city, or self-employed; hiring information referring to companies domiciled in the city and contracts entered into with city residents, the exploitation of microdata from the Labour Force Survey (EPA).

For both cases, the labour market statistics of Madrid municipalities available on the Region web page was used (Conserjería de Economía, hacienda y Empleo Comunidad de Madrid, 2021). The map of the Madrid Region is divided in 10 groups of municipalities as can be seen in Figure 65. For the analysis data of group 1 was used to evaluate unemployment rate at city level, while groups 1, 2, 3, 4 and 5 together correspond to the FUA area.

Figure 65: Map of the Madrid Region (Community of Madrid) with the municipalities grouped

Observations

City Level

Area (km²)	605.0
Population (2020)	3 334 730
Men	1 553 899
Women	1 780 831
% Population 16-64 years old	66.0
% Foreign population	15.4
% Foreign population 16-64 years old	84.0

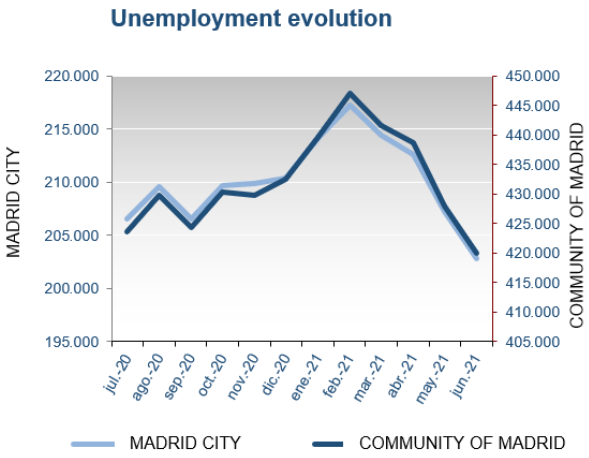


Figure 66: Unemployment evolution in Madrid City in 2020-2021. Source: Conserjería de Economía, Hacienda y Empleo, 2021

FUA level

The FUA area is compound by the city (group 1) and the groups 2, 3, 4 and 5 of municipalities named metropolitan areas of Figure 65. The analysis of each of these metropolitan areas and the global analysis for FUA is presented in Table 30.

Table 30: Unemployment rate of Madrid´s FUA. Source: Conserjería de Economía, Hacienda y Empleo, 2021

Area	Population between 16-64 years old	Number of unemployed people	Unemployment rate
Madrid City	2 200 922	202 866	9.22%
Metropolitan North	236 708	17 170	7.25%
Metropolitan East	450 666	46 568	10.33%
Metropolitan South	876 553	94 542	10.79%
Metropolitan West	333 976	21 323	6.38%
FUA	4 098 825	382 469	9.33%

Current appraisal

The unemployment rate in Madrid City presents a downward trend since January 2021 after a marked increase throughout 2020 due to the economic consequences of COVID-19.

The unemployment rate is similar on city and FUA level in 2021 being around 9%.

The eastern and southern areas of Madrid´s FUA register the worst unemployment rates with almost 11% in Metropolitan South. On the other hand, the northern and western areas are the best ones in terms of unemployment, with rates of 7.25% and 6.38% respectively.

3.7.1.3 Turku

Source/method

Information on the number of jobs and businesses in the FUA was derived from the "Municipal key figures" database provided by Statistics Finland. The latest figures for jobs and businesses available were from 2019. The unemployment rate is derived from a Statistics Finland database.

Observations

Below are presented the number of jobs and businesses in the FUA in 2019.

Municipality	No. of jobs	No. of businesses
Aura	1198	369
Kaarina	9973	2108
Lieto	6593	1579
Masku	2336	652
Mynämäki	1958	730
Naantali	5690	1401
Nousiainen	997	379
Paimio	3120	773
Parainen	5143	1339
Raisio	10697	1676
Rusko	1995	537
Sauvo	729	315
Turku	105 364	12 152
FUA total	**155 793**	**24 010**

Below are presented the unemployment rates in the FUA at the end of 2021.

Municipality	Unemployment rate %
Aura	6.2
Kaarina	6.1
Lieto	5.5
Masku	5.2
Mynämäki	6.6
Naantali	6.8
Nousiainen	5.6
Paimio	5.5
Parainen	6.2
Raisio	7.4
Rusko	4.6
Sauvo	3.7
Turku	13.2

Current appraisal

The number of jobs and businesses in the FUA grows steadily. From 2018 to 2019, for example, there was a 1.5% increase in the number of jobs in the FUA. For the number of businesses, the increase was slightly lower at 0.87%.

3.8. Environment

The impact category environment evaluates the improvement of the environment by using clean vehicles and alternative fuels and by reducing the modal share of private motorized transport by monitoring the pollution/nuisance and resource consumption. The air quality and greenhouse gas (GHG) indicators monitored are listed in Table 31. The data collection details of each urban node are outlined in Table 32.

Table 31: FUA indicators monitored by each of the urban nodes in the CIVITAS category environment

Indicator	Definition
Air pollutant emissions (NO_x, PM2.5, PM10)	Emissions from transport modes based on the vehicle-km per vehicle type in the city/FUA
Greenhouse gas emissions (CO_2)	Emissions from transport modes based on the vehicle-km per vehicle type in the city/FUA
Air quality (NO_x, PM2.5, PM10)	Air concentrations of NO_x, PM2.5 and PM10

Table 32: Data collection methods of each urban node of the environment indicators.

Indicator	Data collection method on city and FUA level (*)		
	Antwerp	**Madrid**	**Turku**
Air pollutant emissions (NO_x, PM2.5, PM10)	SUMI air pollutant emissions indicator. Input data from the traffic model used by the Mobility Department Flanders (MOW).	City: Inventory of Emissions of pollutants from the Madrid City Council Air Quality Portal	VTT Lipasto database, modelling
GHG emissions (CO_2)	SUMI greenhouse gas emissions indicator. Input data from the traffic model used by the MOW.	City: Inventory of Emissions of pollutants from the Madrid City Council Air Quality Portal	VTT Lipasto database, modelling
Air quality (NO_x, PM2.5 and PM10)	Air quality measurements from the Vlaamse Milieu Maatschappij VMM (Flemish Environment Agency)	City: Madrid City Council Air Quality Portal FUA: Air Quality Network of the Madrid Region	Personal contact at the Turku city Environmental Protection office: City: Measurement data available for PM2.5 and PM10. Modelling for NO_2. FUA: From 4 FUA municipalities (Kaarina, Raisio, Naantali, Parainen) measured and modelled data available but not from the other FUA municipalities.
(*) Unless indicated otherwise, the same data collection method is used for collecting the data on the FUA and city level.			

3.8.1. Antwerp

3.8.1.1 Air pollutant emissions

Source/method

The SUMI methodology of the SUMI air pollutant emissions indicator[37] was followed for this indicator. Kilometres driven per vehicle type, which is demanded by the SUMI methodology, are provided by the traffic model used by the Mobility Department Flanders (MOW). The transport regions needed those traffic models. During the preparation of the regional mobility plans, the regional traffic models are used to calculate scenarios.

However, MOW is currently looking at updating its current model/version of the traffic model. For the time being, however, we are using version 4.2.2. In a later version, we provide an update. We started with the exercise that Transport & Mobility Leuven (TML) made in the past for the city, based on data of 2017 (as this year gives a more accurate view than 2020-2021). This exercise was extended for the transport region, using the same reference year as for the city.

SUMI reports the emission harm equivalent index (EHI) in kilograms of PM2.5 equivalent per inhabitant (cap) per year. In addition, here we also report the total tonnes emitted by each particle, the sub-indicators of the SUMI air pollutant EHI.

Observations

City of Antwerp

Table 33: SUMI air pollutant emissions harm index (EHI) of the city of Antwerp in 2017

Air pollutant emissions EHI	
ton PM2.5 $_{eq}$ / year	190
kg PM2.5 $_{eq}$ / cap / year	0.36

Table 34: PM2.5 and NOx emissions of the city of Antwerp in 2017

NOx Emissions	PM2.5 Emissions	non-exhaust PM2.5 emissions

[37] https://transport.ec.europa.eu/other-pages/transport-basic-page/air-pollutant-emissions-indicator_en

ton NO_x / year	1 680	**ton PM2.5 / year**	34	**ton PM2.5 / year**	43
kg NO_x / cap / year	3.19	**kg PM2.5 / cap / year**	0.06	**kg PM2.5 / cap / year**	0.08

Antwerp Transport Region

Table 35: SUMI air pollutant emissions harm index (EHI) of the Antwerp Transport Region in 2017

Air pollutant emissions EHI	
ton $PM2.5_{eq}$ / year	552
kg $PM2.5_{eq}$ / cap / year	0.49

Table 36: PM2.5 and NOx emissions of the Antwerp Transport Region in 2017

NO_x Emissions		**PM2.5 Emissions**		**non-exhaust PM2.5 emissions**	
ton NO_x / year	4 866	**ton PM2.5 / year**	99	**ton PM2.5 / year**	126
kg NO_x / cap / year	4.33	**kg PM2.5 / cap / year**	0.09	**kg PM2.5 / cap / year**	0.11

Current appraisal

The observed differences between the city and the FUA (expressed in /cap/year) are higher in de FUA due to the fact that people live more densely in the city than in the FUA. We can intuitively expect the pollution in the city to be bigger in the surrounding area. Note that other polluting factors, such as the industry sector, are not yet part of the picture.

3.8.1.2 GHG emissions (CO_2)

Source/method

The SUMI methodology of the SUMI greenhouse gas emissions indicator[38] was followed for this indicator. As for the SUMI air pollutant emissions indicator, the vehicle-kilometres per vehicle type are provided by the traffic model used by MOW (see Section 3.8.1.1).

Observations

City of Antwerp

Million kg CO_2/year: 0.623

Antwerp Transport Region

Million kg CO_2/year: 1.068

Current appraisal

The GHG emissions caused by transport are already relatively high, seeing as other polluting factors as the industry sector, for example, are not yet a part of the picture.

[38] https://transport.ec.europa.eu/other-pages/transport-basic-page/greenhouse-gas-emissions-indicator_en

3.8.1.3 Air quality

Source/method

For the baseline reporting of the air quality, the data and analyses available by the *Vlaamse Milieu Maatschappij* (VMM) is used. VMM is the Flemish environmental department and is responsible for the official measurements of air quality, including the Antwerp Transport Region. In the Antwerp Transport Region, VMM can use about 20 measuring points. VMM measures continuously, and the Flemish population can consult the measurements online via the VMM website at an hourly level. These measurements are of course not formed on street level. For the representation of the street level, VMM uses the ATMO-Street model, a model created by the Flemish Institute of Technological Research (VITO).

In this report, the summary measurements of 2020 are reported. Displaying the measurements of a specific hour would be too much influenced by specific factors of one specific moment and not give the necessary global picture.[39] Measurements of 2021 are not (yet) available. Apart from these measures, a report of 2020 specifically for the region of Antwerp is used.[40]

Observations and current appraisal:

Four types of measurements are shown: Particular matter (PM10 and 2.5), NO_2 and Black Carbon. As shown in the figures below, there's more pollution concentrated on the agglomeration of the city of Antwerp. Seeing as the city of Antwerp is one of the biggest cities within Flanders, these figures are not surprising. The other part of the Antwerp Transport Region consists of municipalities with a lower population density and less industrial activity. The port of Antwerp in the upper left corner shows heavier amounts of particle matter PM2.5, NO_2 and Black Carbon. Particle matter PM10 encounters very high concentrations at one point near the harbour and near Antwerpen Luchtbal. However, it is not clear why concentrations are higher in this location compared to the surroundings. In general, however, the European standards for the annual emission of particle matter are met. In 2020, VMM published a report specifically on the Antwerp agglomeration. This report gives deeper insight into the causes of this pollution: (road) traffic and wood burning were the most important sources in the Antwerp agglomeration. (Road) traffic

[39] More information on the specific measurements can be found on this website https://www.vmm.be/lucht
[40] https://www.vmm.be/publicaties/luchtkwaliteit-in-de-antwerpse-agglomeratie-jaarrapport-2020

contributed 75% to the emission of nitrogen oxides, 39% of primary PM10 particulate matter and 51% of elemental carbon. Domestic heating (more specifically wood burning) was the largest source of primary PM2.5 particulate matter (43%). The introduction of the Low Emission Zone (LEZ) has caused the concentrations of Black Carbon to decrease locally. For NO_2, there are no clear indications that the LEZ caused an additional local decrease in concentrations. The current limitations of the LEZ mainly focus on reducing the emission of soot particles.

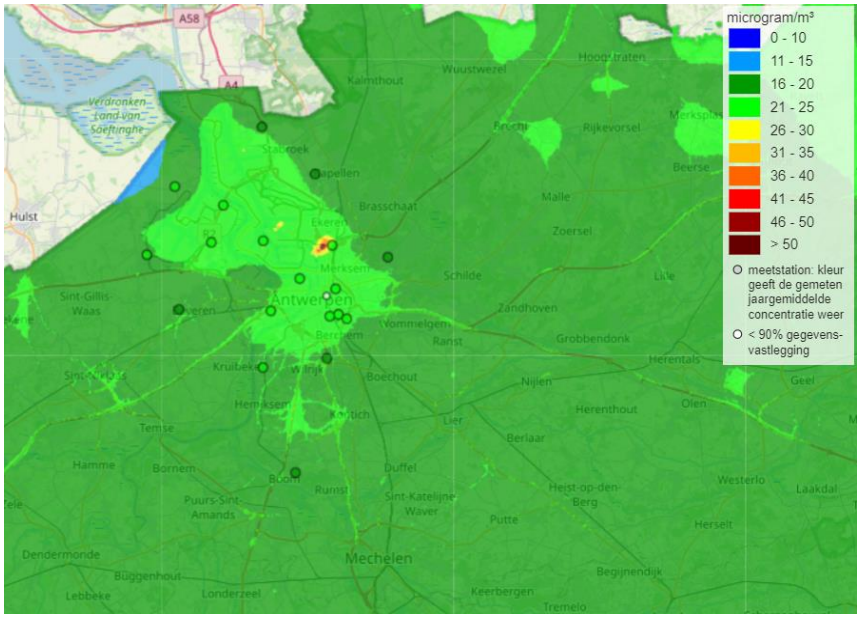


Figure 67: Particulate matter PM10 in microgram/m³ (µg/m³), average of 2020, zoom of the Antwerp Transport Region

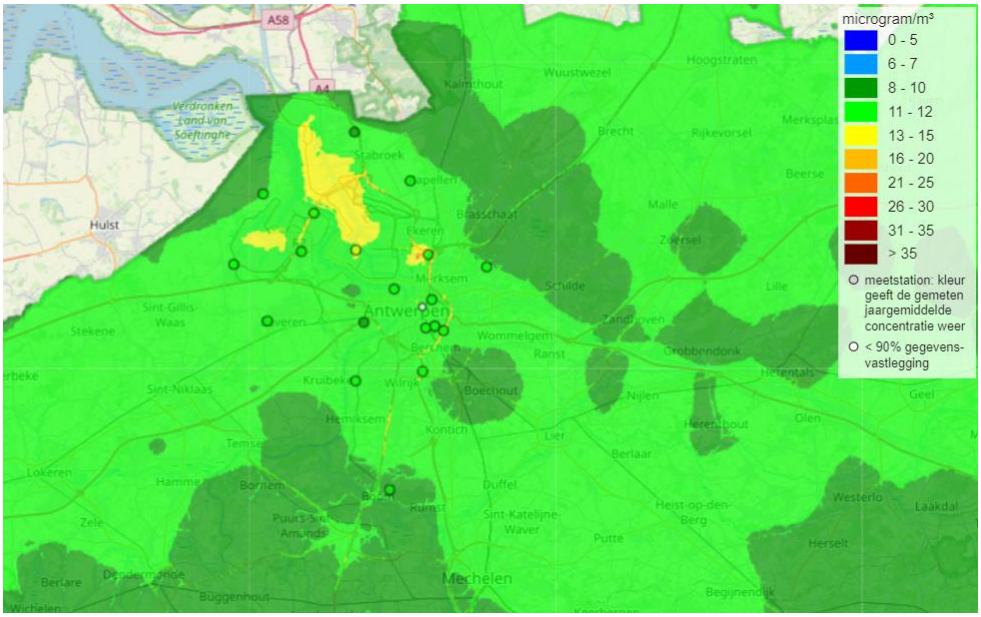


Figure 68: Particulate matter PM2.5 in µg/m³, average of 2020, zoom of the Antwerp Transport Region

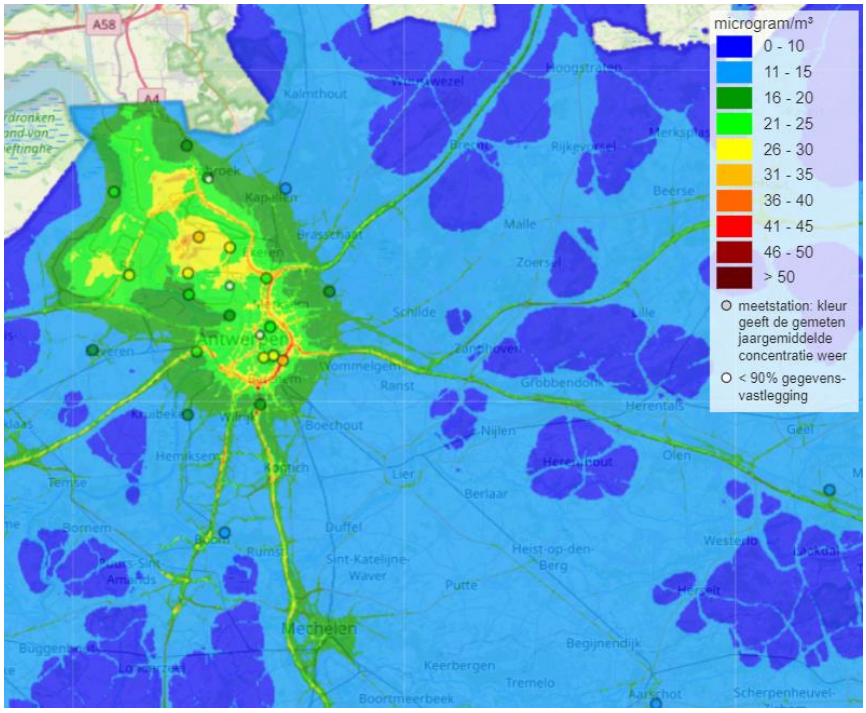


Figure 69: NO_2 in µg/m³, average of 2020, zoom of the Antwerp Transport Region

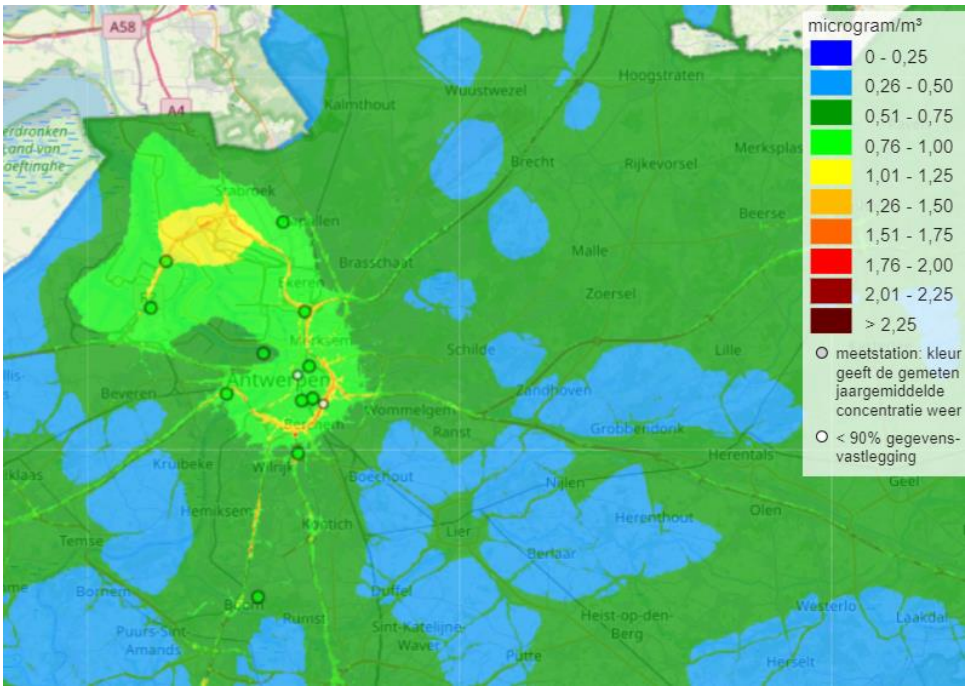


Figure 70: Black Carbon (BC in µg/m³), average of the year 2020, zoom of the Antwerp Transport Region.

3.8.2. Madrid

3.8.2.1 Air pollutant emissions

Source/method

The air pollutant emissions for the city of Madrid were extracted from the Inventory of Emissions of pollutants available in the Air Quality Portal from Madrid City Council. This inventory includes the emissions grouped by sector or activity. For this report, the emissions corresponding to road transport were considered.

No data was available at FUA level.

Observations

Madrid City	PM2.5	PM10	NO_x	PM2.5	PM10	NO_x	PM2.5	PM10	NO_x
	(ton/year)			(kg/cap per year)			% of the total emissions in the city		
2017	437	610	7 297	0.14	0.19	2.26	60.2%	67.1%	49.9%
2018	406	577	6 659	0.13	0.18	2.07	58.0%	65.4%	45.0%
2019	384	553	6 020	0.12	0.17	1.87	57.0%	64.8%	42.1%

Current appraisal

Air pollutant emissions from road transport in Madrid City represent more than the 50% from the total emissions of PM2.5, PM10.

Since 2017, PM2.5, PM10 and NO_x have registered a downward trend.

3.8.2.2 GHG emissions (CO_2)

Source/method

The GHG emissions for the city of Madrid were extracted from the Inventory of Emissions of pollutants available in the Air Quality Portal from Madrid City Council. This inventory includes the emissions grouped by sector or activity. For this report, the emissions corresponding to road transport were considered.

No data was available at FUA level.

Observations

Table 37: GHG emissions in Madrid City for 2017-2019 . Source: Air Quality Portal from Madrid City Council

Madrid City	CO_2		Percentage of the total CO_2 emissions in the city
	(million kg/year)	(ton/cap per year)	
2017	2 737	0.85	38.5%
2018	2 653	0.82	35.7%
2019	2 591	0.80	35.9%

Current appraisal

In Madrid City the main source of GHG emissions is road transport which were the 35.9% of the total emissions in 2019.

Despite the downward trend in the CO_2 emissions between 2017 and 2019, the percentage of the total remains the same between 2018 and 2019.

In 2019, the CO_2 emissions from road transport were 0.8 tons per inhabitant per year.

3.8.2.3 Air quality

Source/method

The quality of the air will be obtained from different measurement stations with key locations.

On FUA level

The air quality will be obtained from registers of the Air Quality Network of the Madrid Region which is currently composed of twenty-four fixed measurement stations distributed in six homogeneous areas of the territory of the Region:

- 3 in urban areas or agglomerations: Corridor de Henares, Urbana Sur and Urbana Noreste (this 3 are in Madrid´s FUA)
- 3 in rural areas: Tajuña Basin, Alberche Basin and Sierra Norte (part of Madrid Region)

Figure 71 describes in more detail the configuration of the Air Quality Network of the Madrid Region.

Figure 71: Air Quality Network of the Madrid Region

On city level

In addition, Madrid City Council has its own network made up of stations distributed throughout the municipality of Madrid. Data from the different measurement stations can be found in the Air Quality Portal of Madrid´s City Council.

Figure 72 shows the locations of the air quality stations managed by Madrid City.

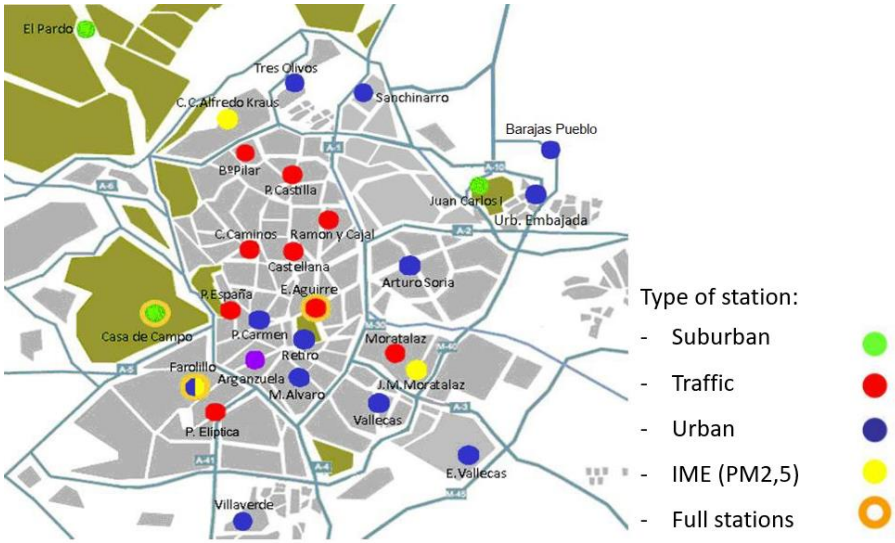


Figure 72: Air quality stations in Madrid City

As previously mentioned, for the project data from key located stations on city and FUA level will be used.

Observations

City Level

- **NO_x**

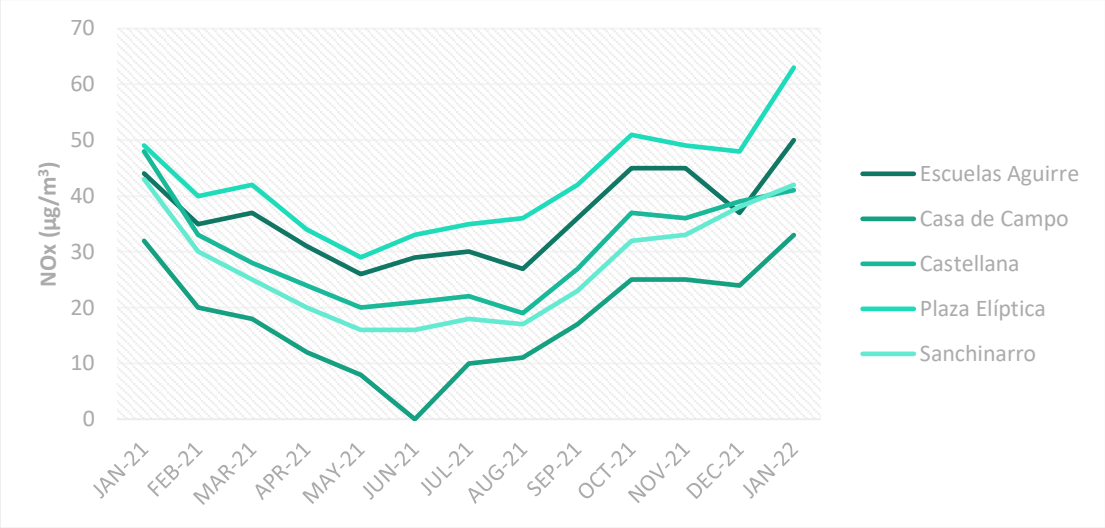


Figure 73: NO_x levels (in µg/m³) in 2021in the selected air quality control stations in Madrid City.

- **PM2.5**

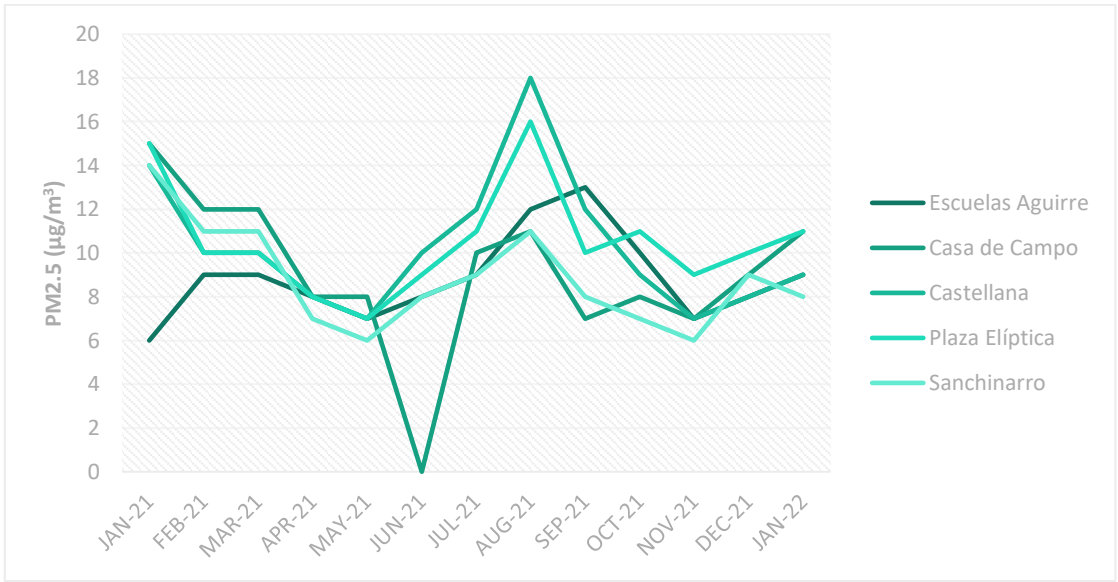


Figure 74: PM2.5 levels (in µg/m³) in 2021in the selected air quality control stations in Madrid City

- **PM10**

Figure 75: PM10 levels (in µg/m3) in 2021in the selected stations in Madrid City

FUA level

Table 38: Average annual in Madrid´s FUA 2019. Source: Red de Calidad del Aire de la Comunidad de Madrid Annual report 2019

Average annual µg/m³			
Measure station	**PM10**	**PM2.5**	**NOx**
Alcalá de Henares	20	12	No data available
Torrejón de Ardoz	21	11	No data available
Getafe	22	12	No data available
Leganés	21	12	No data available
Colmenar Viejo	16	11	No data available
Majadahonda	13	No data available	No data available

Current appraisal

The levels of PM10 in the different measure stations in Madrid city exceeded in four months in 2021 the admissible limits recommended by the World Health Organisation (WHO) (20 µg/m^3). Similarly, in the stations selected for the FUA, where only two of them (Colmenar Viejo and Majadahonda) registered values below 20 µg/m^3.

The values registered for PM2.5 are worse in the city and FUA, since in all cases the limit recommended by WHO (10 µg/m^3) are exceeded.

3.8.3. Turku

3.8.3.1 *Air pollutant emissions*

Source/method

Data for air pollutant emission is derived from the LIPASTO database. LIPASTO is a calculation system developed and maintained by VTT Technical Research Centre of Finland Ltd. It is used to calculate transport emissions and energy consumption in Finland, covering road, rail, waterborne and air transport as well as non-road mobile machinery. LIPASTO has been funded by the Finnish Transport and Communications Agency Traficom, the Ministry of Transport and Communications, the Ministry of the Environment and Statistics Finland in 2013 - 2017.

The unit emission database (http://lipasto.vtt.fi/yksikkopaastot/indexe.htm) covers emission factors for road, rail, waterborne and air transport as well as working machines. Both passenger and freight transport in Finland, and for waterborne and air transport also international traffic to or from Finland, are included. By unit emissions, the number of emissions emitted during operation of vehicles is meant, measured in mass units and allocated to each passenger or tonne of freight transported over one kilometre (g/tonne kilometre, g/passenger kilometre).

Observations

Below are presented the 2020 CO, NO_x and PM emissions from road traffic (in tons) in the city and FUA.

Municipality	CO (t)	NOx (t)	PM (t)
Aura	34	32	1
Kaarina	212	173	4
Lieto	126	100	2
Masku	71	54	1
Mynämäki	62	54	1
Naantali	72	51	1
Nousiainen	34	28	1
Paimio	105	96	3

Municipality	CO (t)	NOx (t)	PM (t)
Parainen	69	56	1
Raisio	131	112	3
Rusko	28	18	0
Sauvo	19	15	0
Turku	635	386	11
FUA total	**1596**	**1175**	**29**

Current appraisal

The highest NO_x concentrations in the FUA can be observed in the Turku city centre and along the main incoming routes and intersections to the city, as well as along the E18 ring road. The concentrations decrease quickly when distance grows form the arteries.

73% of CO emissions are produced by the road traffic. The clear increase in the number of electric and hybrid vehicles in the FUA is likely to further decrease the number of CO emissions in the FUA.

Particulate matter emissions are highest in the Turku city centre and along the busiest roads and intersections.

3.8.3.2 GHG emissions (CO_2)

Source/method

Data for air pollutant emission is derived from the LIPASTO database (http://lipasto.vtt.fi/yksikkopaastot/indexe.htm). LIPASTO is a calculation system developed and maintained by VTT Technical Research Centre of Finland Ltd. It is used to calculate transport emissions and energy consumption in Finland, covering road, rail, waterborne and air transport as well as non-road mobile machinery. LIPASTO has been funded by Finnish Transport and Communications Agency Traficom, Ministry of Transport and Communications, Ministry of the Environment and Statistics Finland in 2013 - 2017.

The unit emission database covers emission factors for road, rail, waterborne and air transport as well as working machines. Both passenger and freight transport in Finland, and for waterborne and air transport also international traffic to or from Finland, are included. By unit emissions is meant the amount of emissions emitted during operation of vehicles, measured in mass units and allocated to each passenger or tonne of freight transported over one kilometre (g/tonne kilometre, g/passenger kilometre)

Observations

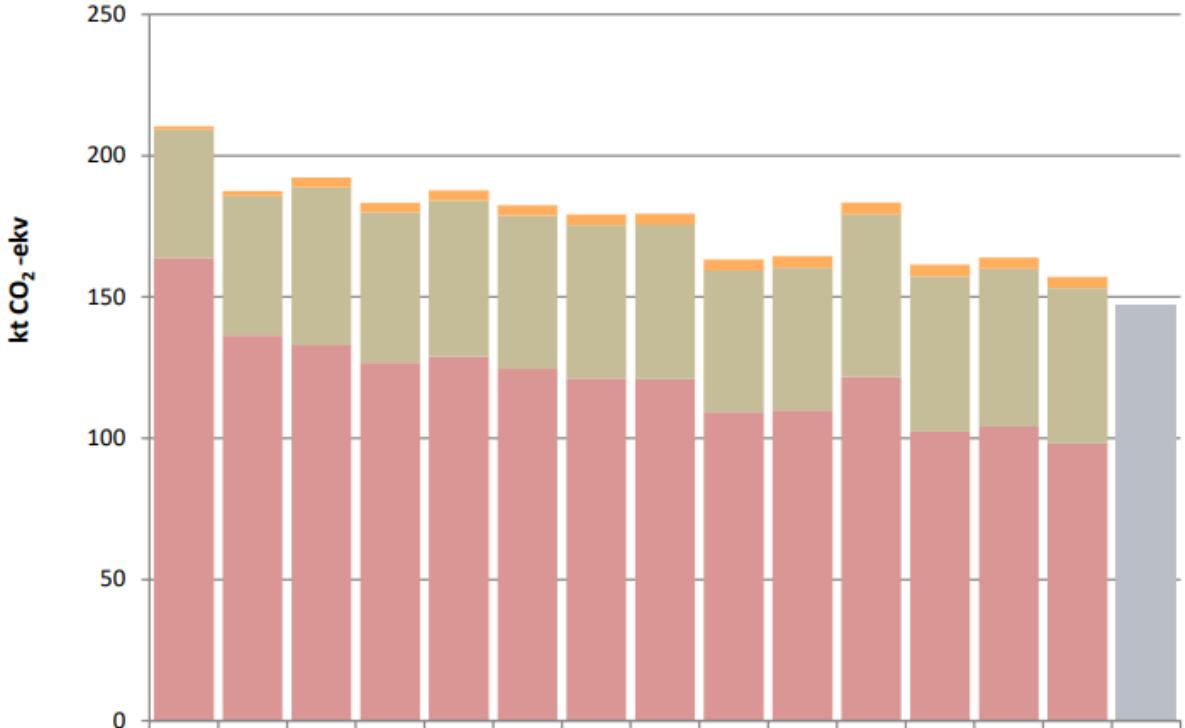
Below are presented the 2020 figures for CO_2 emissions from road traffic (in tons) in the city and FUA.

Municipality	CO_2 (t)
Aura	16 547
Kaarina	70 498
Lieto	43 601
Masku	23 797
Mynämäki	25 064
Naantali	20 752
Nousiainen	13 995
Paimio	41 091

Municipality	CO_2 (t)
Parainen	23 633
Raisio	47 024
Rusko	8 611
Sauvo	7 879
Turku	151 875
FUA total	**494 367**

Current appraisal

Overall, road traffic GHG emissions in the FUA are slowly decreasing. In the city of Turku, the GHG emissions are monitored and reported on a regular basis. The trend from 1990 to 2020 (the 2020 data at this stage was a pre-assessment) can be observed in the graph below. The orange colour stands for mopeds and motorcycles, the beige for main roads and the red for municipal streets and roads.



	1990	2000	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Yhteensä	210,4	187,4	192,3	183,3	187,7	182,5	179,2	179,5	163,2	164,4	183,3	161,4	164,0	157,1	147,3
Moottorip. ja mopot	1,2	1,7	3,5	3,4	3,6	3,8	3,9	3,9	3,9	4,1	4,2	4,1	4,0	3,9	
Päätiet	45,4	49,4	55,9	53,1	55,3	54,2	54,1	54,5	49,9	50,4	57,5	54,8	55,9	54,9	
Kunnan kadut ja tiet	163,8	136,3	132,9	126,7	128,9	124,4	121,2	121,1	109,4	110,0	121,7	102,4	104,1	98,2	

Figure 76: Ktons of CO_2-eq emitted by road transport in the city of Turku between 1990 and 2020. Source: LIPASTO database

3.8.3.3 *Air quality*

Source/method

The monitoring of air quality in the Turku city area is organised in co-operation with the neighbouring cities and the industrial and power production plants. Senior advisor Miika Meretoja at the Turku city Environmental Protection office, who provided the data, is responsible for the carrying out of the monitoring. The measuring network consists of eight fixed and one mobile measuring points.

An air quality review and an emissions dispersion model calculations for the Turku region from 2020 was also reviewed for this indicator (https://www.turku.fi/sites/default/files/atoms/files/turun_seudun_ilmanlaatuselvitys_2020.pdf).

Observations

The measuring station of the city centre, situated at the market square, monitors mainly the effect of traffic on air quality. The results of the measurements are then compared with guide and limit values set up on the basis of what's healthy and what's not.

Besides measuring, air quality and the factors affecting it are researched with emission inventories and dispersion surveys. The long-term effects of the impurities in the air are monitored through biological means, such as, mapping of lichen occurrences, condition evaluation of trees and ground surveys.

Below are presented the yearly average of NO_2, PM10, and PM2.5 from the Turku region measuring stations. Data is not available for NO_x or CO.

NO_2 Yearly averages (20°C) in 2021 (µg/m³)				
The Turku Market Square	**City of Naantali**	**City of Raisio**	**City of Kaarina**	**Ruissalo (an island in Turku)**
14 µg/m³	10 µg/m³	9 µg/m³	9 µg/m³	6 µg/m³

PM10 Yearly averages in 2021 (µg/m³)				
The Turku Market Square	**City of Naantali**	**City of Raisio**	**City of Kaarina**	**City of Parainen**
10.7 µg/m³	10.1 µg/m³	9 µg/m³	8.1 µg/m³	15.9 µg/m³

PM2.5 Yearly average in 2021 (µg/m³)	
City of Raisio	4.5 µg/m³

Current appraisal

Overall, NO_2 levels may exceed the WHO yearly air quality threshold values at some of the busiest intersections in the city of Turku and standard values by some of the busiest streets at the city centre. In the FUA, NO_2 levels are near the daily standard values in the whole core city area, in the centre of the city of Raisio and along the busiest arterial roads. Car traffic emissions have the highest impact on NO_2 levels.

PM2.5 yearly average is well below the yearly WHO threshold value of 25 µg/m3 in the whole Turku region. PM2.5 levels are highest along the busiest traffic routes. Background concentration is the main factor influencing PM2.5 levels, most of which is derived from long-range transboundary air pollution.

PM10 yearly average is well below the yearly WHO threshold value of 40 µg/m3 in the whole Turku region. Daily averages are above threshold and standard values along the Turku city busiest intersections. Road dust raised by the traffic is the main factor influencing PM10 levels.

In the FUA, air quality data is used when making decisions and statements concerning environmental permits and city planning. The gathered data are also useful for the people of Turku. For example, it's good for the asthmatics to know the air quality of Turku on any specific day. For this purpose, real-time air quality data from these measuring points can be accessed via the Finnish Meteorological Institute website:
https://www.ilmatieteenlaitos.fi/ilmanlaatu?as=515&rs=430&ss=186&p=stationindex&pv=20.08.2007&h=09&et=graph&ls=englanti

4. Conclusions

This document presented the baseline situation of the 3 SCALE-UP urban nodes Antwerp, Madrid and Turku on the level of the city and Functional Urban Area (FUA), by identifying the context for innovative change in each urban node and by reporting baseline figures of 24 FUA indicators in 6 CIVITAS impact categories.

The baseline situation of the **context for innovative change** in each urban node was assessed based on an analysis of 4 qualitative indicators – Mood and Motivation, Mass, Momentum and Mechanisms. Important drivers and barriers or challenges are identified in the 3 urban nodes for the four indicators, such as the current COVID-19 momentum which increases the interest in the use of active transportation in Antwerp and Madrid (but also on the use of cars in e.g. Turku) but shows a negative trend on the use of public transport due to its perceived unsafety. In Madrid, for example, it is identified that overall, city authorities have an open mind to accept new transport concepts but that there is a lack of a unified and updated SUMP-strategy at city and regional level.

For each of the 6 CIVITAS impact categories, the baseline situation on city and FUA level was reported, based on a set of FUA indicators which were selected based on relevance and city and FUA data availability.

In the CIVITAS impact category **society-governance**, four qualitative indicators were chosen to analyse the formal and informal cooperation structures and decision-making procedures within the city and FUA of each urban node and to evaluate the availability and types of mobility-related data and the level of data-driven mechanisms that manage the mobility in the city. For example, it is identified that Antwerp city has gained a lot of knowledge on the gathering of data, that is deployed by various internal and external parties and the public, but it is acknowledged that not all data is integrated yet and that there is potential to have a more qualitative data output to allow for a higher level of data-driven decision-making.

For the **society-people** CIVITAS impact category, the baseline situation of the awareness and acceptance of the key elements of mobility was assessed, operational and financial accessibility to the transport network was analysed, person and freight mobility demand was estimated and the contribution of mobility on health was estimated. For example, to estimate the financial accessibility to the transport network, the affordability score of a public transport pass by the poorest quartile of the population was assessed. Madrid estimated the current financial accessibility of PT in the city and the FUA of Madrid at 7.4% and 9.5 % respectively, of the monthly income of the 25% poorest inhabitants, while in Turku the current

financial accessibility of public transport in the city and FUA corresponds to 7% and 6.6% respectively. The Antwerp city and FUA have a lower affordability score, equal to 1.7% and 1.6% respectively.

In the CIVITAS impact category **transport system, in urban node,** the current modal split and the multimodal integration of transport for persons and freight was reported, road safety was assessed, as well as current congestion levels and the quality of the cycling network. Congestion levels, based on TomTom data, are highest in Antwerp, with congestion level of 32% in 2019 and 26% in 2021, followed by Madrid showing congestion levels in 23% in 2019 and 18% in 2021 and turku with a congestion levels of 19% in 2019 and 2021.

In the CIVITAS categories **energy** and **economy**, the current share of low emission cars in the vehicle fleet was estimated, and the number of jobs, business and (un)employment rate in each urban node. Antwerp reported that in the Antwerp Transport Region 2021 only 5.5% of the vehicle fleet are a plug-in hybrid vehicle and only 0.9% is fully electric. In the Turku FUA, the share of low-emission fleets is also rather low, with percentages ranging between 1.7% of the vehicle to 5.3% of the vehicle fleet, depending on municipality. Also in Madrid, a low percentage of 1% of low-emission vehicles were registered in the city of Madrid in 2018.

Finally, the **environment** baseline figures of the air pollution and greenhouse gas emissions from road transport were reported for each urban node and the air quality baseline based on air quality measurements was discussed. In Turku, road traffic CO_2 emissions in the FUA have been slowly decreasing over the last decades and also in Madrid, road transport CO_2 emissions have decreased over recent years.

The evolution of these indicators will be monitored over the course of the SCALE-UP project and reported in D7.6 Moving forward to achieve SCALE-UP objectives in the SCALE-UP FUAs, in September 2024. Not all indicators are optimal yet but their methodology will, where possible, be improved during the project.

5. Annexes

5.1. Annex 1: FUA indicators in the impact category society-governance

Four qualitative indicators are selected to measure the evolution in the CIVITAS impact area society-governance:

- Quality of cooperation structures
- Quality of planning approaches
- Quality of the data layer
- Level of data driven

In the following sections, a common SCALE-UP approach is outlined, to collect information on each indicator, by defining, for each indicator, a list of items to question.

5.1.1. Quality of cooperation structures

Analysis and appraisal of the formal and informal cooperation structures and decision-making procedures

Items to question

- Internal cooperation between the mobility department and other city departments
  - e.g. environmental, special, economic, …
  - e.g. regular common meetings, internal advice, …
- Interaction city mobility department with mobility stakeholders
  - e.g. public transport companies, private mobility service providers,
  - e.g. formal mutual advice, regular meetings, common planning of actions, …
- Organisational body on the level of the Functional Urban Area
  - Participating actors?
  - Advisory body or decision body
  - Financial resources
  - Are the representatives of the participating actors in the daily functioning?
  - ..
- Interaction with other bodies responsibilities for parts of the mobility organisation
  - e.g. the region, national bodies, …
  - e.g. formal mutual advice, regular meetings, common planning of actions, …

Appraisal

Overall synthesis of the baseline situation on the quality of the cooperation structures in order to **push and facilitate** good planning and decisions.

- Main drivers
- Observed barriers or weak(er) aspects

5.1.2. Quality of planning approaches

Analysis and appraisal of the planning approaches in city and FUA and above.

Items to question

- Status and quality[41] of the SUMP of the city
  - e.g. current versions of 2xxx with a time vision to 2xxx
  - e.g. sustainable vision
  - e.g. sustainable modes, walking, cycling, public transport treated as a priority
  - e.g. action list with dedicated budgets to implement the strategy
  - e.g. supported by a strong participatory process involving stakeholders and citizens
  - e.g. integrated planning of freight transport (integrated SULP)
- Status and quality of the mobility planning on the FUA
  - e.g. existing of a full SUMP on FUA level
  - e.g. other mobility related planning on FUA level
  - e.g. formal mutual advice, regular meetings, common planning of actions
  - e.g. action list with dedicated budgets to implement the strategy
  - e.g. supported by a strong participatory process involving stakeholders and citizens
  - e.g. integrated planning of freight transport
- Other mobility related plans to implement a strong sustainable mobility strategy
  - e.g. operational action plans on cycling measures
  - e.g. integrated land-use mobility vision plan

Appraisal

Overall synthesis of the baseline situation on the quality of the planning in order to push the implementation of sustainable mobility strategies and measures.

- Main strong elements
- Observed weak(er) aspects

[41] See the SUMP self-assessment tool: https://www.sump-assessment.eu/English/start

5.1.3. Quality of the data layer

Analysis and appraisal of the quality of the data layers with an extra focus on active modes

Inventory of data

Describe which data are collected and made available on the level of the city, FUA or at higher levels.

- Existence of integrated data platforms on city or regional level
  - e.g. platforms managed by the city, stakeholders, private bodies, …
- Mobility related data collected on integrated platforms
  - which type of data is collected, on-line or off-line,
  - purpose of these data e.g. static and real-time information, for planning and optimisation and real-time management of the multi-modal transport system
  - e.g. safety data in general and specifically on active modes
  - e.g. traffic flows in the city, on the motorways, …
  - e.g. parking data
  - e.g. cycling flows, pedestrian flows, public transport passenger flows
  - e.g. air pollution

A template table for the analysis and appraisal of the quality of the data layers is given in Table 39.

Type of data	Collected on city level	Collected on regional level	On-line (real-time)	Off-line	Provided by	Made available to	Other comments

Table 39: Template table for the inventory of data

Appraisal

Synthesis of the current status of data management in the city and FUA to plan, monitor and optimise the functioning of the multi-modal mobility system and to inform its users (and more…).

5.1.4. Level of data driven

Analysis and appraisal of the level to which extent the multi-modal mobility system is planned, organised and used in a data driven way. Here not the quality of the data is assessed but an analysis is done on the extent to which elements of the multi-modal system are steered based on data that is collected. Some examples are given below.

Inventory of mechanisms

- Real-time mechanisms in the management of the multi-modal mobility system that are data driven, steered and pushed by the data we collect
  - e.g. parking guidance system guiding the cars to parking places and Park & Rides taking into account the occupancy rates of the parkings and the traffic flows e.g. congestion level and air quality levels in the city
- Operational planning mechanisms in the management of the multi-modal mobility system that are data driven
  - e.g. closing of the city centre for cars based on measurements and predictions of the air quality in the city

Appraisal

Synthesis of the current extent in which processes in the organisation of the multi-modal system are data driven.

5.2. Annex 2: Indicators for the context for change

To assess the status of each of the 4 indicators for the context for change — Mood and Motivation, Mass, Momentum and Mechanisms — a range of questions are listed, and examples are given from EU cities on their level of maturity for that specific aspect.

The questions were answered by each urban node during workshops with local stakeholders (e.g. SCALE-UP Measure Leaders, representatives of different society groups, etc.). The observations during the workshop are complemented by studying what is happening and published in the community and what is formulated in urban policy.

The observations for each of the indicators are synthesised into an appraisal for each indicator, thereby identifying the main drivers to push change and the observed barriers or weak(er) aspects.

5.2.1. Mood and Motivation

Mood identifies the level of **acceptance** of a new type of transport policy, whether citizens, planners and policy makers are open to new ways of organising mobility and accepting new ways of living. Motivation identifies the **quality of the governance and organisational structures** that drive a change in transport policy. Both aspects are assessed together.

Possible questions to assess the level of maturity of Mood and Motivation:

- Do the existing transport or mobility policies specifically **address sustainable urban mobility**? e.g. in a SUMP
- Is there an **ongoing discussion** about the need for new or updated transport policy, to better meet mobility needs, to increase liveability?
- Are **citizens or community groups active participants** in the discussion about transport and mobility policy?
- Are the **local authorities/ agencies with responsibility** for urban mobility open to look at new types of mobility policy?
- Are **citizens (and lobby groups)** open to look at new types of mobility policy?
- Is **car traffic perceived to be a crucial problem** that requires active mitigation?

Examples
The city has an open mind to accept new transport concepts.
The transport and mobility responsible prefer trying things out, rather than studying them further. They dare to make errors and learn from those errors, "learning by doing and trial and error".
There are multiple articles on new mobility solutions in the city publications/press.
There is a generally accepted SUMP with strong sustainable goals & actions.

5.2.2. Mass

Even if there is a high acceptance to introduce some changes, it is crucial there is **capacity to make change happen**. E.g. are the appropriate organisational structures and people with sufficient capacity in place to design, organise and operate new mobility services?

Possible questions to assess the level of maturity of Mass:

- Is there existing **capacity** in the area to design, organise and operate new mobility services?
- Is there **any formal or ad hoc forum** that brings together stakeholders to discuss and consider new or amended transport policies?
- Are there **working arrangements** between the institutions/agencies and mobility service providers?
- Have any of the institutional, operator or community stakeholders **participated in European projects** (other than SCALE-UP), and have they experience in know-how exchange?
- Is there a **strategy for supporting activities** to be done for changing the mobility behaviour of the population of the region?

Examples
Decision makers are aware of the fact that the related deficits are an issue especially for the elderly generation.
Private and public agencies organizing knowledge-transfer and supporting local communities by developing similar initiatives.
Political and operational cooperation platforms between city and region.
There are research groups on sustainable mobility solutions.
The city department working on citizens awareness and behavioural change.

5.2.3. Momentum

This aspect identifies whether elements to speed up change are available in the city. If a city wants to have a change, it needs to 'grab the moment'. For that, momentum is needed.

Possible questions to assess the level of maturity of Momentum

- Are there any **incentives** (legislation, funding,…) of the regional, national or European level that pushes the change?
- Are there **any citizens initiatives game changers** in the mindsets on urban mobility and acceptance of urban traffic factors as safety and air quality?
- Is there a specific **political momentum** of changed visions and policy goals?
- Is there any **demographic or economic momentum** that requires new approaches on mobility?

Examples
At national level, laws have recently been voted that provide incentives for people who use alternative mobility (carpooling and cycling) at least 100 days a year for their commuting, accelerating the use of alternative mobility solutions.
The COVID-19 period pushed the rethinking of mobility in the city.
The recently elected government wants to start a new direction in the mobility policy.

5.2.4. Mechanisms

Last but not least, strong processes or mechanisms are needed to develop new solutions, and to control and manage change.

Possible questions to assess the level of maturity of Mechanisms

- Are there specific **organisational structures** in the city and in between the city, region and national levels to **develop, monitor and manage** the implementation of new mobility strategies?
- How stable are **the working relationships and business agreements** among the city and other participating stakeholders?
- Is there a **participative process** for local communities and people **to shape the mobility solutions** in line with their needs and preferences?

Examples
City department with persons of the different city/regional sectors to manage new strategies in an integrated way.
Public-private partnerships to develop and implement integrated mobility solutions (infrastructure, management, services, promotion, ..).
Integrated monitoring and evaluation approach to optimise running policies towards the sustainable goals set.