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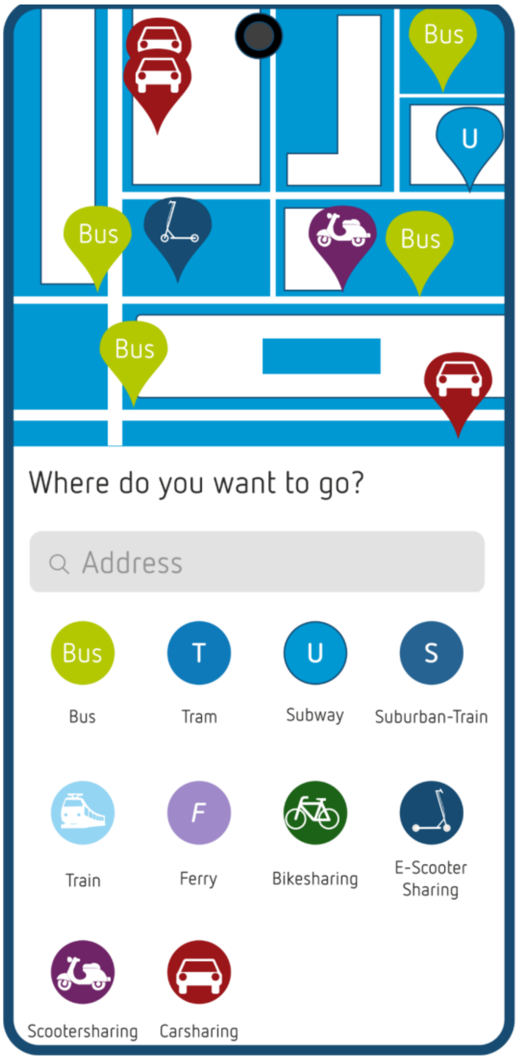

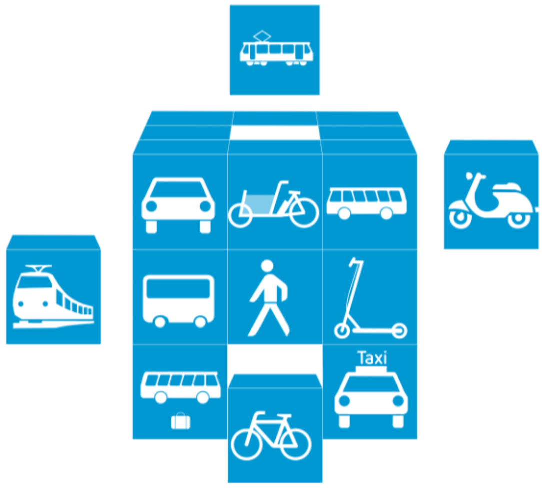

Mobility as a Service – MaaS

Concept and Transferability Report

HUPMOBILE – Holistic Urban and Peri-urban Mobility Report, 2021

Imprint

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Project note

The EU co-funded project **HUPMOBILE – Holistic Urban and Peri-urban Mobility** (2019–2021) brings together municipalities, universities and other expert organisations in their efforts to develop a holistic approach to the planning, implementation, optimisation and management of integrated, sustainable mobility solutions in the Baltic Sea port cities.

The carried out activities enable major urban mobility stakeholders such as city authorities, as well as infrastructure providers and transport providers to assess and integrate innovative mobility options into their mobility management plans and policies. The developed HUPMOBILE framework allows the planning and implementation of well-functioning interfaces and links in urban- and peri-urban transport considering the different transportation flows in the local context.

Within HUPMOBILE, partner cities plan, test and implement innovative sustainable urban mobility for both people and goods (i.e. freight, cargo logistics and delivery), which are easily adoptable for follower cities. These include greener urban logistics and combinations of goods- and passenger traffic, intelligent traffic systems-based services, tools for stakeholder participation, and new tools for transportation mobility management and Mobility-as-a-Service (MaaS).

Content

Introduction

The Free and Hanseatic City of Hamburg and here the District of Altona is a project partner in the European Interreg project "HUPMOBILE". Together with the Baltic partner cities Tallinn, Turku and Riga, sustainable approaches to the control, optimization, and management of traffic and transportation are to be developed under the leadership of Aalto University Helsinki. Thematically, the focus of HUPMOBILE is on commuter movements in port cities.

In the project HUPMOBILE two focal points represent the main themes of the project: The use of environmentally friendly means of transport (active mobility) and the area of logistics in the port. In the following, the study on the innovative concept of Mobility as a Service (MaaS for short), a system that brings together all means of transport in a user-oriented and bundled way, is presented. The city of Hamburg has already gained experience with various car-sharing providers in recent years. In addition, Hamburg has a very well-established bike-sharing system. Currently, public transport providers are working on linking different modes of transport to solve the problem of the first and last mile in particular. For this purpose mobility hubs have already been installed in Hamburg. However, numerous challenges have not yet been solved, for which the HUPMOBILE project was initiated: So for example the centrally located mobility hubs currently cannot solve accessibility problems in suburban and peripheral areas. Downtown, in particular, is heavily burdened by high commuter volumes. Thus, alternative transportation models must grow in importance.Moreover MaaS approaches should reduce motorized commuter traffic in the future by linking operational mobility management. Here, the Altona district authority wants to set a good example (for this the Klimatelschutzkonzept Mobilität Altona is the binding basis for this.).

The aim of this report is, besides the theoretical-scientific approach of the often differently defined term MaaS, the development of a concept in which the potential of MaaS systems is put into focus and evaluated. The main component of the idea is the planning of intelligent bicycle routes in the district of Altona, whereby solutions are worked out in particular for the traffic "bottlenecks" Teufelsbrück and Alter Elbtunnel (Old Elbe Tunnel) on the one hand and the other hand the accessibility of the work location Schnackenburgallee is guaranteed. The bottlenecks are important connecting points between the port area and Hamburg Altona. Thousands of commuters travel along here every day. Their mobility behaviour must be improved in the direction of active mobility. The district of Altona suffers extremely from the high traffic loads resulting from the port area. It is therefore important to further develop active mobility and public transport, especially in the port area. The necessary infrastructure must be provided for this. In addition, the possibilities of making logistics transport more environmentally friendly (e.g. cargo bicycles) must also be examined, for which the appropriate infrastructural arrangements must also be established. In general, this report also aims to identify challenges for active mobility so that transferability to other port citites is possible. Since MaaS is primarily intended to reduce individual traffic, this study supports the overarching goals of HUPMOBILE. The target group of the report are cities that want to deal with MaaS in the future and that especially want to use MaaS as a solution to traffic bottlenecks.

1. Theoretical-scientific approach to MaaS

How mobility will look in the future is one of the defining decisions in the second decade of the 21st century. Due to climate change and societal changes, Mobility as a Service (MaaS) promises a new approach to solving traffic problems and climate-related consequences in urban areas. MaaS represents a target state that embodies a counter-design to today's mobility behavior. Thus, MaaS can efficiently use resources and a sustainable shift from today's modality to inter- and multimodality. At the beginning of this chapter, the concept of MaaS is approached theoretically and scientifically. The implementation steps of a MaaS ecosystem are then explained in more detail before two best-practice variants of already implemented MaaS systems are presented with the practical examples of Whim from Finland and UbiGo from Sweden.

1.1. Definition

In the Smart City context, the sharing economy has emerged as a strategy for sustainable consumption. Shared mobility means short-term access to shared vehicles, depending on the users' needs, instead of owning one's car. Among other things, shared mobility is the goal of MaaS, which offers mobility as a service in various forms of sharing[1]. Currently, none of the existing multimodal mobility platforms in Germany combines the data of all mobility providers. Ideally, this is implemented by

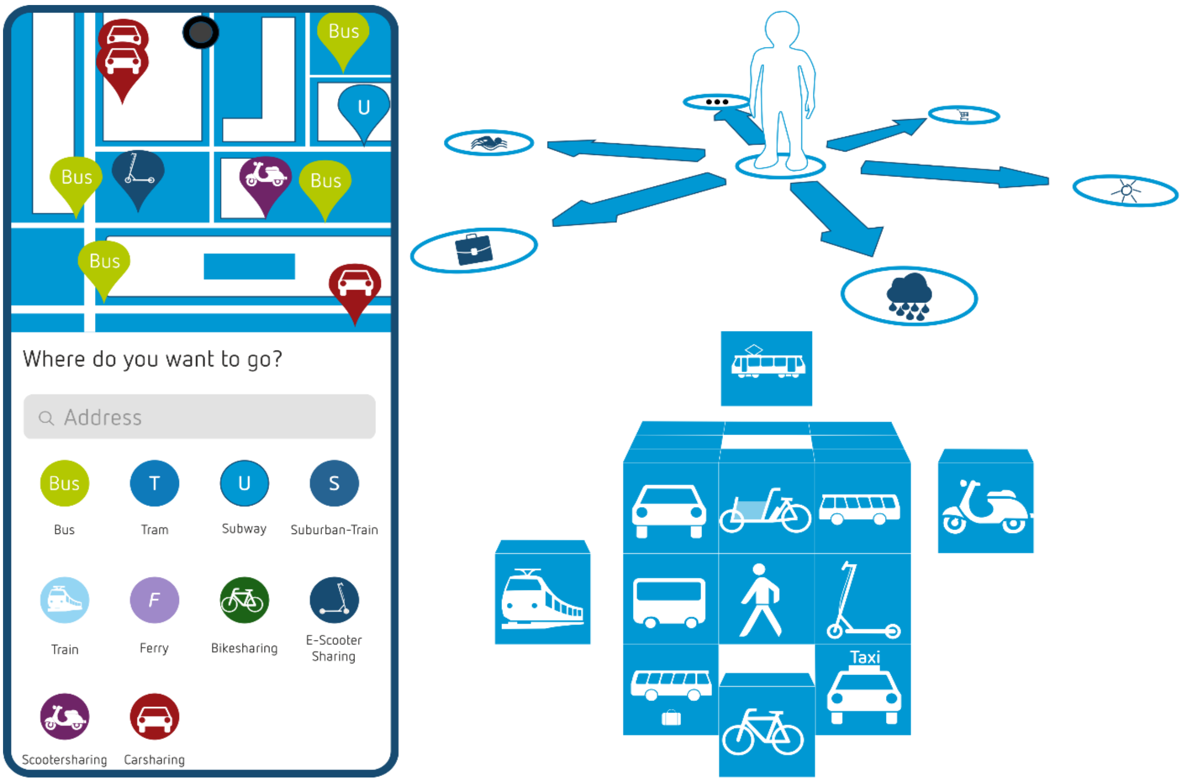

Figure 1: The idea of "Seamless Mobility" (source: own illustration, Planersocietät)

[1] Arias-Molinares, García-Palomares (2020): 253

combining transportation services from public and private transportation providers on-demand and via a uniform gateway that creates and manages the trip in a MaaS system. Through what is known as an application programming interface (API), data is tapped or fed in from external parties so that all data is available in a standardized format. There is also a single payment channel instead of multiple ticketing and payment processes. MaaS thus overcomes the existing boundary between individual transport and public transport towards public individual transport. In the best case, users can decide how they want to travel based on the purpose of the trip, the weather, and the availability of different modes of transport. MaaS matches mobility to each individual's personal needs, suggesting to users all possible modes of transport to accomplish a journey from A to B. Different users have different mobility requirements: Business travelers, for example, value reliability and punctuality, while students tend to book with price in mind. This potential conflict of interest in MaaS attributes underlines the need to develop a service that combines choices for specific target groups.

In addition, it is possible to pay for each mode of transport individually via an app or to decide via a monthly plan which mode of transport is to be used regularly and then to take out a subscription that functions analogously to a ticket for local transport. When planning the trip, users have the following means of transport at their disposal: Public transport shared vehicle fleets (consisting of car-sharing, bike-sharing, and scooter-sharing), cabs, and ride-hailing and ride-sharing service providers.)[2].

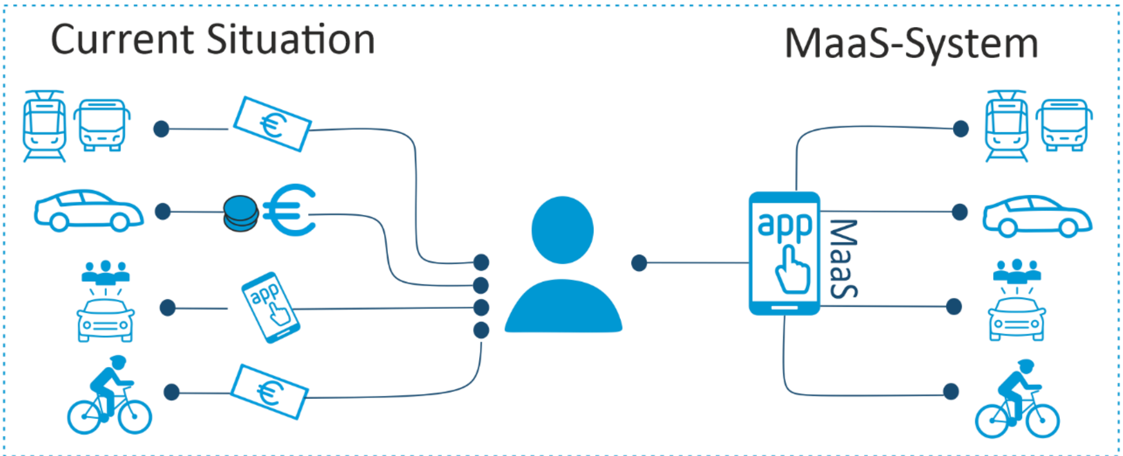

Figure 2: The current situation vs. MaaS (source: own illustration, Planersocietät)

Following this approach, we adopt the definition of University College London (UCL), which defines MaaS as "Mobility-as-a-Service (Maas) is a user-centric, intelligent mobility management and distribution system, in which an integrator brings together offerings of multiple mobility service providers, and provides end-users access to them through a digital interface, allowing them to seamlessly plan and pay for mobility."[3] A similar definition is provided by EMTA (European Metropolitan Transport

[2] UTIP (2019): 2 f.
[3] UCL 2018: 3

Authority) in 2019[4]. Accordingly, MaaS represents an innovative concept that handles all mobility requirements on demand for the customer. The service is based on the seamless integration of all public and commercial modes of transport. Thus, with the help of MaaS structures, all mobility service providers are brought together in a single service. Here, the top priority of the service is to enable multimodal travel.

Furthermore, MaaS generates additional insights about the demand, the needs, and the behavior of the users. Ideally, the collection of data helps cities and authorities to develop traffic and infrastructure structures further. So-called shared mobility can offer a solution to the problems of the first and last mile.

Currently, transport operators are the main focus of attention on the supply side. However, many more companies from various industries, such as consumer service providers, can join the so-called MaaS platform. This includes data import, data storage, trip planning, optimization, ticket sales, payment, and communication[5]. Thus, users are provided with target and actual data for public transport, sharing and pooling offers, and their location and availability[6].

The three core characteristics of MaaS - focus on users, platform-based, and independence from own vehicles - can be further formulated in ten categories:

1. combination of means of transport: Intermodality (users can differentiate between different modes of transport and travel intermodally).
2. fare option (either flat rate or pay-as-you-go option)
3. one platform (app/website)
4. multiple actors (interaction of users, transport providers, platform management bodies)
5. technological use (mobile internet, GPS tracking and e-tickets)
6. demand-driven (users are at the center: create the best possible individual transport solution through multimodal travel planning)
7. registration (registration is required on the platform (single sign-on))
8. personalization (the offers refer to the individual behavior of the users)
9. customer orientation
10. real-time information

[4] Eltis (2019): 7
[5] Jittrapirom et al. (2017): 16
[6] Mobility-Inside (2021)

There is no doubt that the introduction of MaaS requires a paradigm shift in society for high user acceptance. In the long term, there would be a shift from individual ownership to on-demand service. Figure 3 shows an exemplary scenario: autonomous vehicles alone will not reduce total IMT. Holistic approaches, such as MaaS, are needed for a reduction to be noticeable in the long term.

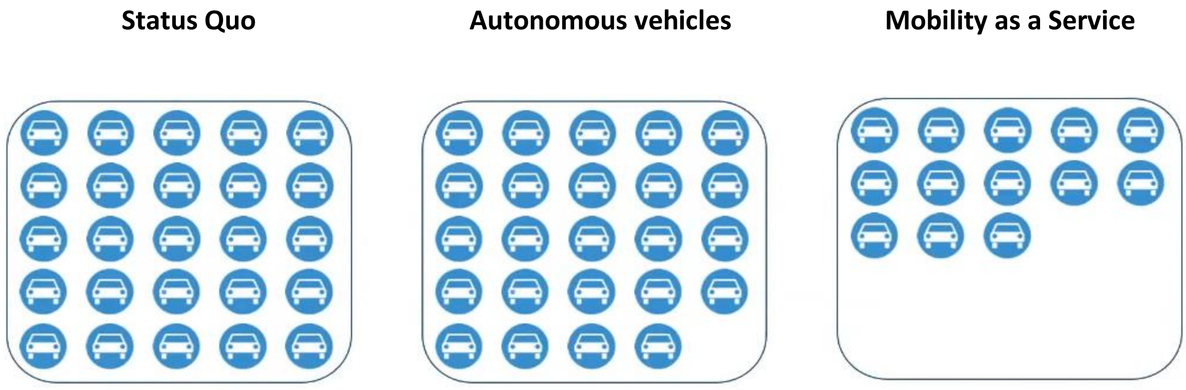

Figure 3: Status qou vs. MaaS in realtion to car traffic (source: own illustration, Planersocietät)

Whim and UbiGo are two European systems that have now gained worldwide notoriety. Others can be classified into different categories according to their level of integration[7]:

(1) MaaS pilots with partial integration: a basic level of integration, the system has ticketing, payment, and ICT integration in parts. Examples of MaaS pilots at this level are Moovel or hvv switch (both Germany).
(2) MaaS pilots with advanced integration: Each pilot has entire ticketing, payment system, and ICT integration. Pilots from this category are Smile (Vienna, Austria) or Optymod (Lyon, France).
(3) MaaS pilots with advanced integration and mobility packages: They offer monthly packages and pay-as-you-go options for mobility. Pilots from this category are UbiGo (Gothenburg, Sweden) and the Whim app in Helsinki (Finland), Antwerp (Belgium), and West Midlands (UK).

Chances

In general, the establishment of a MaaS system in a municipality offers numerous opportunities. However, MaaS can only generate real added value when the system is established beyond municipal boundaries, in the best case on a Europe-wide scale. In this way, car traffic and car ownership can be reduced in the long term. Therefore, in addition to the introduction of MaaS, other push and pull measures are also necessary to reduce car traffic and promote environmental transportation.

Furthermore, a customized transportation service based on customer needs can be provided. The personalized approach of MaaS can inspire the development of sustainable transportation solutions.

[7] Arias-Molinares, García-Palomares (2020): 258

It provides access to all modes of transport, which can create awareness for sustainable use, thus decreasing the space requirements of mobility forms in the long run. Furthermore, MaaS catalyzes bringing together data and information services. Accordingly, valuable datasets and insights are shared between MaaS stakeholders (depending on the MaaS operator), opening up further opportunities through a better understanding of how transportation networks work, how usage patterns change, and how information is disseminated. There is also the potential to increase revenues for public transport operators, which are the backbone of a MaaS system. This can be achieved by increasing ridership due to improved linkages to other modes of transportation, especially for the first and last mile. The public transport service can be optimized through an enhanced understanding of the required demand through data collection and analysis[8].

Challenges

On the other hand, there are numerous challenges in establishing MaaS systems within a municipality and beyond. For example, there are challenges in the technical and business areas, in the question of data protection regulation, but also barriers for specific user groups. Furthermore, it must be emphasized that MaaS cannot be seen as a "panacea" for all traffic problems. Instead, it is one of many building blocks on the path to sustainable mobility. At best, MaaS can contribute to providing sustainable alternatives to the private car by making different means of transport available in a low-threshold manner. Starting from the premise of the own car as the "model solution" or "gold standard", as it is widely seen, a rethinking must also occur here above all, in which mobility and means of transport are seen as a service. In addition to the establishment of MaaS, other measures must also be implemented that, for example, increase the quality of stay in public spaces or make the use of one's car seem unattractive.

Concerning data protection, there are high hurdles, especially in Germany, which lead to problems from a user's point of view, particularly in connection with mobility services. Above all, single sign-on, i.e., central registration with a service that passes on the corresponding data to the other services, is a significant problem in terms of data protection - but at the same time also an essential factor in the use of MaaS. The attractiveness of a product can suffer a significant loss of quality if users have to register separately for each component of the MaaS system (car sharing, bus, scooter, etc.).

However, the most significant difficulty is that the primary conditions in cities and regions are always different, so it seems complicated to apply a single tried-and-tested system universally. Consequently, every MaaS system in a municipality is in some way unique. Furthermore, it is questionable whether MaaS can make a significant contribution to environmental protection at all, as there are currently few studies that show whether users switch to environmentally friendly means of transport, or even whether motorized private transport increases as a result of the use of rental cars.

[8] IET (2019): 6

According to initial studies, free-floating car sharing, for example, has corresponding effects. A Jevons paradox of this kind could also threaten MaaS, especially if autonomous vehicles are increasingly integrated into it.

The business areas of mobility service providers are also problematic. In this context, private companies serve primarily certain urban areas, mainly urban and high-density areas, in a way that is understandable from a business perspective against the background of social participation and to prevent social inequalities and a purely entrepreneurial, profit-oriented, and commercial approach, intervention on the part of the government or local authorities would be necessary. These need to make the underlying infrastructure available to both MaaS providers and transport operators. In addition, legislation and policies at the state level must ensure that data sources are consistent and shared from both the public and private sectors. The sharing of necessary mobility data will be done in compliance with data protection regulations.

Another problem in establishing a MaaS system is financing. While MaaS is an attractive concept for travelers (getting all mobility needs from one provider), it needs to be financially attractive compared to procuring services from multiple providers. This could lead to challenges associated with building a financially sustainable business model for the MaaS operator that allows competitive pricing while supporting a defined level of service (e.g., in case of disruptions to transportation services). In addition, it must be determined which provider receives how much money for intermodal trips (example: a journey from A to B is made 25% by rental bike, 50% by bus, and again 25% by rental car). Is the payout based on the company's current costs? Is everything equated? Are the fees for the general public included?

Furthermore, MaaS is dependent on both transport and communications infrastructure. In large cities with a 5G mobile network, this is not a significant problem. Further, however, there are rural areas that currently have low bandwidth mobile coverage and lack reliable public transportation, leaving potential passengers to rely on private vehicles. Therefore, to realize the benefits of MaaS as widely as possible, reliable transport and communications infrastructure are essential[9].

Care must also be taken to ensure that the digital orientation of MaaS structures does not leave the older and digitally averse segments of the population behind. Furthermore, to ensure that MaaS does not lead to social exclusion in the future, the part of the population that does not have the digital prerequisites must also be reached.

[9] IET (2019): 18 f.

1.2. The implementation of MaaS

The successful implementation of a MaaS system should focus on what is most important - the users. One of the biggest challenges is to offer an individually tailored mobility package. The foundation for MaaS is laid by the sharing economy, as the so-called millennials are the first generation to be accustomed to technological progress. Other essential elements for MaaS are mobile payment options, GPS, Internet of Things, Big Data, or connectivity among different modes of transport. On the other hand, the development of MaaS is slowed down by numerous factors, such as the non-existent standardization of data formats and APIs, regulations, public-private collaboration, and their conflicting objectives.

The implementation of MaaS can proceed differently depending on the operator model (cf. Chap. 1.3). In the following implementation pattern, the municipality is the initiator. Due to the exercise of its planning sovereignty, the phases can be implemented as described. Thus, the establishment of a MaaS system concerning sustainable mobility planning can be divided into four phases[10]:

1. Preparation and analysis
2. Strategy development
3. Measure planning
4. Implementation and monitoring

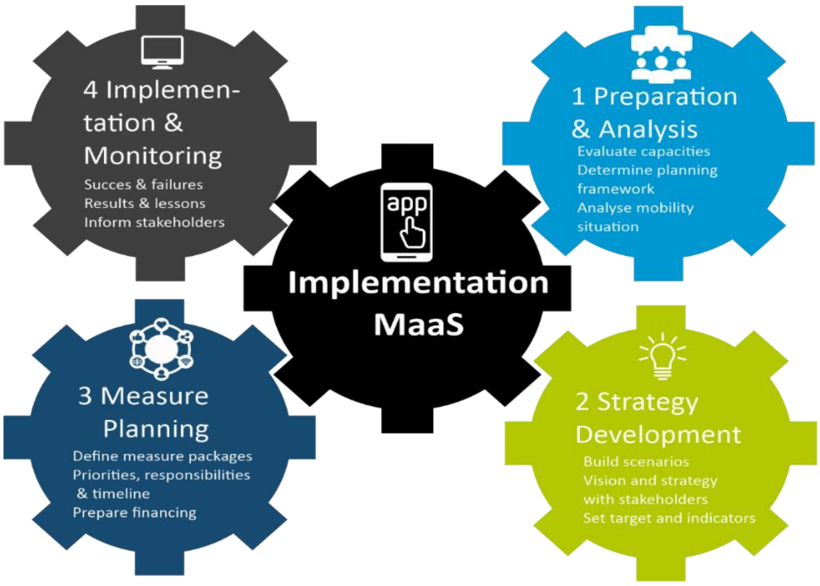

Figure 4: Implementation phases of MaaS (source: own illustration,, Planersocietät)

[10] Eltis (2019): 17 ff.

Phase 1

In the first phase, a working structure with a planning framework must first be established. Here, the municipality (or other MaaS operators) should aim to bring together all stakeholders. These have different attitudes and strategies as well as different interests to be included in the MaaS plan. Next, the mobility situation must be surveyed. Here, a comprehensive pre-analysis is appropriate. With the characteristics of MaaS listed in chapter 1.1, the first questions to ask are: What is necessary for MaaS?

- Since MaaS aims at intermodality, **many transport modes** must be available, eloquently integrated physically into urban structures. So the questions are: How prepared is the current transport system and which transport modes are available? Are the cycles of the different transport modes coordinated with each other? During which periods are which parts of the city served or not served? In addition, the density of the network of individual transport modes also plays an important role.
- MaaS is offered through a **single platform** in the municipalities. The status quo of this criterion also needs to be examined when introducing a MaaS system. Is there already a website/app that bundles the currently available offers?
- With MaaS, the data is transmitted in real-time. This requires data sharing and a firm privacy policy. Third-party providers can access the data or feed their data via APIs. All transportation providers need to **disclose their travel data** here. This is the only way to make trip planning seamless and allow MaaS to play out its advantage over conservative transportation modes. What is their level of readiness?
- Another decisive factor is how modern the **ICT infrastructure** in the municipality already is. Are there already smart ticketing options available, for example?
- MaaS stands for a **paradigm shift** in society. In some areas, the focus is on individual means of transportation, but this is changing to on-demand services. So what does the reorganization and readiness in society look like?

This process's scope and content strongly depend on the actor constellation of the MaaS operator; different models are possible here (see chap. 1.4). Aggregated, anonymized usage data should be shared in a two-way path between cities, public transport authorities, and public and private transport operators.

Excursus: MaaS in Sustainable Urban Mobility Plans

In municipalities, transport developments can be controlled and influenced by informal instruments such as transport development plans or mobility concepts. MaaS structures can be coupled with an existing instrument of transport planning - the Sustainable Urban Mobility Plan (SUMP) - to simplify their establishment. SUMPs are used by local and regional authorities for strategic mobility planning. The focus is on a shift towards sustainable transport modes and the integration of all transport modes. Thus, a SUMP can contribute to the solution of urban transport problems. It can be seen that the main objectives of a SUMP and a MaaS system are to a certain extent in line with each other. In the following, the eight principles of a SUMP will be put into context with MaaS. The focus here is on the areas in which MaaS can add value to future transportation planning: By contextualizing the eight SUMP principles, it becomes clear which supporting role MaaS can play in future urban and transport planning. Several added values from integrating MaaS into a SUMP are listed below:

- MaaS has the potential to better monitor, facilitate, and influence mobility demand patterns and accessibility, and to promote multimodality. The service can be established nationwide in urban areas and to some extent in suburban areas.
- MaaS can serve for evaluating the current and future performance of the urban and regional transportation system, given adequate capacity, resources, and insti-tutional facilities. Extensive data is needed to derive findings of the evaluation framework from the impacts of MaaS.
- Through MaaS, information on demand and use is obtained so that supply is more adapted to the needs of users. Information, booking, payment and ticketing systems must be compatible.
- MaaS crosses municipal, regional and possibly even national borders, so that cooperation among numerous different institutional bodies at regional and national level is a necessity.
- The involvement of citizens and stakeholder groups is considered key to the success of the quality of the process. Further important is the design of an assessment framework regarding the impact of MaaS. This raises the question of how the impact of MaaS can be measured in the long term.

Phase 2

The second phase is characterized by the development of future scenarios, collaborative visions with stakeholders, and the formulation of targets and indicators. The main challenge remains to bring all stakeholders (public administration, private sector, and scientific institutions) together for a common mobility strategy. The city defines the strategy for MaaS in an open dialogue with all stakeholders and then formulates target values. These can include: increasing environmentally friendly modes of transport in the modal split, reducing car use and car ownership, improving access to different modes of transport, influencing travel behavior, or even improving air quality. The general goal is to achieve a significant shift to more sustainable modes of transportation. It is crucial here that an operationalizable and transparently measurable evaluation framework is designed.

Phase 3

The third phase is the planning of measures. Important aspects are the selection of measures and the clarification of responsibilities. Possible steps here include the modernization of booking and ticketing systems, support for the interoperability of services, or the development of multimodal hubs. In general, planning is needed to integrate traditional transport into multimodal mobility so that in the future individual transport and local public transport blur into individual public transport. While the actions and responsibilities in the implementation of MaaS strongly depend on the role of the key stakeholders, it is common to stimulate an innovative approach through pilot projects. Through these, for example, technological barriers can be overcome.

Further on, MaaS measures can have a targeted influence on traffic management. For example, MaaS can refer to other means of transport so that traffic flow is optimized and mobility is made more efficient. In addition, authorities should define and harmonize quality standards for all new mobility providers at this stage. Guidelines provide general algorithms so that there is a level playing field for all transport providers.

Phase 4

In the fourth phase, the measures must be introduced and monitored to evaluate the MaaS system's continuous evaluation. This is the only way to document and show progress. The entire process is understood as learning-by-doing so that specific measures must be questioned repeatedly and readjusted if necessary. For there to be a high level of willingness to use MaaS within the population, certain aspects must be guaranteed. For example, motorized private transport must be made as unattractive as possible through planned push factors, such as increasing parking costs or taking away public parking spaces.

In contrast, MaaS is made as attractive as possible using a single app for trip planning, booking, and tickets. The same applies to dynamic information transmission, which displays delays and other events in real-time. It is also essential to ensure digital access to information and data. To this end, the data must be reliable and secure against third-party interference. In this aspect, regulations on the local government and the EU play an important role. Data security and data protection must be defined by law. In addition, an open data standard is needed, so that market access for new mobility services is possible without any problems. Also of high importance is the exchange of data between the mobility service providers and the MaaS operator.[11] Transport companies may feel concerned about disclosing their data.

Currently, in many municipalities, the right of third parties to sell tickets on behalf of a transport company is not possible. However, the MaaS operator cannot act as an intermediary between the mobility service and the users without this step. Here, government agencies' task is to promote open data exchange and implement policies and regulations. In Germany, this is already being practiced by MDM - Mobility Data Marketplace practiced [12]. With the MDM platform, firmly defined standards for data exchange are securely provided by the Federal Ministry of Transport and Digital Infrastructure. According to the EU's Intelligent Transport Systems Action Plan, the MDM represents the national access point for mobility data prescribed via regulations. On the MDM, data from other portals (geo-portal.de, mCLOUD.de, open-data-oepnv.de) are offered and as much mobility data as possible about different means of transport, network elements, or actors.

An indispensable prerequisite for using MaaS is currently the availability of a smartphone or credit card. The current modal split and the share of car owners are essential indicators that show how easy MaaS is or is not to implement. For example, MaaS can be a viable alternative to private vehicles in areas with reliable public transport and car-sharing services. This is in contrast to places where a high proportion of MIV dominates. It is to be expected that the MaaS offer will be more readily accepted by the younger generation, as they are familiar with the technology and have a greater affinity for sharing.

[11] More detailed models are presented in chapter 1.4

[12] https://www.mdm-portal.de/

1.3. MaaS operating- and governance models

In the following, different MaaS operation and governance models will be presented, showing the possible roles of a city regarding establishing a MaaS system. At the outset, it should be mentioned that due to the uniqueness of each city and region, there is no universal model. However, it can be said that the possible potentials brought about by MaaS depend on the type of model chosen. The most important question is always who is the operator of the MaaS system.

(1) Private operator

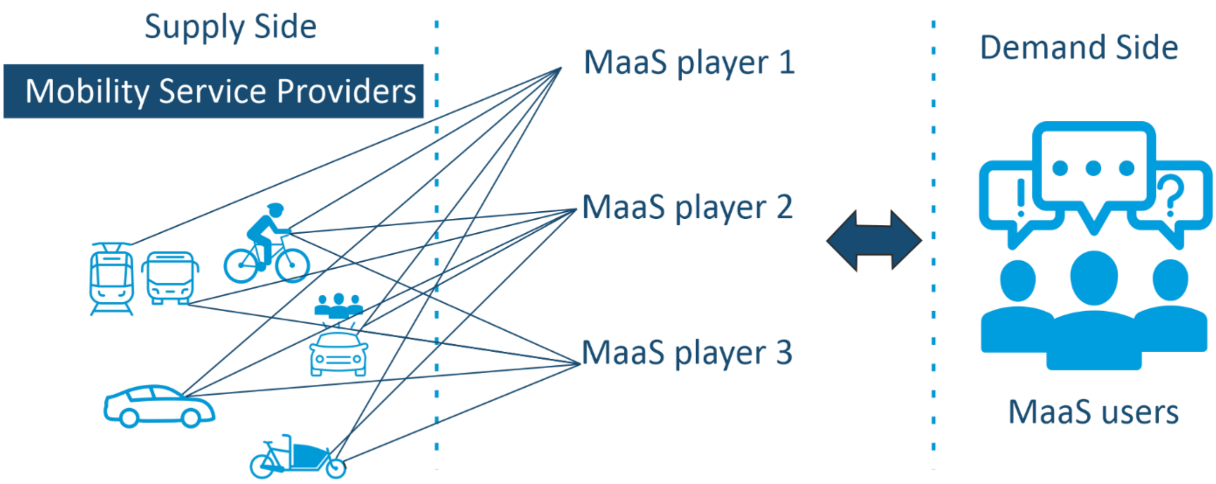

Figure 5: MaaS-Modell 1: Private provider (source: own illustration, Planersocietät)

Commercial companies act as MaaS operators in the first model, entering into bilateral contracts with transport operators. This model could lead to a more customer-oriented approach with high innovation potential based on the intense competition in the free market economy. From a policy perspective, public authorities should monitor market developments and consider policy measures where appropriate, ensuring that social inclusion and sustainable transport modes are promoted. Furthermore, policy intervention may be required in the mutual exchange of data between MaaS operators and mobility service providers. For example, legislation could be enacted to require all transportation operators, whether private or public, to share their data. Since the entire MaaS system is commercial, ineffective aspects could be effectively transformed through political regulation[13]. The Act on Transport Services from Finland can serve as an example. Here, the following is enshrined in chapter 2:

"In addition to what is provided elsewhere in the law, a traffic control and management service provider has the right to obtain, notwithstanding secrecy provisions or business or professional secrecy, information that is necessary for the traffic control and management service provider for the performance of its statutory duties. The right to obtain information covers information on traffic control

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[13] ELTIS (2019): 32, UTIP (2019): 17

equipment and their functioning, on traffic incidents and accidents, on disturbances in traffic and communication networks, on vehicle locations, meteorological data, and information on conditions, as well as other information for forming a traffic situation picture and about traffic safety and traffic flow. A traffic control and management service provider has the right to obtain information from:

1. public or private actors who perform repair and maintenance activities and construction work for the infrastructure network;
2. communication network administrators on disturbances in the communications network;
3. pilotage service providers and port authorities;
4. other traffic control and management service providers;
5. train, vessel and aircraft owners, traffic operators or their representatives;
6. on a separate request from other actors whose actions influence traffic safety or traffic flow." (Act on Transport Services 2018: 57 f.)

As a result, it is precisely specified which information MaaS operators receive.

(2) Open Back-End platform

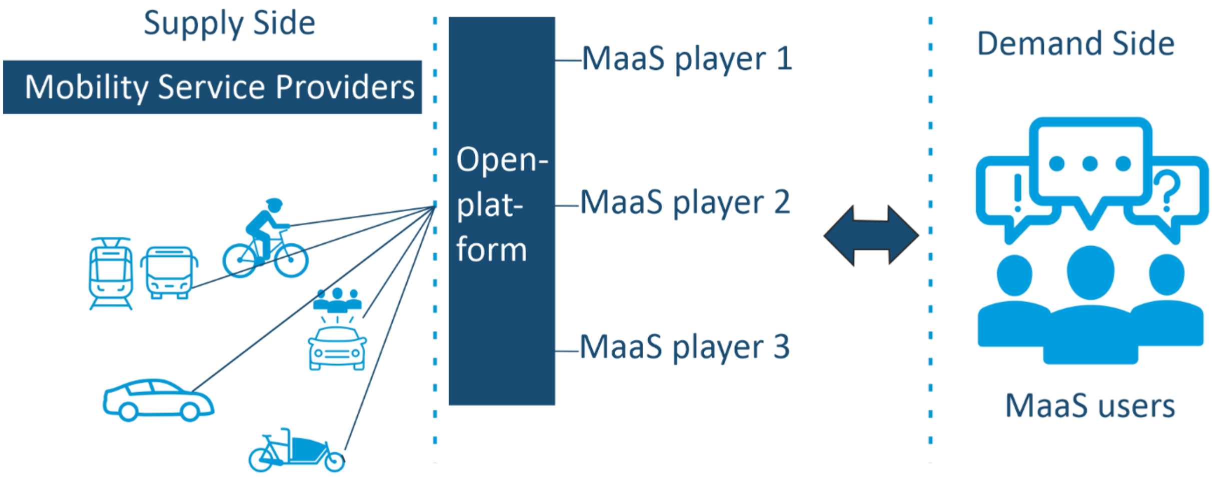

Figure 6: MaaS-Modell 2: Open Back-End platform (source: own illustration, Planersocietät)

In the second model, an open back-end platform would be set up by a public body. The platform serves as an open infrastructure, so to speak, various MaaS providers can build different alternatives. All data must be disclosed for integration on the platform. On the one hand, this model leaves room for competition; on the other hand, it offers the opportunity for a customer-oriented and honest approach. The role of the authorities here is to ensure fair and non-discriminatory rules for the sharing of data[14]. In Germany, mobility inside is a good example of this[15].

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[14] ELTIS (2019): 33, UTIP (2019: 18

[15] More informations under https://www.mobility-inside.de/

(3) Public transport as operator

In the third model, public transport is the integrator in theory. The MaaS services could either be entirely operated by the public sector or licensed to a private organization for a fixed period. Since public transport has the most customers in many cases and also counts as the backbone of sustainable and urban mobility, it makes sense for public transport to take the lead in integrating other mobility service providers. This form would also lead to a significant increase in the attractiveness of public transport and consequently retain old customers and attract new ones. Thus, on the one hand, the model can increase sustainable mobility and be socially inclusive. However, on the other hand, there is a risk that it could be perceived as less innovative and customer-oriented. Further, it is unclear which public transport operator would take the leading position as the initiator of the MaaS system[16].

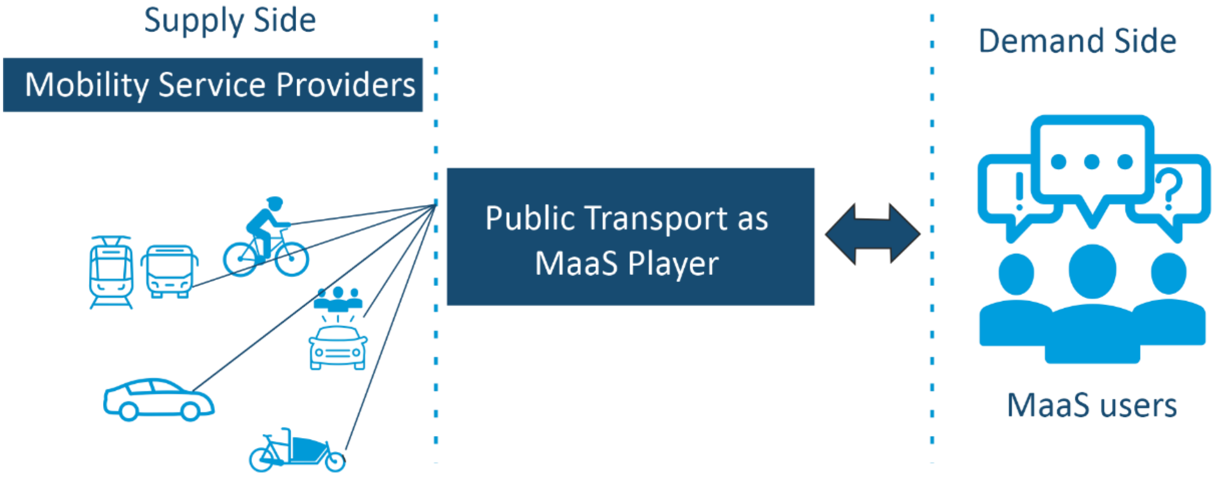


Figure 7: MaaS-Modell 3: Public trasnport as operator (source: own illustration, Planersocietät)

When establishing MaaS structures in a city, it must consider what role and function it wants to assume in the system. Irrespective of this, four further aspects are necessary for successful establishment[17]:

- A solid and reliable digital transport and traffic infrastructure must be in place.
- A commercial framework must be created that enables competition and collaboration.
- An understanding must be created that MaaS is a service for which some payment must be made.
- Recognition that MaaS is a user-centric service designed to support the mobility needs of the desired lifestyle.

[16] ELTIS (2019): 34, UTIP (2019): 19
[17] IET (2019): 5

Advantages and disadvantages of the different models

	MODELL 1: PRIVATE COMPANIES	MODELL 2: OPEN BACK-END PLATFORM	MODELL 3: PUBLIC TRANSPORT
BENEFITS	• Variety of differentiated offers • Better choice for users	• Variety of differentiated offers • Better choice of options for users • Low barriers to entry • Easy access for data for the public sector • Better controllability of MaaS development by the public sector	• Easier regulation and protection of public value due to the close organisational or contractual relationship between the public MaaS entity and the authorities • Easier access to data for the public sector
BARRIERS	• Political regulation for the sharing of data • High barriers to market entry (contract negotiations with every supplier) • Risk of low alignment between MaaS impacts and policy objectives, as MaaS providers act in a profit-maximising way • Risk of market dominance	• Risk of slow and bureaucratic processes • Dependence of the public sector on technology organisations to develop and maintain the platform	• Limited choice for users • May not be designed to meet the needs and preferences of citizens. • Risk of more MaaS providers forming that function in an autobased way • Customers of this private competing product would be unreachable for the public sector • European competition law

1.4. International examples for MaaS: Whim und UbiGo

The current mobility situation in German cities is as follows: Complicated tariff systems for local public transport, many different car-sharing, bike-sharing providers, and cabs found in isolated locations. MaaS is intended to simplify this, as shown, for example, by two internationally successful MaaS systems.

Looking at the chronological development of MaaS, Sampo Hietanen (CEO of ITS Finland, later CEO of MaaS Global) claims to be the inventor of the concept, as he proposed the idea of a transport service on-demand bookable in different variants to the Finnish Ministry of Transport already in 2006. [18] Shortly afterward, the latter published the first "Intelligent transportation strategy" in 2009. Three years later, the first MaaS pilot project was launched in Sweden with UbiGo, and at the same time, Sonja Heikkila described MaaS for the first time in a scientific study. Finally, Whim was founded in 2016.

According to individual preferences, the Finnish capital Helsinki is the first city in which multimodal mobility is enabled on a user-oriented basis. The basis for this is a decree from the Ministry of Transport and Communications, which led to the development of the Whim platform by the company MaaS Global. Users can plan their route with an app. Buses, streetcars, car-sharing providers, rental cars, rental bicycles, cabs, and other means of transport are considered. Once the user has chosen one or more means of transportation, the necessary tickets are ordered automatically. In addition to seamless route planning, Whim's primary goal is to reduce car ownership. According to a survey by the operators, 38 percent can do without their cars. By 2030, one million private cars are to be replaced by Whim subscriptions.[19]

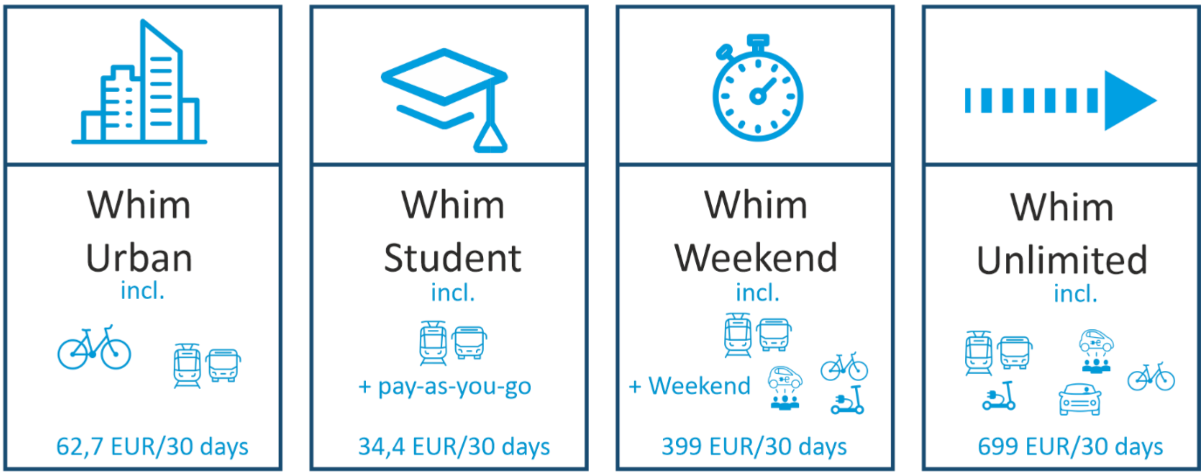


Figure 8: Whim prices and tickets (source: Whimapp.com)

[18] Arias-Molinares, García-Palomares (2020): 257
[19] www.whimapp.com

The unique feature of the Finnish example is the flat rates that users can book. For around 60 euros a month, public transport in Helsinki can be used without restriction. Furthermore, rental bicycles are included for a period of use of 30 minutes at no additional cost. Moreover, discounts for cabs and rental cars are given for specific journeys. Thus, for about 700 euros per month, rental bicycles, rental cars, and cabs are available for unlimited use at no additional cost. By way of comparison, the average monthly price of a mid-range car is 600 euros. The value is based on the German Automobile Association (ADAC) calculations, which include numerous individual items such as insurance, tax, parking space costs, fuel costs, maintenance, depreciation, and workshop costs (luxury class cars can cost up to 1.500 euros per month).

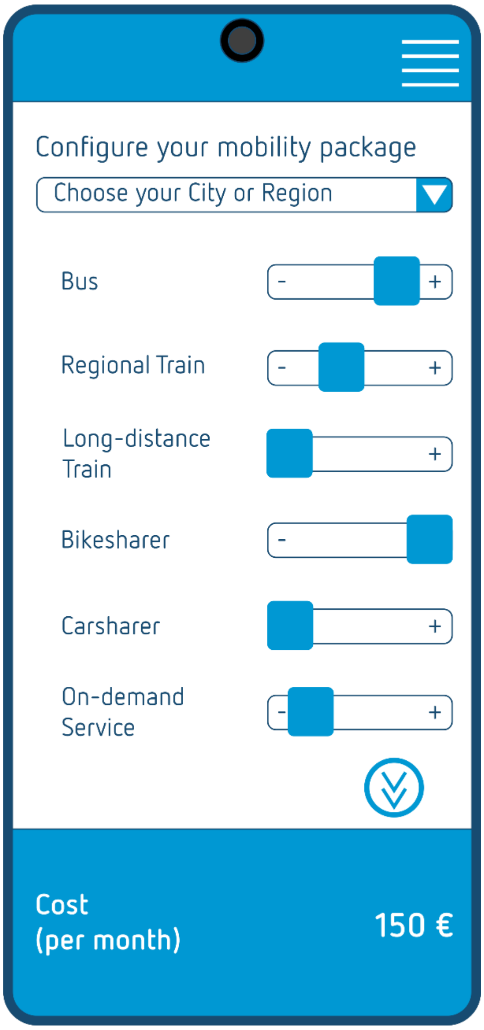


Figure 9: Choice of transport according to needs and costs (source: own illustration, Planersocietät)

In Helsinki, too, the essential prerequisite for being able to offer mobility from a single source is having enough data available. The basis for the available data is the Act on Transport Services, which the Finnish government enacted on January 1, 2018. The regulation obliges all transport and traffic companies to disclose their data. For example, public transport companies share their information on timetables and real-time data regarding current position and bus delays and trains. Likewise, cabs and car-sharing fleets disclose their availability. Also mandated by the Act on Transport Services is a specific data standard. For example, open programming interfaces are imposed on transport and traffic companies so that apps (such as Whim) and third-party providers can purchase tickets or book vehicles[20]. Thus, legislation, such as the Act on Transport Services, is a prerequisite for establishing a MaaS system in other countries. Without such legislation, app developers are dependent on transportation companies voluntarily sharing their data.

According to Sampo Hietanen, founder of Whim, customers with a Whim subscription use public transport for 72 percent of their trips, so concerns about a shift to more car use in Helsinki have not materialized. Whim is currently expanding to other cities and countries. In Finland, the MaaS system can also be found in Turku. In Europe, users can also find Whim in Vienna (Austria), the West Midlands (England), and Antwerp (Netherlands). Other cities that have established MaaS in Whim are Tokyo (Japan) and Singapore (Malaysia). In subscription format, Whim, on the one hand, provided a

[20] UTIP (2019): 14

viable solution to the mobility needs of residents. Thus, on the other hand, it is less attractive for people who only stay in the city for a shorter duration, such as vacationers. Here, the simple offer of car-sharing providers is currently a more accessible variant to use.

Another best-practice example is UbiGo. The MaaS app enables residents in Sweden to consume all available public and private mobility in a city via mobility subscription. UbiGo also combines public transportation, car sharing, car rental services, and cabs. The difference with Whim is that UbiGo is based on a flexible monthly subscription with an account shared by all household members. According to the company, sharing an account has a positive impact on user adoption. Each app user searches for and books route through the app. A mobility subscription linked to a mobility account, e.g., of the family, is selected for payment. A subscription for public transport, car-sharing, or car rental reduces the personal need for a private car. Every month, the user's credit is topped up according to the desired settings. If there is still credit available at the end of the month, the remaining amount is credited to the following month. Thus, the owner of a mobility account receives a monthly statement for all mobility services consumed. In addition, the booking of specific means of transport can be restricted, e.g., no cab rides for children or only car rental for employees.

2. MaaS in Hamburg-Altona

The result of this report should be fields of action for the linking of active mobility (primarily bicycle traffic) and commercial traffic with MaaS, this means how to integrate MaaS especially for cycling and economic transport.. The basis for this is the analysis of the existing and missing structures for a future MaaS system in the Hanseatic city. Thus this chapter is dedicated to the spectrum of available transport modes and their spatial and temporal integration and existing data protection guidelines, among other things.

2.1. Components of MaaS-Systems

As an immediate necessity for integrating a MaaS system, there is an existing broad spectrum of transport modes. Thus, the questions arise: How prepared is the current traffic system? What modes of transportation are available? What is the density of providers? According to the classification of MaaS systems (cf. chapter 1.1), Hamburg with the hvv switch app can be classified in category 1. This is a MaaS pilot with partial integration. There is a basic level of integration, as the system has partial ticketing, payment, and ICT integration.

Current mobility offer

The range of mobility options in Hamburg is diverse. In addition to the classic public transport system, which in Hamburg consists of underground, suburban and regional trains, buses, and ferries, the mobility offer is supplemented by various sharing providers. Public transport is organized by the Hamburg Transport Association (hvv) with the goal of "one ticket, one tariff, and a coordinated transport offer". Thus, the hvv is responsible for tickets, fares, and schedules. Hamburger Hochbahn AG (HHA) is the largest transport company in Hamburg. It operates the subways (consisting of the lines U1-U4) and a large part of the city buses (Metrobus lines 1-29). Supplementary city and regional bus lines, express bus lines, and Xpress buses are operated by Verkehrsbetrieb Hamburg-Holstein GmbH (VHH). Suburban trains (consisting of lines S1, S2, S3, S11, S21, S31) and regional trains and regional trains are operated by Deutsche Bahn (DB). Special light rail services (lines A1-A3) are also operated by Altona-Kaltenkirchen-Neumünster Eisenbahn GmbH (AKN). Nordbahn Eisenbahngesellschaft mbh & Co. KG is responsible for the regional trains RB 61, 63, 71, and 82. Various car-sharing providers are represented in the city area, with SHARE NOW and SIXT Share Carsharing offering free-floating car-sharing and Miles, Ubeequo Carsharing, Greenwheels, Flinkster, Cambio, and Europcar offering stationary car sharing. StadtRAD forms the bike-sharing offer in Hamburg with more than 2,600 rental bikes at over 200 locations. Since 2019, the principle of ride-sharing has been represented in Hamburg by various providers (VW MOIA, VHH ioki, DB Clevershuttle). The journey is shared, mostly in small e-buses, with unknown passengers, a so-called "shared taxi principle". In addition, Hamburg also experienced the massive development of scooter sharing in recent years. Providers are TIER, Bird, Circ, VOI, and Lime. Furthermore, there are also ride-hailing offers with Uber and MyTaxi.

The so-called hvv switch points are intended to make it possible to switch between the various public and individual modes of transport, particularly at S-Bahn, and U-Bahn stops. When the first hvv switch point was launched in 2013, car2go and Europcar were integrated into the service. Drive Now, Cambio and StadtRAD followed as a supplement to the bus, train, and ferry. There are currently 18 hvv switch points at subway and S-Bahn stations. The offering is being successively expanded, including in the city districts, so that there are now over 70 locations of hvv switch points with various mobility offerings. Currently, the car-sharing providers SIXT share, SHARE NOW, and cambio is available to users at the hvv switch points.

The public transport offer is bundled and displayed on the app or website on the hvv-switch platform. In addition to the uncomplicated purchase of hvv tickets, users can book a SIXT rental car or a MOIA shuttle via the app. Furthermore, there is the possibility of booking a cab.

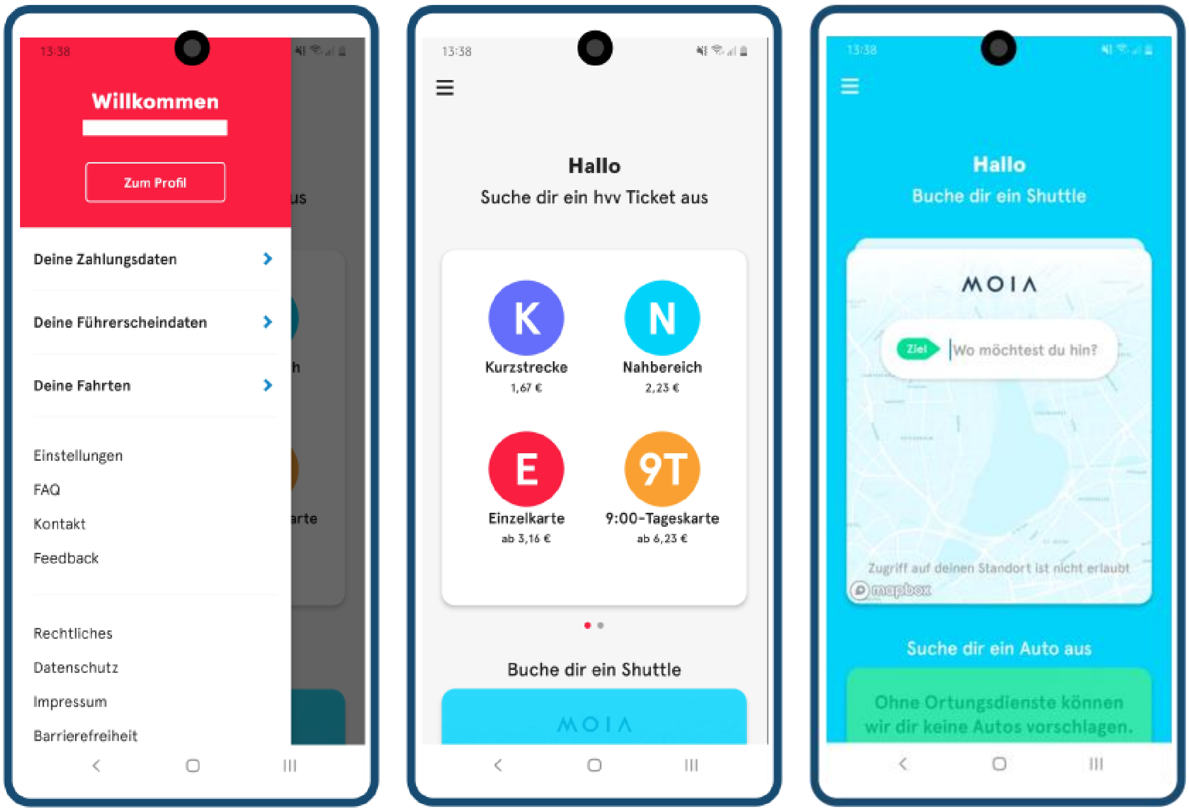


Figure 10: hvv-switch App (source: own illustration,, Planersocietät)

ICT-Infrastructure

All required to use the various means of transport is registration, and payment is handled uniformly via a payment provider using the app. The tickets are offered seven percent cheaper via the app than at the ticket machine or bus. Furthermore, if a route is planned via Google Maps, the appropriate ticket can be purchased directly in the hvv switch. This shows that the ICT infrastructure, another essential component of a MaaS system, is already installed with the associated smart ticketing. The Urban Data Hub Hamburg is in charge of bundling all travel information and uniform payment processes.

The density of individual modes of transport

In addition to the general availability of various means of transportation, the density and distribution of these means are also crucial. Therefore, the expansion of individual means of transport is discussed separately below. Due to the range of services available, it is impossible to differentiate between the different frequencies of the respective lines.

PT

Altona is served by bus and S-Bahn services. With a radius of up to 400 m[21] within walking distance, the public transport system covers most areas. In short to medium term, the Hamburg-Takt also means even better bus connections, both in terms of the number of trips/timing and new bus connections. This objective is at least anchored in the current coalition agreement. It is uncertain how soon it will be implemented, especially after the pandemic.

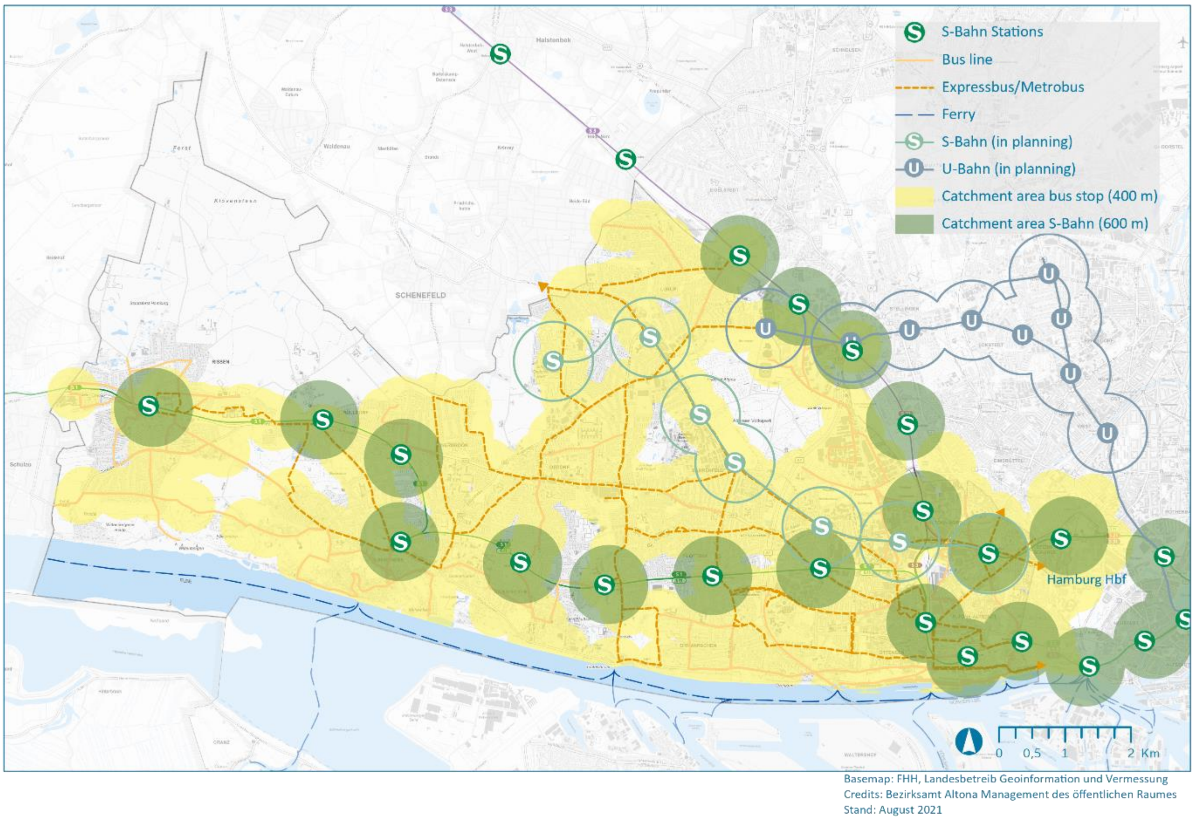


Figure 11: Public transport services in Altona (source: Bezirksamt Hamburg Altona accoring to Geoportal Hamburg)

StadtRad

The StadtRAD[22] service (Deutsche Bahn Connect on behalf of the City of Hamburg) is one of the largest bike rental systems in Germany, with over 200 stations citywide, 32 of which are in Altona (as of

[21] Every resident of the city of Hamburg should be guaranteed access to a public bus stop within this radius.
[22] More informations under https://stadtrad.hamburg.de/de

March 2020), and approximately 2,500 rental bikes. As can be seen in the figure, there is a dense network of 27 StadtRAD rental bike stations, especially in the eastern part of Altona in the train station area. At some stations it is possible to rent cargo bikes and at a few stations e-bikes are already available for rent. However, it is clear that an expansion of these, especially in the western section of Altona, appears necessary for comprehensive availability and thus also high utilization rates. Here, the density decreases sharply. On the other hand, the bottleneck (Teufelsbrück: there is a lot of traffic here at professional rush hour), has a StadtRad station. In the future, these parts of Altona should be made accessible through additional StadtRAD stations.

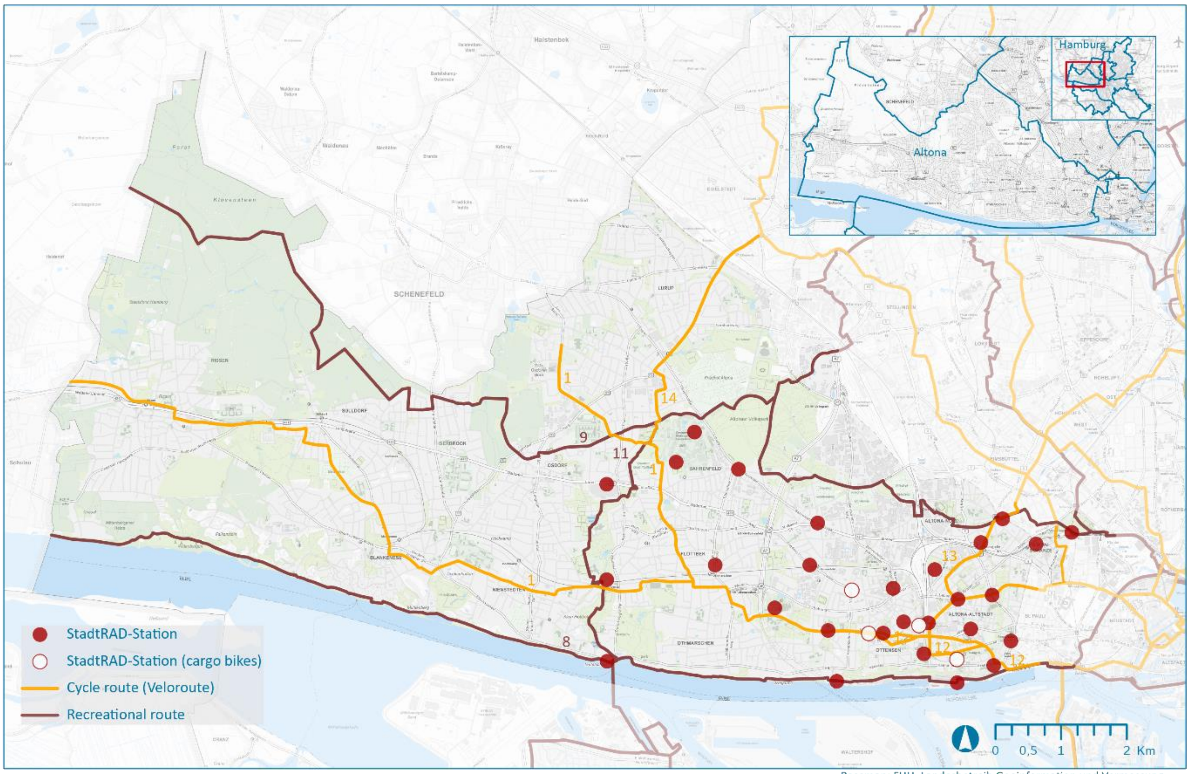


Figure 12: StadtRad stations in Altona (source: Bezirksamt Altona accoring to Geoportal Hamburg)

Therefore, it can be seen that of the necessary aspects for the integration of MaaS, Hamburg already has a highly differentiated transport mode offering with a versatile public transport offering that is flanked by various sharing offerings and an ICT infrastructure. In addition, the offer is bundled in the hvv switch app, in which route planning and the payment process take place. However, not all providers are currently integrated here.

Hvv switch/Carsharing/Ridesharing/E-Scootersharing

Currently, 12 hvv switch points are installed in Altona-Nord and -Altstadt, as well as Sternschanze and Ottensen. In total, there are over 70 stations in Hamburg. Here, too, there is a need for targeted densification of hvv switch points in Altona's western and northern directions.

Various carsharing providers are represented in Altona. Primarily the station-based offers cover predominantly the urban inner-city eastern areas (primarily through hvv switch stations). The largest station-based carsharing providers in Altona include Greenwheels (12 stations) and Cambio (10 stations), plus free-floating providers make their fleets available in certain areas.

New ridesharing services are also available in Altona. MOIA's concept is based on transporting several people with low-emission minibusses and drivers while accepting minor detours. The service area currently extends from Blankenese in the west via Fuhlsbüttel and Wandsbek in the north and Horn in the east. Extensions are currently being planned exclusively north of the Elbe in all directions. IOKI's service covered the two service areas of Osdorf/Lurup (and Billbrook in the Mitte district) and was awarded the German Mobility Prize in 2019. The unique feature of IOKI is that it serves neighborhoods and settlements that are not operated by rail-based public transport. In the service area, emission-free and barrier-free vehicles run between existing public transport stops and provide passengers with a feeder to the following public transport interface.

Since 2019, various companies have been offering e-scooter sharing on a free-floating basis. Within these permitted zones, the availability of the different providers is strongly concentrated in the dense eastern districts of Altona-Altstadt and -Nord, Ottensen, and Sternschanze.

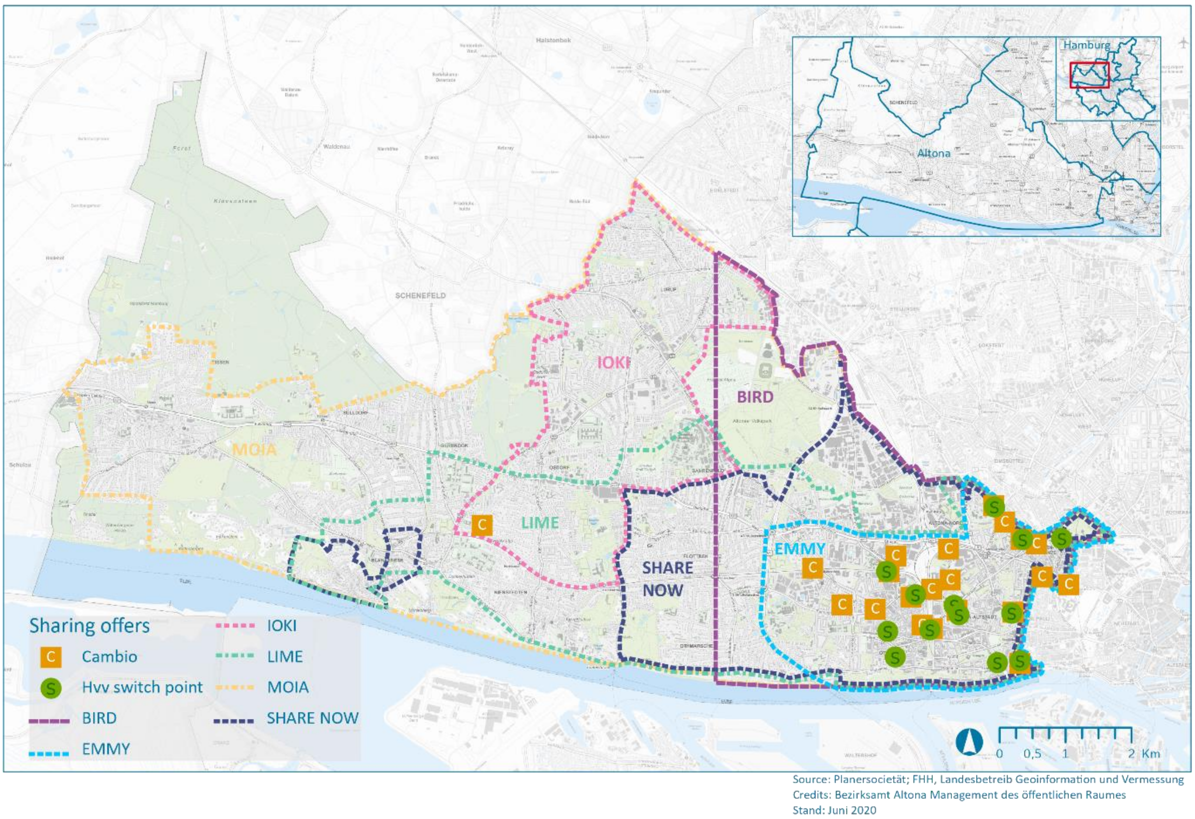


Figure 13: Sharing services in Altona (source: Bezirksamt Altona accoring to Geoportal Hamburg)

In general, it can be seen that a wide variety of sharing forms flanks the public transport services in Hamburg Altona. With StadtRad and other sharing providers (especially car-sharing), however, it is clear that there is not yet widespread availability.

2.2. Missing items of a MaaS-systems

In the classification of the MaaS pilots (see section 1.1), hvv switch is placed in the lowest level in the basic model. Thus, the system has ticketing, payment, and ICT structures in parts. However, various aspects are still missing for hvv switch to become a complete MaaS system. Some of them will now be discussed.

Full integration of mobility providers

There is no integration of all mobility providers. Currently, it is only possible to book hvv tickets, trips with the ridesharing service MOIA and rental cars from SIXT share. StadtRAD, MILES Mobility, cambio, and ioki must be integrated into the platform as quickly as possible. In addition, the direct integration of cabs, SHARE NOW, and the e-scooter providers are missing.

Mobility package offer

For hvv switch to catch up with other MaaS providers, there must be a complete ticketing and payment system in the future. Based on this, users will be able to purchase various mobility packages. Monthly subscriptions or pay-as-you-go options are offered for individual mobility needs.

Open data exchange

Germany lacks legislation on open and secure data exchange with standardized data. The envisaged solution on data in the European portal data.europa (www.data.europa.eu/en) would be desirable.

Excursus: European solution for standardized data exchange

The digital transformation of municipalities is crucial for the future development of German municipalities. This requires a digital infrastructure in the form of a smart city data platform, i.e., a network of different systems in one system. It is important that the digital data platforms are based on a kind of European digital sovereignty. In this way, the ICT industry, in cooperation with federal, state and municipal policymakers and the European framework, can open up opportunities for digital transformation in municipalities while at the same time safeguarding the digital sovereignty of citizens and the state on the basis of European values and security standards.

Consequently, the digital data platform must be equipped in such a way that the digital self-determination of citizens and the state's ability to act are guaranteed. The focus here is on data sovereignty, security, data protection, market diversity and economic independence. In addition, open digital ecosystems instead of local, individual solutions are the way forward. Smart cities and smart regions require a common basic ethical, legal and technical understanding of the benefits, opportunities and risks of digital networking. The transformation process requires close cooperation between the federal government, the states and the municipalities and the involvement of a European framework that creates a recognized set of rules and harmonized structures. Clear governance structures and technical/organizational control architectures are needed to establish this complex cooperation.

In summary, the European values and security standards form the basis of the European path in the digital transformation, while guaranteeing the digital sovereignty of citizens, companies and the state.

3. The focus of bicycle and commercial traffic in the MaaS-systems

A MaaS ecosystem includes many different aspects. This chapter will address the need for a broad spectrum of transport modes, focusing specifically on cycling and commercial transport. Due to its numerous advantages over a motorized vehicle, the bicycle represents the transport mode of the climate-friendly transport transition. Commercial traffic, on the other hand, is on the rise due to increasing online trade. These two other developments are to be taken up so that MaaS creates solutions for the modes of transport.

3.1. Cycling

In the following, the focus will be on bicycle traffic in Hamburg Altona. To demonstrate the relevance of this mode of transport in Altona, traffic counts are carried out and evaluated at the sites of importance for bicycle traffic, namely the Alter Elbtunnel and Teufelsbrück, after the contextualization of bicycle traffic in the MaaS system. Both locations represent a traffic bottleneck, for which among the structures of the port (harbour basin etc.) are responsible, and have a high active mobility commuter volume. Therefore, the counts are intended to clarify the general bicycle traffic volume (and additional pedestrian traffic). The bottlenecks are essential links between the port and Altona. All commuter traffic passes through the Elbtunnel in particular, or there is also a high volume at the Teufelsbrück location. Altona also feels the traffic impact of the port. Heavy traffic enters the district from the A7 motorway via Schnackenburgallee, so a good alternative needs to be created for people who want to move quickly within the district, in addition to the IMT through AM and PT. HUPMOBILE deals with the mobility of both, people and goods, which is why these routes need to be considered separately, both for increasing the active mobility of commuters and the delivery of goods, for example with cargo bikes. This is followed by network analysis of the study area, where vital north-south and west-east tangents are considered. Here, a primary and secondary route network for source and destination traffic is established for east-west connections between Altona Bahnhof, Alter Elbtunnel, and Teufelsbrück, as well as for north-south relations between Alter Elbtunnel, Teufelsbrück and Schnackenburg Allee. All source and destination locations represent traffic bottlenecks due to their concentration of workplaces or important connection points.

In the third part, an explicit description of the current situation of bicycle traffic in the port follows. Finally, an as-is analysis of the cycling infrastructure in Altona and the identification of general challenges for cycling in port cities results in a transferability to other HUPMOBILE partner cities.

Cycling as a part of Mobility as a Service

The bicycle can play a decisive role in the overall structure of Mobility as a Service, with the focus on bicycle rental systems in particular. In large cities, in particular, there is often an excellent public transportation system. What prevents commuters from using it permanently is the problem of the so-called last mile. The bicycle can fill this gap and systematically supplement public transport by serving the first and last mile in the MaaS system. Provided they have the physical ability, commuters could, for example, ride a bicycle to the train station near their home, then take the train to Altona station, and then ride a bike the last mile to their workplace. Another fundamental prerequisite for the use of bicycles is a safely developed bicycle infrastructure and the conversion of car drivers. Thus, the widespread safety concerns in society, on the one hand, curb a high demand for use.

On the other hand, bike-sharing services are currently the most common way to cover the last mile, mainly because of the price advantages. However, high availability and a short distance to the next bike-sharing station are essential. Here, as described above, Altona is already well-positioned with the StadtRAD stations in Altona Mitte. However, for extensive use in the entire district, numerous additional stations must be installed, and unproblematic transport in other means of transport (bus, S-Bahn, U-Bahn, ferry) must be guaranteed.

Requirement of the field of action

Various traffic counts were carried out to prove the high volume of cycling traffic between the port area and Hamburg Altona. So the implementation of traffic counts for bicycle and pedestrian traffic at the Alter Elbtunnel and at Teufelsbrück are intended to highlight the need for the field of action of bicycle traffic. Furthermore, a scientifically based traffic count with a transparent, systematic procedure is the basis for later fields of action and the development of measures in the spectrum of MaaS.

Alter Elbtunnel

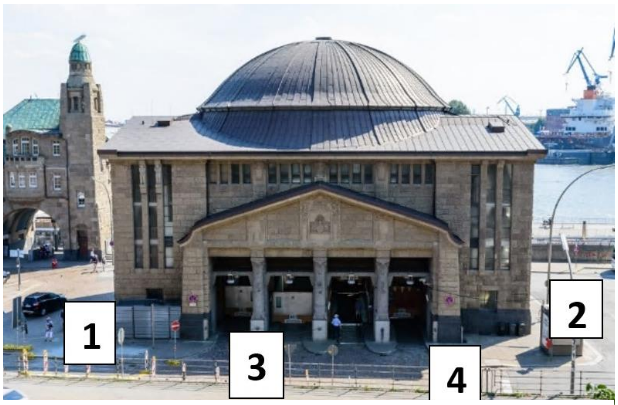


Figure 14: Counting station Alter Elbtunnel (source: own illustration, Planersocietät)

The Alter Elbtunnel passes under the North Elbe. It connects the northern edge of the port at St. Pauli Landungsbrücken (north entrance) with the Elbe island of Steinwerder (southern entrance) with two tunnel tubes. The tunnel currently serves as an essential link between the port area and between Altona and Wilhelmsburg. Commuters, in particular, use the popular connection on foot or by bicycle. The count took place on 12.04.2021 at the Alter Elbtunnel. The aim was to count all persons crossing the Alter Elbtunnel on foot or by bicycle during the survey interval on a working day. The count generally distinguishes between people entering or leaving the Elbe Tunnel between 06:00-10:00 and 15:00-19:00. The Elbe Tunnel can be passed through four different entrances or exits. The counting stations were placed so that a distinction can be made between pedestrians and cyclists coming from the directions Altona (A) and St. Pauli (SP). For example, at Station 3, all people walking/cycling in the order of St. Pauli are counted, distinguishing between walkers and cyclists. In addition, cyclists are differentiated into commuters (C, Commuter) and non-commuters (NC, Non-Commuter) based on their appearance. This differentiation represents a subjective assessment; nevertheless, it is intended to investigate whether numerous "presumed commuters" use the popular commute route. At station 4, all persons walking/driving or coming in the direction of St. Pauli are counted. The same distinction is made between those walking and those bicycling, differentiated between commuters and non-commuters. The side entrances form counting stations 1 and 2, where all people going to/from Altona and all people going to/from St. Pauli are counted. Here, too, a distinction is made between people walking and people cycling (subdivision into commuters and non-commuters).

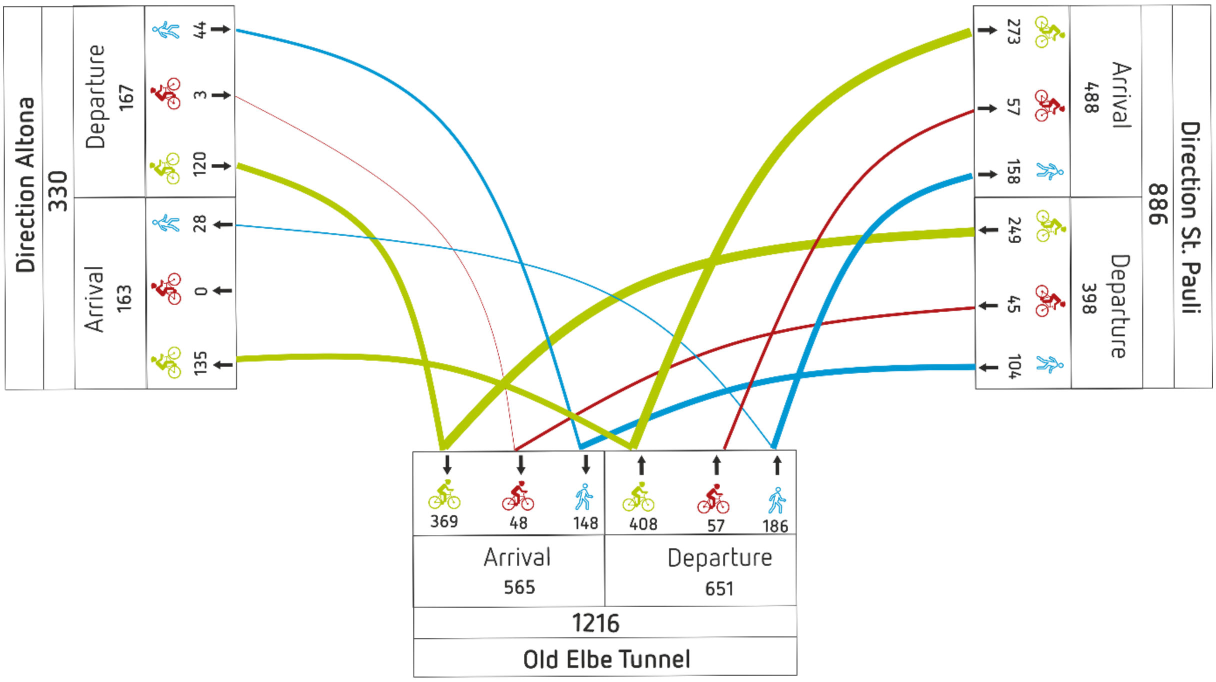


Figure 15: Evaluation of the count (source: own illustration, Planersocietät)

The evaluation of the counting results shows that during the counting intervals on the counting day, 882 people passed the Elbe Tunnel by bicycle and 334 people on foot so that a total of 1,216 people were recorded. There is a much higher frequency between Hafen - Alter Elbtunnel - St. Pauli than to Altona. This applies to both pedestrian and bicycle traffic. In the counting intervals (06:00-10:00 and 15:00-19:00), 886 people pass through the Alter Elbtunnel from or in the direction of St. Pauli, with 488 people having a destination in St. Pauli and 398 people traveling through the Elbtunnel to the port area. By comparison, 330 people travel from or to Altona.

Furthermore, 167 travel through the Alter Elbtunnel to Altona, and 163 come from the direction of Altona and pursue a destination in the port area. Of the travelers with a goal of St. Pauli, the people are divided into 66% bicyclists (55% C, 11% NC) and 34% walking. Of the travelers from St.Pauli, 74% are bicyclists (63% C, 11% NC), and 26% are on foot.

Of the travelers with the destination Altona, the persons are divided into 82 % bicyclists (C) and 18 % walking. Of the travelers from Altona, 74% are bicyclists (72% C, 2% NC), and 26% are walkers.

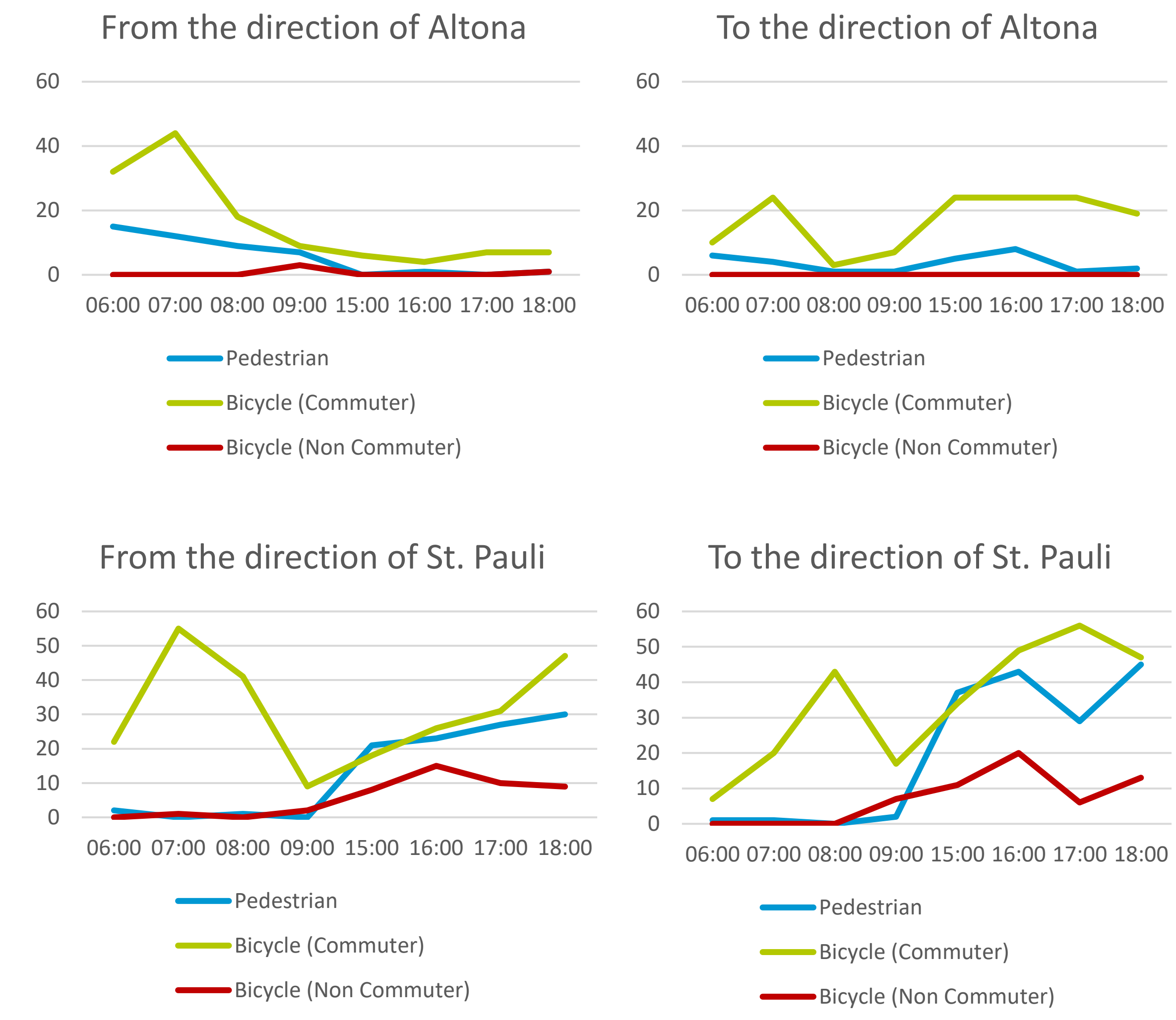


Figure 16: Individual evaluation of different target directions (source: own illustration,, Planersocietät)

When looking at the unique destinations in a differentiated way, it can be seen that in all cases, between 06:00-09:00, the commuting bicycle traffic reaches the highest frequency (except for the direction to St.Pauli). The highest values of commuting bicycle traffic (C) are reached to St. Pauli between 17:00-18:00 with 56 persons, from St. Pauli between 07:00-08:00 with 55 persons to Altona between 15:00-17:00 with 24 persons each and from Altona between 07:00-08:00 with 44 persons. In the midday area, the volume of foot traffic also increases.

Supplementary count from October 2020

A non-representative count was already carried out at the Alter Elbtunnel in October 2020. At this time, the pandemic situation in Germany had relatively relaxed, and both tourist and professional travel to and within Hamburg was possible. Thus, it must be assumed that mobility within Hamburg was much higher in October 2020 than in April 2021, as the pandemic development increased at that time. In April 2021, compared to the October count, there is a significant decrease in people walking (-72%) and bicycling (-19%).

Direction of Altona

	From the direction Altona October 2020	From the direction of Altona April 2021	Increase or decrease (in %)
Pedestrian	74	44	-41
Bicycle (Commuter)	152	120	-21
Bicycle (Non-Commuter)	31	3	-90

	To the direction Altona October 2020	To the direction of Altona April 2021	Increase or decrease (in %)
Pedestrian	153	28	-82
Bicycle (Commuter)	166	135	-31
Bicycle (Non-Commuter)	21	0	-100

Direction of St. Pauli

	From the direction St.Pauli October 2020	From the direction of St. Pauli April 2021	Increase or decrease (in %)
Pedestrian	693	104	-85
Bicycle (Commuter)	278	249	-10
Bicycle (Non-Commuter)	64	103	+60

	To the direction St.Pauli October 2020	To the direction of St. Pauli April 2021	Increase or decrease (in %)
Pedestrian	842	158	-81
Bicycle (Commuter)	316	273	-14
Bicycle (Non-Commuter)	69	57	-17

Table 1: Comparison of traffic counts at the Alter Elbtunnel

Teufelsbrück

The Teufelsbrück ferry terminal is located west of the Elbe beach and on the southern edge of Jenischpark in Hamburg Altona, where the Flottbek stream flows into the Elbe. The Elbchaussee leads to Teufelsbrücker Platz, which was redesigned in 2009. On the one hand, Teufelsbrücker Platz is a popular destination for excursions. On the other, it is the starting point for numerous employees of different companies, who use the ferry terminal to get directly to the companies premises. On week-days, this creates a traffic bottleneck due to the rush-hour traffic of the employees.

The count at Teufelsbrücker Platz took place on May 5, 2021. The aim was to count all people arriving at the Teufelsbrück ferry terminal on a working day on foot, bicycle, bus, or cab. The counting intervals were set between 06:00-10:00 and 15:00-18:00. To ensure that as many people as possible were counted, three counting stations were set up with different locations.

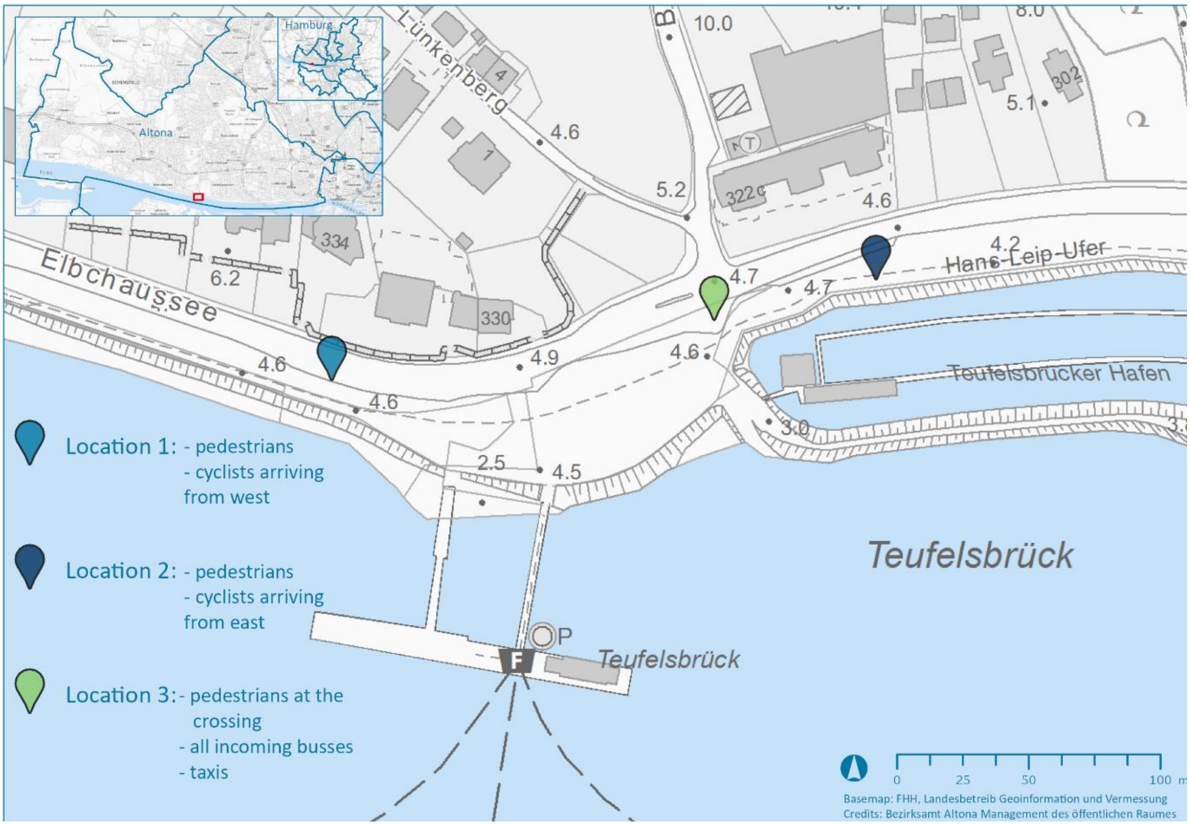


Figure 17: Counting stations (source: Bezirksamt Altona)

At location 1, all persons coming from the west are counted. This includes all

- people walking
- bicyclists crossing Teufelsbrücker Platz
- Cyclists were arriving at Teufelsbrück and parking their bicycles.

At location 2, all persons coming from the east are counted. This includes all

- people walking
- bicyclists crossing Teufelsbrücker Platz
- Cyclists were arriving at Teufelsbrück and parking their bicycles.

At location 3

- all pedestrians crossing the Elbchaussee at the pedestrian crossing in the direction of Teufelsbrück
- all arriving buses
- all arriving cabs.

In addition, the bicycles at the bicycle parking facilities at Teufelsbrücker Platz are counted at the following times: 05:45, 10:15, 14:45, 19:15. Furthermore, a distinction is made between scooters, ordinary bicycles, cargo bicycles, pedelecs, and scrap bicycles.

Due to an existing construction site on the counting day, cyclists were also recorded at location 3. Through specific agreements between the counting personnel, it was ensured that no duplication occurred in the recording of cyclists.

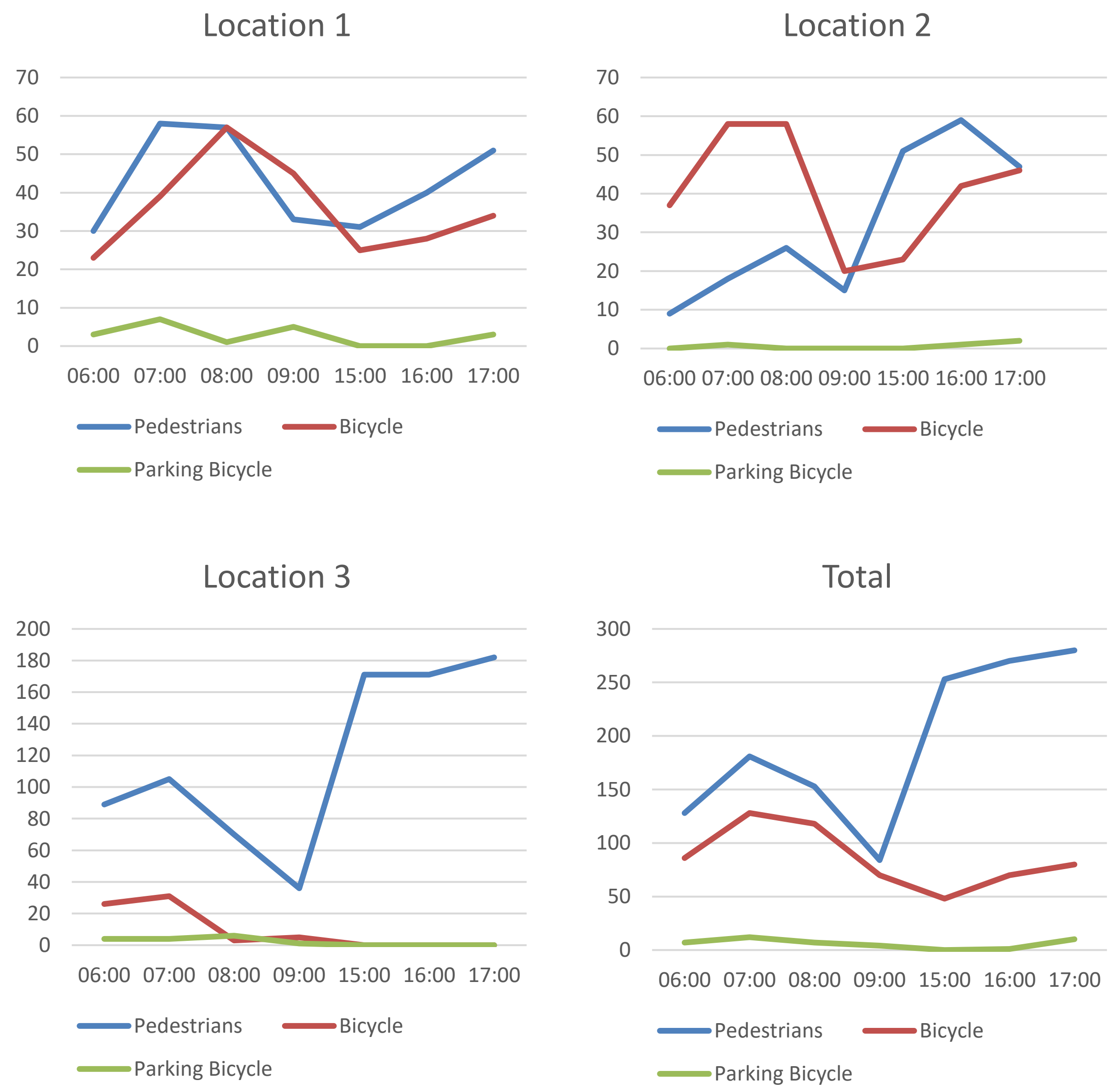
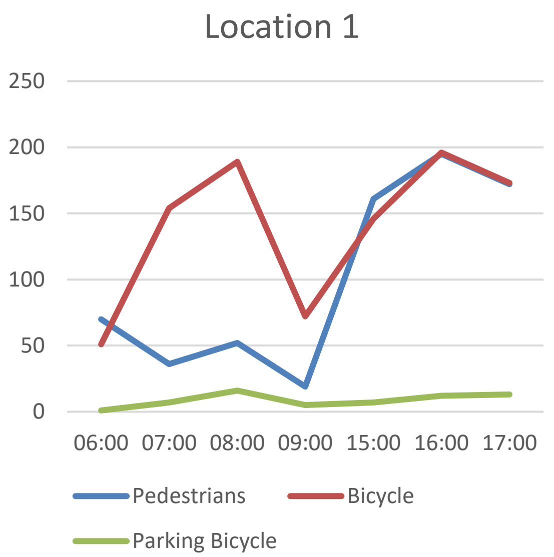


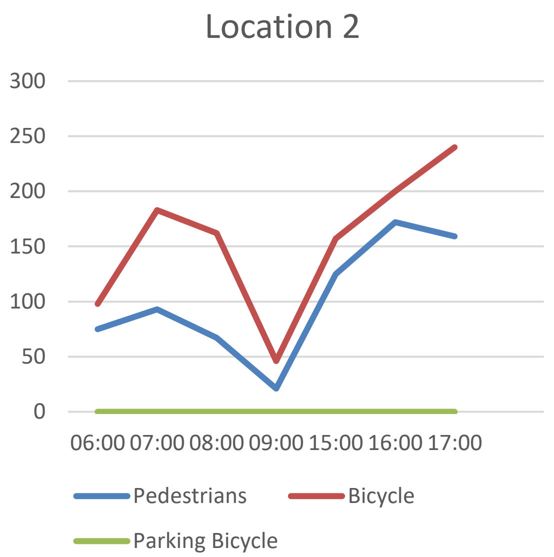
Figure 18: Results of the count Teufelsbrück May 2021 (source: own evaluation, Planersocietät)

Figure 19: Counting Teufelsbrück, construction site (source: Bezirksamt Altona, Heike Bunte)

The result of the count shows that the destination traffic of Airbus employees particularly characterizes Teufelsbrücker Platz. A total of almost 1.500 pedestrians and 600 cyclists were counted in the counting as mentioned above interval.

On 12 August[23], a second count took place to verify the results. Here, the focus was on stations 1 and 2 listed above. Thus, all cyclists and pedestrians coming from the west were counted at station 1 and from the east at station 2. The count yielded the following results:





[23] A more detailed presentation of the results of the traffic count can be found in the annex.

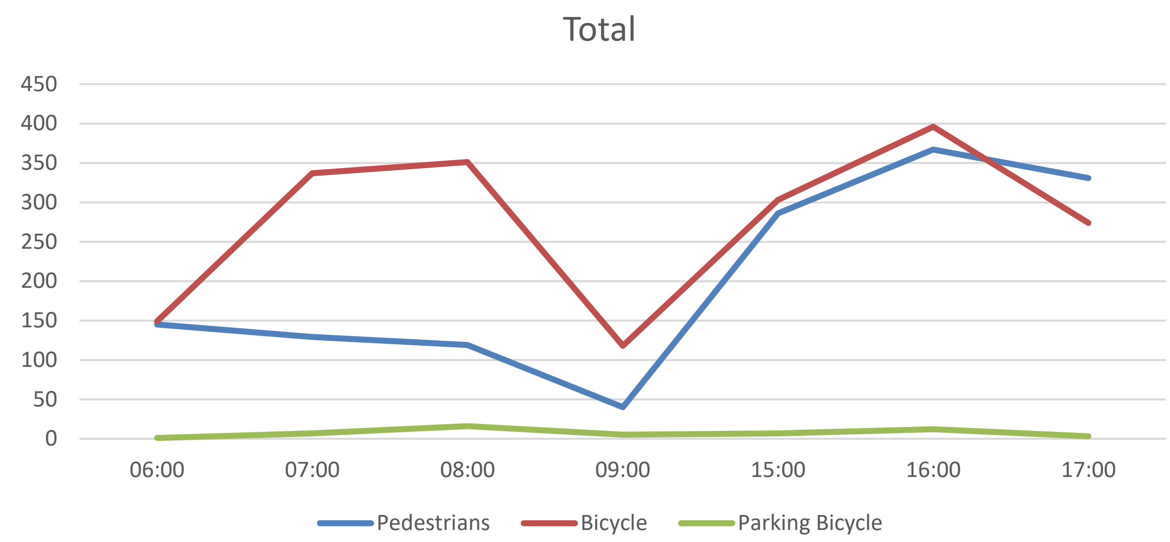


Figure 20: Results of the count Teufelsbrück August 2021 (source: own evaluation, Planersocietät)

The comparison of the counts shows a clear difference in parts, which is related to the development of the Covid 19 pandemic in Germany. There were significantly more people on the road in August. This is reflected in particular in the numbers of cyclists. There was an increase of over 300 %. This is more moderate for pedestrians. Here, there was an increase of 5 % in August compared to the May census. The second count in particular highlights the importance of Teufelsbrücker Platz as a traffic intersection. In the diagram, the data from May are shown in the lighter colours and the data from August in the darker colours.

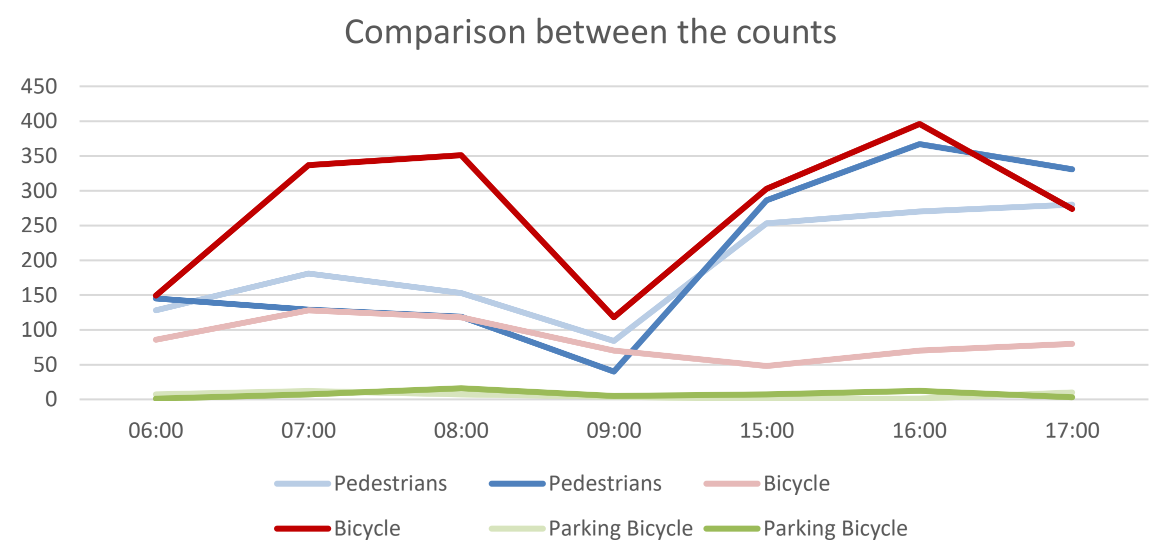


Figure 21: Comparison between the counts of May and August 2021 (source: own evaluation, Planersocietät)

In addition, another census was conducted on 17 August. Here, only 717 cyclists were counted during the above-mentioned periods. This can be explained by the weather conditions on 17 August, where it rained heavily to moderately all day. Nevertheless, 1309 pedestrians were counted.

Challenges for Altona: Network analysis and identification of relevant connections

In the following, relevant bicycle infrastructure routes in the district of Altona are presented. For the HUPMOBILE project, the focus is on east-west and north-south axes connecting and linking the source and destination locations Teufelsbrück, Bahrenfeld (Desy)[24], Volksparkarena, Bahnhof Altona, and Alter Elbtunnel as traffic bottlenecks or spaces for the integration and installation of ITS (see also ITS concept). The possible routes were identified in consultation with the Altona district authority and subjected to an initial analysis of the current situation based on road surveys.

East-west axis

Between the Teufelsbrück ferry terminal and the Alter Elbtunnel, there are three different route options in Hans-Leip-Ufer, Elbchaussee, and Bernadottestraße, which are very similar in terms of their distances by bicycle (approx. 7 km). In particular, the immediate vicinity of the Alter Elbtunnel is problematic for cyclists.

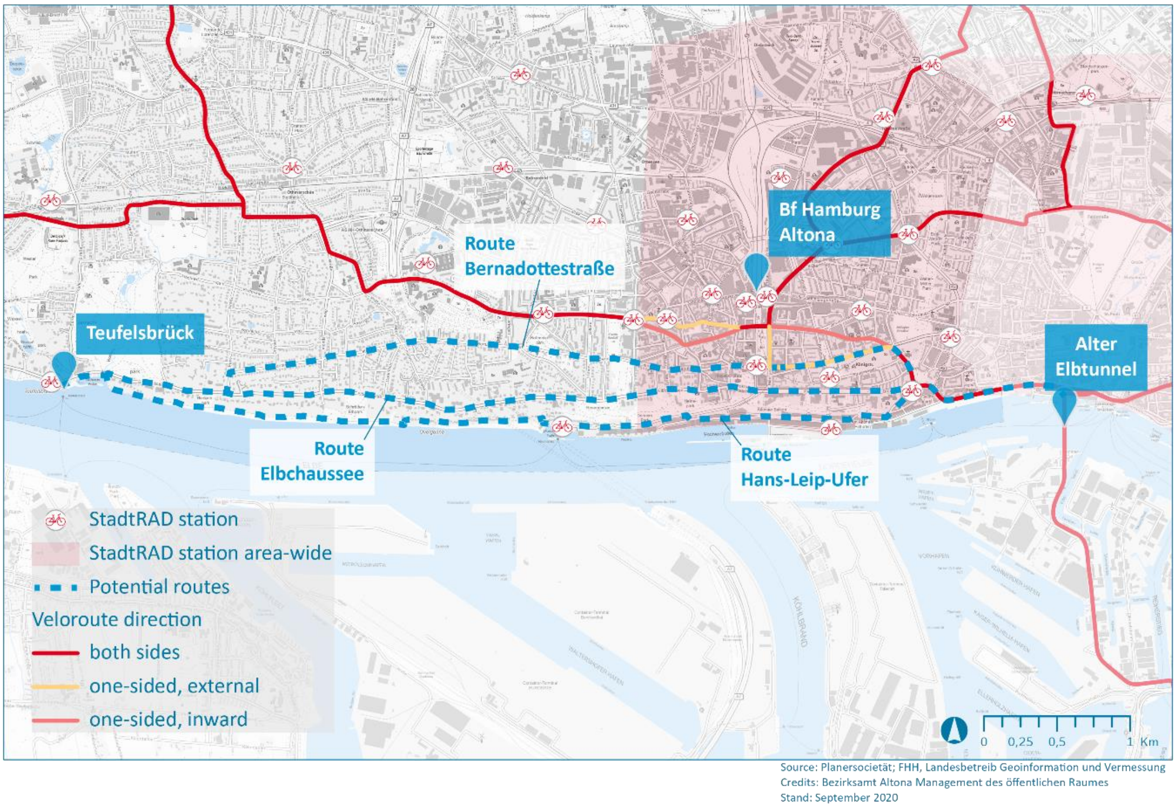


Figure 22: East-west connections (source: own illustration, Planersocietät, scale basic map: 1:45:000)

[24] The German Electron Synchrotron DESY in the Helmholtz Association is a research centre for basic scientific research. In the future, the Science City Bahrenfeld will be built here in an urban area as a major employer in Hamburg.

Bernadottestraße

The direct connection from the Alter Elbtunnel in the direction of Altona is highly problematic for all routes, whereby high traffic volumes must be taken into account with narrow bicycle traffic facilities on St. Pauli Hafenstrasse and Fischmarkt. The existing cycling facilities (mainly separate sidewalks and cycle paths) currently have widths of only about 1.50 m and are therefore not ERA-compliant[25].

In the further course, the guidance form briefly changes to a shared sidewalk and bike path. This is particularly problematic since, in this area (crossing St. Pauli Fischmarkt and Breite Straße), there are also gradients of around 4%.

Figure 23: Bernadottenstraße cycle path (source: own photos, Planersocietät)

The route continues via Palmaille and Max-Brauer-Allee to Platz der Republik and then via Ottenser Marktplatz to Holländische Reihe, before finally crossing Bernadottestraße for about three kilometers. The last kilometer to Teufelsbrück runs along the Elbchaussee.

On the Platz der Republik, cyclists are guided along a bicycle lane. In the area of the Ottenser Marktplatz, cyclists ride in mixed traffic on the roadway in a 30 km/h zone. At the transition to Holländische Reihe, the street cross-section narrows. Very narrow sidewalks and lane widths characterize the first section of the 500-meter-long street. Here, too, bicyclists ride in mixed traffic on the roadway at a speed limit of 30 km/h. A conspicuous number of bicycle parking facilities in the form of bicycle racks are installed in the first section of Holländische Reihe up to the intersection of Rothestraße for residents in the road space. At the intersection of Große Brunnenstraße, Holländische Reihe merges into Bernadottestraße. This is also characterized in the first section by a narrow roadway as well as narrow pedestrian facilities. Cyclists are also guided on the street in mixed traffic in the first section of Bernadottestraße. In the area after Fischer Allee, a bicycle lane is separated from the roadway in the westbound direction and bicycle lanes on the street in the eastbound direction. After the entrance to Trenknerweg, there is no paved bicycle lane in the western direction. After crossing the A7 freeway following the traffic circle, cyclists are again guided in mixed traffic on the carriageway. Arriving in Othmarschen, the road surface changes to uneven cobblestones from the

[25] The German research society of street and transportation (Forschungsgesellschaft für Straßen- und Verkehrswesen FGSV) developed Recommendations for cycle infrastructure ("Empfehlungen für Radverkehrsanlagen (ERA)") which were updated in 2010 for the last time and are currently in the process of getting updated. Those recommendations form the basis of planning activities regarding cycle planning.

intersection with Halbmondstraße, and there are no bicycle facilities further on. Via Parkstraße, the last kilometer to Teufelsbrück then runs along Elbchaussee. The road cross-section is also characterized by narrow pedestrian traffic and a lack of bicycle facilities. From the access road to Hans-Leip-Ufer, there is a cycle path on the side near the river bank as far as Teufelsbrücker Platz.

Figure 24: Western section Bernadottestraße (left), Holländische Reihe (right) (source: own photos, Planersocietät)

Elbchaussee

Another way to reach the Teufelsbrücker Platz ferry terminal from the Alter Elbtunnel is via the Elbchaussee, which has heavy traffic of 25,000 to 34,000 vehicles (average daily traffic on working days). After leaving the Alter Elbtunnel, St. Pauli Hafenstrasse leads westward. Separate bike lanes are available here in both directions of travel. The connection to Elbchaussee is via Breite Straße and Palmaille. However, once on the Elbchaussee, the character of the 4.5 km long road to the destination quickly becomes apparent: a narrow cross-section with narrow pedestrian facilities, non-existent separate bicycle facilities, a high traffic volume, and a public space that is characterized in part by stationary motor vehicle traffic but also by numerous existing green structures.

Hans-Leip-Ufer

In addition, the destination Teufelsbrück can be reached via the Hans-Leip-Ufer. This is a shared footpath and cycle path that is between 2 and 3 meters wide in large parts. The connection is made from the Alter Elbtunnel via the route St. Pauli Fischmarkt - Große Elbstraße - Neumühle - Övelgönne cycle path - Hans-Leip-Ufer. A current extension of the Övelgönne cycle path was last prevented in 2019 by a referendum. The Hans-Leip-Ufer is heavily used by tourist uses (Elbe Cycle Route) and the associated high bicycle and pedestrian traffic volume. Thus, due to the existing conflicts of use between pedestrians and cyclists and the already overburdened infrastructure, further use as a commuter route suitable for everyday use is challenging to realize. Nevertheless, this route connection should be retained as a potential route because of future expansion scenarios.

North-south axis

The essential north-south connections between Teufelsbrück and Alter Elbtunnel and the destinations in the north DESY and Schnackenburgallee potential routes are outlined. Between the Teufelsbrück ferry terminal and northern destinations, there are two route variants: Heinrich-Plett-

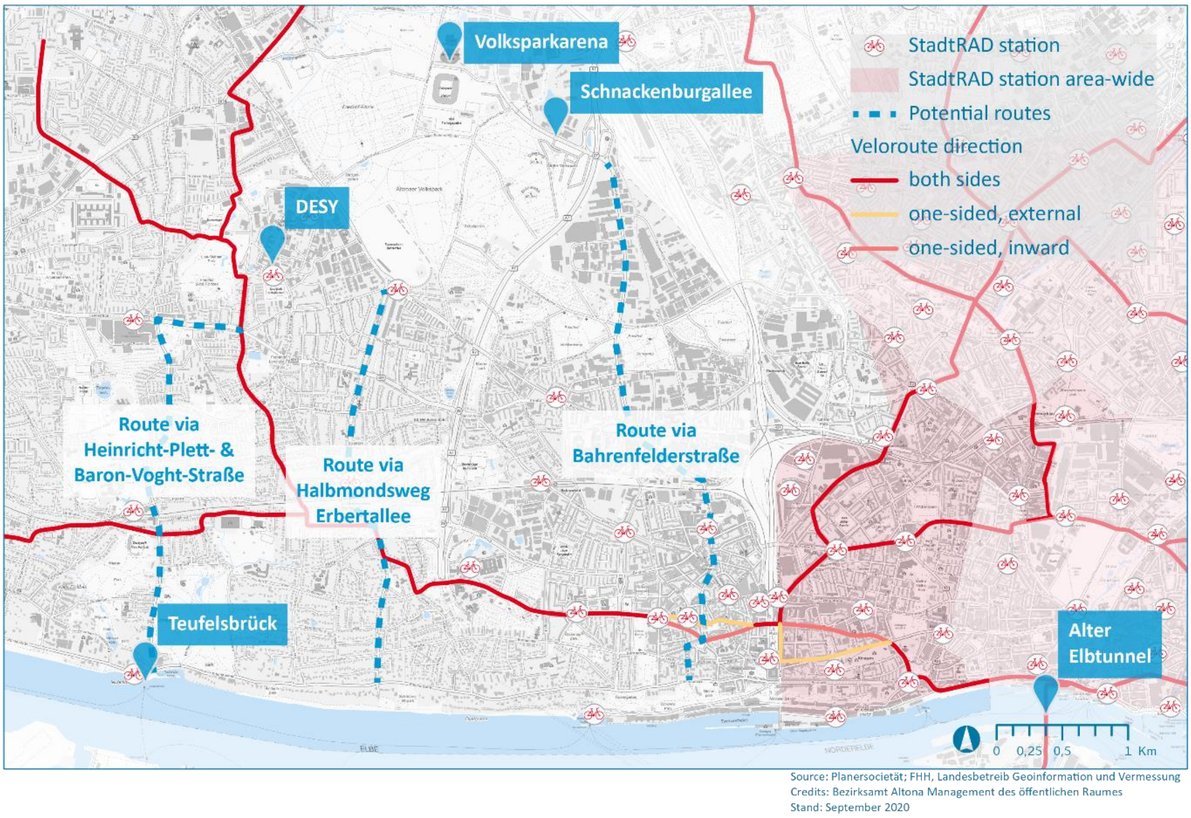


Figure 25: North-south connections (source: own representation, Planersocietät, scale basic map: 1:65:000)

Strasse - Baron-Voght-Strasse and Halbmondsweg and Elbertallee have only minor differences in their distances by bicycle (approx. 4.5 km). A potential route between the Old Elbtunnel and Schnackenburgallee with approx. 5.5 km runs along Bahrenfelderstraße. The immediate vicinity of the Alter Elbtunnel is particularly problematic for cyclists. The starting point is partly the Elbchaussee already described or the initial route at the Alter Elbtunnel St. Pauli Fischmarkt-Breite Str.-Palmaille.

Baron-Voght-Straße

Starting from Teufelsbrückerplatz, the axis Baron-Voght-Straße/Heinrich-Plett-Straße provides a direct connection to DESY. The first section of Baron-Voght-Straße has a narrow cross-section of the road space; here, bicycle traffic is guided on the street in mixed traffic at low traffic volumes.

Figure 26: Baron-Voght-Straße (source: Mapillary)

Towards the north, the cross-section of the road widens slightly, and the traffic load increases. Nevertheless, bicycle traffic is guided in mixed traffic on the roadway or a sidewalk open for bicyclists. After the intersection, the route continues north along Heinrich-Plette-Strasse. Here, a bicycle lane separated from the pedestrian traffic is installed in the side space first on the eastern side and from the height of Wisplerstraße also on the western side. Osdorfer Landstraße (continuing on Notkestraße) provides the connection to DESY and Schnackenburgalllee as a transverse axis. Here, too, the principle of the segregated cycle track with mandatory use is continued. At the junction of Osdorfer Landstrasse/Notkestrasse, there is a safe crossing with traffic lights in the direction of DESY. In contrast to Osdorfer Landstrasse, which has heavy traffic, cyclists ride in mixed traffic on Notkestraße, with the sidewalk also being open.

Halbmondsweg/Ebertallee

The northbound axis starts with a turn into Halbmondsweg from Elbchaussee. Here, cyclists are initially guided in mixed traffic and motor vehicle traffic on the roadway, whereby the sidewalk to the west is open to bicycle traffic. Cyclists thus have the freedom to choose between using the carriageway or the side space, but the minimum width of 2.50 m is not achieved in many parts. In addition, the sidewalk is in a cyclist-unfriendly condition due to numerous obstacles.

Figure 27: Halbmondsweg (left), Reventlowstraße (right) (source: Mapillary)

This form of guidance exists up to the intersection of Halbmondsweg/Borchlingweg. Subsequently, numerous cyclists use an unpaved path to the east until the intersection of Klein Flottbeker Weg, which is then on the opposite side of the road. Thus the cyclists arrive in the Reventlowstraße either on this way, in the mixed traffic, or on the sidewalk opened for cyclists. From the height of Roose's

Weg, a shared sidewalk and bicycle path is designated on the western side of Reventlowstraße. With the widening of Reventlowstraße from the height of Walderseestraße, northbound cyclists will be guided on a bicycle lane on the roadway. From Jungmannstraße onwards, southbound cyclists will be directed along a mandatory cycle lane in the side space, which will later change to a cycle lane. From the level of Statthalterplatz, the guidance changes to a separate sidewalk and bike lane. Once they reach Dürerstraße, cyclists are guided either in mixed traffic on the roadway or a sidewalk open to cyclists. Throughout Elbertallee, cyclists are guided in mixed traffic. The route ends at DESY. Overall, it is clear that the axis contains numerous alternating forms of bicycle guidance. In addition, bike lanes and bike paths that require use do not have the recommended minimum widths (cf. ERA) in large parts and are often in poor condition in terms of surface structure. Lurup and Bahrenfelder Chaussee provide the connection to Schnackenburgallee.

Bahrenfelder Straße

The axis between Alter Elbtunnel and Schnackenburgallee starts via Elbchaussee. Rothestraße, which is predominantly residential, then leads northward, with bicycle traffic on the roadway in mixed traffic at a speed limit of 30 km/h. The route is characterized by narrow pedestrian facilities. The side space is characterized by limited pedestrian facilities. In addition, stationary car traffic dominates the appearance of the street. Nöltingstraße has the same characteristics as Rothestraße and forms the transition to Bahrenfelder Straße. At the junction to Barnerstraße, separated bike lanes are installed in the side space of Bahrenfelder Straße, which are subject to use in the further course. This form of guidance is continued on Bahrenfelder Steindamm and finally also on Bornkampsweg as far as Schnackenburgallee.

Figure 28: Bahrenfelder Straße (source: Mapillary)

Cycling in port areas

In the HUPMOBILE project, one focus area is the immediate port area. All partner cities have a port, and these areas are also developing in terms of traffic. Therefore, first, the general challenges to cycling in the harbor are discussed before planning, especially traffic planning in the port area. In addition, a survey among the HUPMOBILE partner cities on the topic of cycling in the port provides a link between the challenges in the individual municipalities.

The Port of Hamburg is located on the Lower Elbe and represents the third-largest port in Europe after Rotterdam and Antwerp. Cycling in port areas is becoming increasingly popular and attractive. Tourist bike tours through the Port of Hamburg have been offered for years. With the increasing acceptance of the bicycle as a means of transportation suitable for everyday use, the connection between Harburg/Wilhelmsburg and Altona is used by numerous commuters every day, as traffic counts show. To promote active mobility, which has been chosen as one of the main goals of the HUPMOBILE project, further development of the bicycle infrastructure in the port area is essential.

Challenges for cycling in port areas

There are numerous challenges for bicycle traffic in the port area of Hamburg. The biggest problem is the high proportion of heavy goods traffic and the associated increased potential for conflict with cyclists. In general, the port area has an increased volume of traffic. This results in the need for more or less separate bicycle traffic facilities. Unfortunately, guidance in mixed traffic, bicyclists, and motorized traffic on a common traffic area does not seem to be possible. However, there may be too little space for the development of separate bicycle lanes. Another need is the design of safe intersections. Especially with the high percentage of heavy traffic, it is essential to provide a safe crossing for cyclists. In addition to the internal ones, there are numerous external challenges in designing bicycle infrastructure facilities in port areas that cannot be directly influenced.

One external challenge that arises is the weather. The proximity to the North Sea and the Baltic Sea allows maritime influences to affect the city. On more than 50 days a year, these circumstances result in dense fog in the port area. In addition, strong winds blow through the port area at times, which can cause intense storms, especially in the winter months. The fog and strong winds make cycling in the harbor unsafe and thus unattractive. Thus, the given weather conditions represent a kind of limit of cycling in the port.

Another given challenge is the small islands formed by the Elbe. The numerous smaller and larger harbor basins have a barrier effect for cyclists. Thus, the expansion of pedestrian and cyclist bridges is not possible without problems. The same applies to extending the frequency of the already operating ferries or new ferry connections because all route planning in the port area is strictly timed. Therefore, an expansion of services in favor of cycling, whether through new infrastructural constructions or ferries transporting commuting cyclists between Harburg and Altona, is challenging to realize due to the cargo operations in the port.

Figure 29: Cycling in the port of Hamburg - current situation (souce: Heike Bunte, Bezirksamt Altona)

Port area responsibilities

Today, the Port of Hamburg area is managed by the Hamburg Port Authority (HPA), which acts in the capacity of the owner for the City of Hamburg. It supervises the port and operates the port management. The HPA is responsible for the water and land infrastructure, particularly the port railroad, the road and bridge network, and shipping traffic safety. Consequently, the planning of new transport routes and the maintenance, upkeep, and modernization of existing facilities is the responsibility of the HPA, which has the planning authority in this field. In addition, the HPA maintains more than 130 km of the road network and more than 300 km of railway tracks. The port authority is also responsible for the Alter Elbtunnel, all ferry terminals, and bridges. The HPA aims to use state-of-the-art communication systems to guide traffic through the port area in a targeted manner and provide information on possible disruptions via LED boards. Modern ITS systems are used for this purpose.

Results of the survey on experiences in other cities

A written survey on the situation of cycling within the port areas was conducted among the HUPMOBILE partner cities during the project period. The survey was intended to identify common challenges for strengthening cycling in port areas. Further, the basic idea of the survey was that each partner city could describe its own experiences of the traffic situation in the port, thus creating another platform for exchange. Therefore, the results show impressions from Hamburg, Riga, Turku, Helsinki, and Tallinn. Queried were:

- Information on the modal split
- Responsibilities of traffic planning in the port area
- Current traffic problems in the port
- Proposals for improvement of the current situation

The modal split in the individual municipalities varies greatly. Riga, for example, has a public transport share of almost 50 %, while in Turku and Tallinn, motorized private transport dominates. The percentage of pedestrian traffic is nearly 10 % in Riga and Turku, while Tallinn falls behind with only 4 %. In Helsinki, most journeys are made on foot (34 %). In Turku, cycling plays an important role in organizing their everyday journeys, accounting for almost 30 %. In Hamburg (15 %), Riga (14 %) and Tallinn (12 %), there is still potential for increasing the share. At 64 %, environmental transport is the second most popular mode of transport in Hamburg after Riga (69 %).

The responsibility for transport infrastructure in the port areas of the partner cities also looks heterogeneous. In Riga, for example, the responsibility lies with the Riga Freeport Authority and the Riga City Development Department, which can only influence planning to a limited extent through recommendations. In Turku, there is a restricted influence in traffic planning in the immediate port area; for example, the administration plans roads near the terminals and influences the planning process for pedestrian and bicycle facilities. In Tallinn, there is an influence in traffic planning for motorized private transport and public transport. Consequently, bicycle and pedestrian traffic do not have a formative position in current planning. Finally, although the Altona district government has no direct influence on the port area, it does influence the immediate surroundings, such as maintenance of infrastructure, commuter ferries, and/or combination with other modes of transport (bicycle parking, public transport situation).

The main problems described in the port areas are the heavy traffic and the increasing motorized individual traffic. As suggestions for improving the current traffic situation, Riga proposes constructing suitable port access roads and the general expansion of the infrastructure. Turku sees a need for action in new traffic regulations, which should increase pedestrian and bicycle traffic safety in particular. In Tallinn, a new streetcar line is to provide relief. In addition, the focus here is to be on ITS-supported traffic management approaches that facilitate traffic flow and thus also reduce emissions.

In addition, there was an explicit request for proposed measures to improve traffic safety. This is to be achieved in Riga by separating the various traffic flows (rail, road traffic, vulnerable road users). In Tallinn, more crosswalks in the port area and appropriate sidewalk widths, and speed reductions for motorized individual traffic should increase safety and attractiveness for pedestrians.

The increase in active mobility in Riga is to be achieved through the conception of mobility hubs. Unfortunately, the other cities left the last point unanswered or saw it as problematic due to the privatized areas of the port area.

Furthermore, an additional survey of the partner cities was explicitly conducted on cycling in the port.

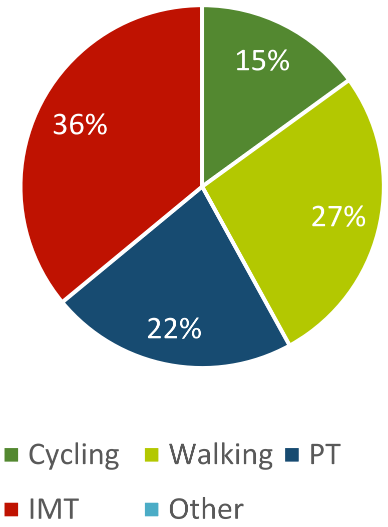
Riga

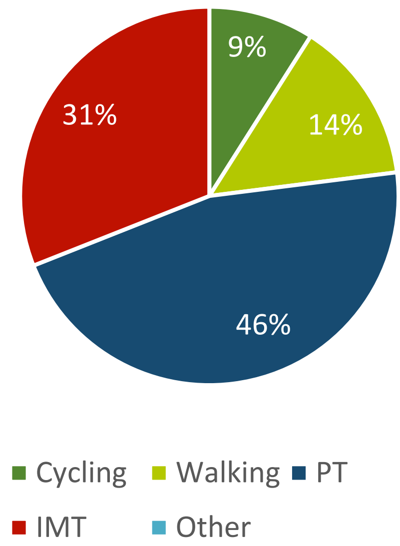
Riga does not have a dedicated bicycle route network that includes the port area. Nevertheless, there are efforts to expand a cycling network in the port area. The reasons why cycling in the port area should be strengthened are considered commuters and better connections to surrounding residential areas. It is unclear how heavily the port area is currently used by cyclists since no concrete traffic figures are available from traffic counts. However, accident statistics on bicycle traffic in the port are available, from which conflict points can be derived in the future.

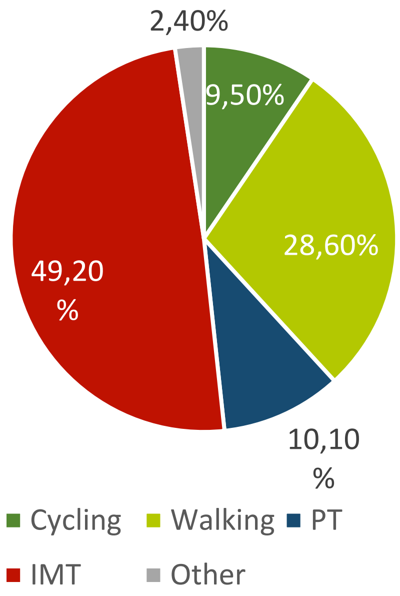
With regard to safety aspects in the port, there are no restrictions on the desired forms of bicycle guidance. These are to be installed according to general recommendations and could therefore also be created in mixed traffic. However, special attention in the planning will be paid to the intersections. Here, the protected intersections from the Low Countries serve as a model. In addition, traffic signals at essential crossing points are to ensure the necessary safety. Therefore, there are no further plans to increase the safety of bicycle traffic in the port.

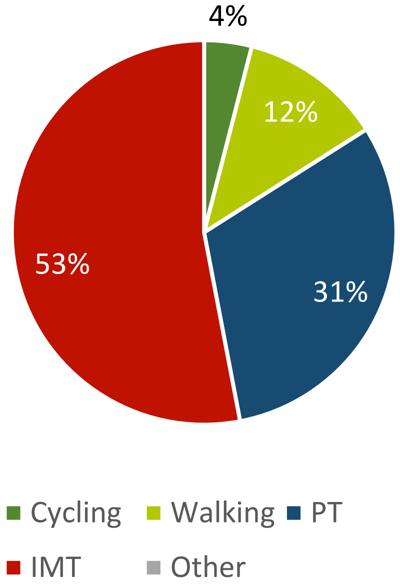
Turku

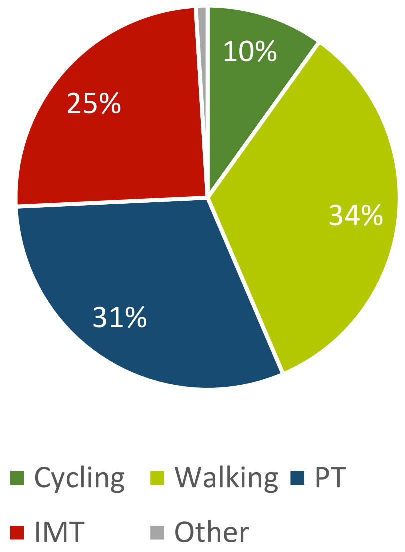
In Turku, there is a bicycle network of primary and secondary routes that includes the port. In addition to the evidence from Riga, tourist reasons are also mentioned as background reasons why bicycle traffic should be strengthened in the port area. Furthermore, there are data from traffic censuses in Turku and current accident statistics on bicycle traffic. Nevertheless, there are currently no precise plans regarding future desirable bicycle routing forms. To increase the safety of cyclists and pedestrians, car traffic should be diverted to other routes in the future.

HUPMOBILE Partner City:	Hamburg
Modal Split:	**Responsibility for traffic planning in the port area:**
	HPA – Hamburg Port Authority **Influence on that organization towards planning processes** ☒ **Yes**, but limited to recommendations ☐ No **Main traffic problems in the port** ☒ **Heavy Vehicles** ☒ **Car (IMT)** ☐ PT ☐ Other
Budget per year to improve traffic situation of all means of transport in the port area	•
Ideas for improving traffic in the port area by 2025/2030	• With the "Bündnis für Radverkehr" the City of Hamburg as a whole try to influence HPA to improve active mobility /PT in Harbor Areas.
Measures to improve traffic safety in the port area:	•
Comments to increase active mobility in the port area	• Increase knowledge / Try to sensitize upper political levels towards active mobility options in these regions.

HUPMOBILE Partner City:	Riga
Modal Split:	**Responsibility for traffic planning in the port area:**
	Riga Freeport Authority; Riga City Development Department
	Influence on that organization towards planning processes
	☒ **Yes**, but limited to recommendations ☐ No
	Main traffic problems in the port
	☒ **Heavy Vehicles** ☐ **Car (IMT)** ☐ PT ☐ Other
Budget per year to improve traffic situation of all means of transport in the port area	• 15 million EUR for new infrastructure, reconstruction and maintenance • Amount depending on availability of the EU funds and other funding sources
Ideas for improving traffic in the port area by 2025/2030	• construction of suitable port access roads and infrastructure • the urban area is to be kept free of freight traffic through motorway expansion
Measures to improve traffic safety in the port area:	• separation of various traffic flows (rail, freight / road traffic, vulnerable road users, etc.). • two-level traffic junctions with railways
Comments to increase active mobility in the port area	• the port area needs a more holistic approach to promotion of active mobility • concept for water transport • concept of the Mobility Points

<table>
<tr><th>HUPMOBILE Partner City:</th><th>Turku</th></tr>
<tr><td>Modal Split:</td><td>Responsibility for traffic planning in the port area:</td></tr>
<tr><td rowspan="5">
</td><td>Port of Turku has their “own area” but city does traffic planning for streets eg near terminal.</td></tr>
<tr><td>Influence on that organization towards planning processes (If yes, what kind of traffic do you manage?)</td></tr>
<tr><td>☒ Yes ☒ Bicycle ☒ Pedestrian
☐ No ☒ Car (IMT) ☒ PT ☐ Other</td></tr>
<tr><td>Main traffic problems in the port</td></tr>
<tr><td>☒ Heavy Vehicles
☒ Car (IMT)
☐ PT
☐ Other</td></tr>
<tr><td>Budget per year to improve traffic situation of all means of transport in the port area</td><td>• no informations</td></tr>
<tr><td>Ideas for improving traffic in the port area by 2025/2030</td><td>• Renewal of traffic regulations, these are intended in particular to increase safety</td></tr>
<tr><td>Measures to improve traffic safety in the port area:</td><td>• Renewal of traffic regulations, these are intended in particular to increase safety</td></tr>
<tr><td>Comments to increase active mobility in the port area</td><td></td></tr>
</table>

HUPMOBILE Partner City:	Tallinn
Modal Split:	**Responsibility for traffic planning in the port area:**
	 **Influence on that organization towards planning processes** ☒**Yes** ☐ Bicycle ☐ Pedestrian ☐No ☒ **Car (IMT)** ☒**PT** ☐ Other **Main traffic problems in the port** ☒ **Heavy Vehicles** ☒ **Car (IMT)** ☐ PT ☐ Other
Budget per year to improve traffic situation of all means of transport in the port area	• All traffic related expenses to the port area will be carried out mainly as project basis • E.g. building a new tramline connecting city centre and airport to the harbor, new Reidi road serving in- and outbound traffic from and to the port area (both cars and trucks).
Ideas for improving traffic in the port area by 2025/2030	• Cargo volume and car traffic will increase by 5 % per year in the port until 2030 • new tram line • Reidi Street has adaptive traffic management components that facilitate traffic flow and thereby reduce emissions • virtual queuing system for trucks
Measures to improve traffic safety in the port area:	• pedestrian crossing, sidewalks • reducing speed • All measures are taking care as a project basis, meaning city has no direct plan with port area
Comments to increase active mobility in the port area	• very difficult as the port is privately owned

HUPMOBILE Partner City:	Helsinki
Modal Split:	**Responsibility for traffic planning in the port area:**
	The Urban Environment Divison is in cooperation wirh the Port of Helsinki responsible fpr the traffic planning in the port.
	Influence on that organization towards planning processes
	☐ Yes ☒ No
	Main traffic problems in the port
	☒ **Heavy Vehicles** ☒ **Car (IMT)** ☐ PT ☐ Other
per year to improve traffic situation of all means of transport in Budget the port area	• no informations
Ideas for improving traffic in the port area by 2025/2030	• Improving PT to the harbour • Overall electrification
Measures to improve traffic safety in the port area:	• There is hardly any port area in the city centre, and therefore port traffic and its safety are handled in a similar way as other safety measures in the city.
Comments to increase active mobility in the port area	• The purpose it to make as many people as possible to arrive to the terminals by public transport and by active modes • However, it is easy to go (or go by) the harbour by foot or by bicycle. • in this sense, Port of Helsinki differs from many other ports as the main (cargo) operations are not anymore in the city centre.

Excurses: Trans-European Networks - Potential to improve cycling infrastructure

The European Union developed the Trans-European Networks to improve the internal market and economic and social cohesion within the Union. A further objective is to achieve a transport system that is as uniform as possible. Art. 170 to 172 in the Treaty on the Functioning of the European Union serve as the legal basis. Guidelines that define the goals and priorities of TEN development are explained here. Among other things, the TENs comprise transport networks - TEN-T - which include roads and railway lines, and ports. Thus, the alignment of the TEN-T can also influence cycling and walking in port areas. Furthermore, there is even the possibility of financing these infrastructure plans through European subsidies.

The ECF (European Cyclists Federation) tries to influence the revision of the TEN-T guidelines and thus wants to contribute to cycling along the TEN corridors. In particular, to achieve the European Green Deal goals, cycling must be significantly expanded. The European Commission published its strategy for sustainable and intelligent mobility on 9 December 2020. The goal is to reduce greenhouse gas emissions from the transport sector by 90 percent by 2050. Furthermore, measures aimed at a safe infrastructure for cyclists and pedestrians and innovative MaaS concepts are to be financially supported.

However, the ECF regrets that no specific milestones have yet been set for cycling as a mode of transport in the future transport system. In general, the revision of the Guidelines still gives too little priority to active mobility. Thus, it calls for an integration of cycling into the TEN-T. This would improve the connection between transport modes, close gaps, and, above all, remove traffic bottlenecks. Therefore, the further development of the TEN-T should be closely considered together with cycling planning because this way, the existing infrastructure can be used even more efficiently. Overall, cycling must play a central role in the European transport network. The integration of EuroVelo and cycling into the TEN-T will foster an unprecedented growth of cycling infrastructure across the EU and eliminate the high follow-up costs of adapting cycling infrastructure to the TEN-T infrastructure.

The ECF recommendation regarding cycling in port areas in connection with TEN-T is that cycling connections in urban TEN-T nodes should be improved, and the design of roads that allow safe cycling should be pushed. Furthermore, port areas are essential centers for commercial activities and jobs. To ensure good accessibility, it should be possible for both commuters and tourists to reach these areas by bicycle. Currently, however, it is often unclear which authority is driving planning for walking and cycling in port areas and on which decisions the planning is based. For example, are leisure routes based on tourist traffic decisive? Or is it businesses in port areas that want to use cargo bikes to transport their goods in the future and thus push the last mile to expand the bicycle infrastructure? Are there other bases for decision-making? This must be considered and evaluated in the next few years to develop the bicycle infrastructure in port areas.

3.2. Commercial traffic

Since MaaS bundles all modes of transport in a user-oriented manner, the question arises as to how commercial transport can also be included in the platform in the future. This part will be taken up again in the development of measures. Now, however, the development of commercial traffic concerning online retailing will be presented first. This is followed by a presentation of the survey on the ordering behavior of residents in Altona during the peak phase of the Corona pandemic.

Development of online retail

According to forecasts, the population living in cities will rise to around 85 percent in Germany by 2050 [26]. Over the same period, life expectancy is expected to increase from 82 to 87 years for women and 77 to 83 years.[27] There are also signs of an increase in single households. The average living space per inhabitant has increased by almost 5 percent from 2010 (45 m2) to 2019 (47 m2), confirming a past trend.[28] Hamburg is also growing. The population is expected to grow by 4.7 percent by 2035.

The continuing increase in the shift from stationary to online retail is seen as the driver of the dynamic development of the logistics sector. Germany's online retail sales rose by almost 200 percent from 2010 (€20.2 billion) to 2019 (€59.2 billion).[29] A further increase in the volume of shipments in online retailing is also expected in the future. The pandemic is likely to reinforce this trend. The development in online retail shown correlates with the strong growth rate of courier express parcel logistics, which is growing 1.6 times faster than GDP. For example, 3.65 billion shipments were transported in 2019 alone. In 2024, it is assumed that more than 4.3 billion CEP shipments will be delivered. The delivery volume per end customer has increased by about 50 percent from 2008 with 15 shipments to 2018 with 23 shipments (including three returns). The changes in the retail sector are also having an impact on supply chains, which are becoming increasingly complex.

Due to the general rise in customer demands and the associated increase in goods requirements (including fresh and chilled), suppliers have to redesign existing concepts. In addition, alternative delivery concepts, such as deliveries to retail outlets or parcel stations near homes, are gaining in importance[30].

Covid-19-Pandemic as catalyst

[26] Statista (2020a)
[27] Statista (2020b)
[28] Statista (2020c)
[29] Statista (2020d)
[30] IHK Stuttgart (2020): 12

The current pandemic is acting as a catalyst for urban logistics. The lockdown, in particular, has led to much more frequent online ordering. Many who previously had not ordered or had only ordered certain goods have realized the advantages and convenience of ordering online.

Regardless of the impact of the Covid 19 pandemic, it is predicted that parcel shipments will continue to increase by 5 percent annually through 2023. In addition, a study by the DLR Institute (German Aerospace Center) for Transportation Research found that a quarter of respondents are shopping online more as a result of the Covid 19 pandemic. The growth of online retail requires innovative concepts to solve delivery problems in high-density inner cities. This is also the case in Mitte Altona.

Online survey on emission-free parcel delivery by the Altona district office

With the support of Quartiersmanagement Mitte Altona as the operator of a mobile station and the cooperation partner DB Smart City, the district office of Altona developed an online survey together. This started at the end of June 2021, with 7,500 people from Mitte Altona invited to participate by mail. The survey is intended to gain insights into households' current and future purchasing and ordering behavior to incorporate into the concrete design of prospective micro depots, delivery, or pick-up services. In addition, we are interested in how people's mobility behavior has changed acutely and sustainably due to the pandemic.

Mobility and delivery preferences in Hamburg Altona - survey results

An online survey on mobility and delivery preferences in Hamburg Altona was conducted by Deutsche Bahn Vertrieb GmbH in the survey period between 22 June and 20 August 2021. The sample comprises a total of 808 respondents, with 48 % male and 52 % female, and an average age of 42.5 years. 85 % of the respondents are employed, 37 % live in couple households, 31 % in family households and 23 % in single households. The questions were aimed at the current mobility situation, especially against the background of the Covid 19 pandemic, at the evaluation and potential of the services of the neighbourhood management's mobile stations, the ordering behaviour and the attractiveness of pick-up services.

Core results of the survey:

Mobility situation

- In the current situation, where two thirds of the respondents have at least two to three times a week in the "home office", the main mobility purposes are localised in shopping / errands, walking / exercise as well as commuting to work.
- Bicycles and (walking) dominate mobility behaviour in Hamburg Altona (after, as before the pandemic).
- Public transport has seen a sharp decline since the beginning of the pandemic. In contrast, there has been a slight increase in (private) cars and (own) cargo bikes.
- After the pandemic, a strong (re-)increase in public transport can be expected. The use of bicycles will also increase slightly (further), while the use of cars will decrease (again).

Services of the neighbourhood management's mobile station

- Strong affinity with the cargo bike: About 70% of the respondents either already use the cargo bike rental service or can imagine using it in the future.
- Very high satisfaction values are measurable for the cargo bike rental service: over 85% of respondents are very satisfied or satisfied.
- 4 out of 5 respondents are interested in the parcel (pick-up) service, 2/3 in the green bio box service. Both services would be used weekly by about 1/3 of the respondents.

E-commerce - drivers and needs

- About 40% of the respondents receive parcel deliveries with goods they ordered online at least weekly.
- Independence from opening hours, greater choice as well as time savings (among other things through delivery) are the main arguments in favour of online. Except for very urgent items and perishable products, there are relatively few things that test persons would not order online. On the other hand, however, there is a clear plea from residents for increasing the share of emission-free delivery traffic.
- Two thirds would be willing to pay a surcharge for delivery in reusable packaging (although the "standard packaging" made of cardboard is "learned" and currently mostly accepted).

4. Fields of action for the further development of a MaaS system with a focus on cycling and commercial transport

Based on the theoretical-scientific examination of MaaS, the study of cycling in the port, and the online survey on the ordering behavior of residents in Mitte Altona, the following fields of action are recommended for other cycling and cycling commercial transport in a potential future MaaS system in Hamburg. The basis for a MaaS system is the further development of ITS structures in the Hanseatic city. Altogether, six different fields of action can be derived:

- Date
- Mobilityhubs
- Interoperability mobility providers
- Innovative linking between means of transport
- Commercial traffic
- Accompanying measures

These, in turn, give rise to various measures. It should be noted that the measures are not isolated solutions but must be applied to the entire district of Altona or the city as a whole.

Fields of action	Date	Mobilityhubs	Interoperability mobility providers	Innovative linking between means of transport	Commercial traffic	Accompanying measures
Measures	(D1) Real-time data	(M1) Developing new hubs	(MP1) Integration StadtRAD (MP2) Integration other mobility providers (MP3) Offer of mobility packages	(I1) Bike and taxi (I2) Bike and ferry	(C1) Tracked parcel delivery (C2) Cargo bikes	(A1) Reduction of IMT (A2) Improvment of cycling infra-structure

Figure 30: MaaS: Field of actions and measures (source: own illustration, Planersocietät)

D1 Real-time data

Real-time data is essential for the integration of a complete MaaS system. For example, counting stations transmit the current passenger numbers on the ferry in real-time to display the free capacity via the mobility screen. Other interesting aspects that can also be recorded by counting stations and included in the mobility screen are freely available city bikes and the number of unoccupied bicycle parking spaces. In addition, a permanent counting station for cyclists will be set up. In this way, current traffic volumes can be recorded in real-time. Based on this data, an up-to-date traffic situation, as well as reliable and time-of-day-dependent traffic planning data, can be derived.

M1 Developing new hubs

At the beginning of 2021, 79 hvv switch points were in operation in Hamburg[31]. Eighteen are located at bus stops, 61 are distributed decentrally in the neighborhoods. Additional hvv switch points in the center of Hamburg-Altona can contribute to a reduction in private car use. A representative survey by the Technical University of Hamburg[32] shows that this is possible with the hvv switch points. In the survey, eight percent of respondents said they had given up their cars because of the new service, while 21 percent said they had consciously decided not to buy a car. The general idea of living without their car is also already firmly established among users. In particular, the conversion of public parking spaces into decentralized switch points meets a high level of approval in the survey.

In central Altona, further hvv switch points provide a mobility offer and other services, such as a parcel station, so that there is a demand-oriented, multimodal shared mobility offer. In Altona, too, carsharing remains the main component, as at a standard hvv switch point. In addition, a broad, multimodal proposal of shared flexible mobility services will be provided within the neighborhood so that routes and route chains of the residents are bundled here. In addition to charging infrastructure, all micro-mobility forms (bike sharing, cargo bike-sharing, e-scooter sharing), as well as a ride-pooling offer, will be established. Here, too, the station is closely related to the app. The difference to the mobility station at Teufelsbrück or Schnackenburgallee is that the hvv switch points in the center do not have to be adapted exclusively to the needs of work trips. In the center, leisure routes or routes to local suppliers also play a significant role.

MP1 Integration StadtRAD

Currently, StadtRAD stations and hvv-switch points still stand in parts by themselves. In general, in terms of quantity, the establishment of additional StadtRAD stations poses fewer challenges than that of a hvv switch point. Soon, hvv switch and StadtRAD need to be thought of together, and integrating the popular bike rental system into the app needs to occur. The integration was original to be completed by mid-2021[33]. However, the step is elementary to increase the usage figures of hvv switch significantly. Thus, a new target group (currently only using StadtRAD) would also be offered further sharing forms.

MP2 Integration other mobility providers

In addition to StadtRAD, hvv switch must integrate other mobility providers and means of transport into the app. In Hamburg, this applies specifically to ioki, all e-scooter providers, and other car-sharing providers in addition to SIXT (cambio, SHARE NOW, WeShare). A more diverse offering opens up new mobility options for users and significantly increases the target group of hvv-switch app users.

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[31] Hvv switch (2021)
[32] Technische Universität Hamburg (2020)
[33] Hvv-switch (2021)

MP3 Offer of mobility packages

Once all mobility providers and means of transport have been integrated into the hvv switch app, the next step towards achieving a complete MaaS system is developing various mobility packages. Whim can be seen as a pioneer and role model here. The offers can be tailored specifically to social groups (students, families, professionals), exclusive use of specific modes of transport (for example, only StadtRAD and public transport), or even for tourists. When setting up the packages, an analysis of the target groups must be carried out in advance. Specific usage patterns, preferences, and lifestyles are included here.

Innovative linking between means of transport

In Hamburg-Altona, the establishment of MaaS structures should not be based exclusively on existing mobility links. This refers to the growing number of switch points in Hamburg, which provide users with an interface between different mobility services. Currently, the switch points are located primarily at S-Bahn and U-Bahn stations. The mobility offered thus mainly consists of the extension of pure public transport in car and bike-sharing providers. In the following, the potential of linking bicycle and cab and bicycle and ferry along the section Teufelsbrück to Alter Elbtunnel will be examined. The stretch represents a highly frequented section between the two traffic bottlenecks. In addition, further factors have to be considered for the connection, such as the service times of the public transport or generally the travel times of the different modes of transportation (bicycle, cab, public transport, and ferry), so that a qualitative statement can be made in the result. Finally, using a scenario conception, the advantages of different situations are explained.

By bicycle, it is possible to cover the more than eight kilometer route between the Alter Elbrunnel and Teufelsbrück in 27 minutes. An exemplary route would run, as outlined above, starting from the Alter Elbtunnel via St. Pauli Hafenstraße - St. Pauli Alter Fischmarkt - Palmaille - Klopstockstraße - Holländische Reihe - Bernadottenstraße - Parkstraße - Jenischpark - Baron-Voght-Straße[34] to the destination Teufelsbrück.

The route for the same destination starting again from the Alter Elbrunnel by car would run along the Elbchaussee. St. Pauli Hafenstraße is also reached via Palmaille or Breite Straße. The route is about 7.5 km long and can be covered by car in about a quarter of an hour, depending on the traffic situation.

Again, the route mentioned above is equally manageable by public transport in various constellations. The starting point can be the bus stop Davidstraße on the Reeperbahn, which can be reached on foot in ten minutes outgoing of the Alter Elbtunnel. Bus number 112 in the direction of Blankenese runs every 20 minutes and takes about half an hour to reach the desired destination. An alternative is bus line 2, which runs from St. Pauli Hafenstraße to Altona Town Hall. Here it is also

[34] Vgl. ITS-Bericht

necessary to change to bus line 112 in the direction of Blankenese. The destination Teufelsbrück is reached in less than half an hour.

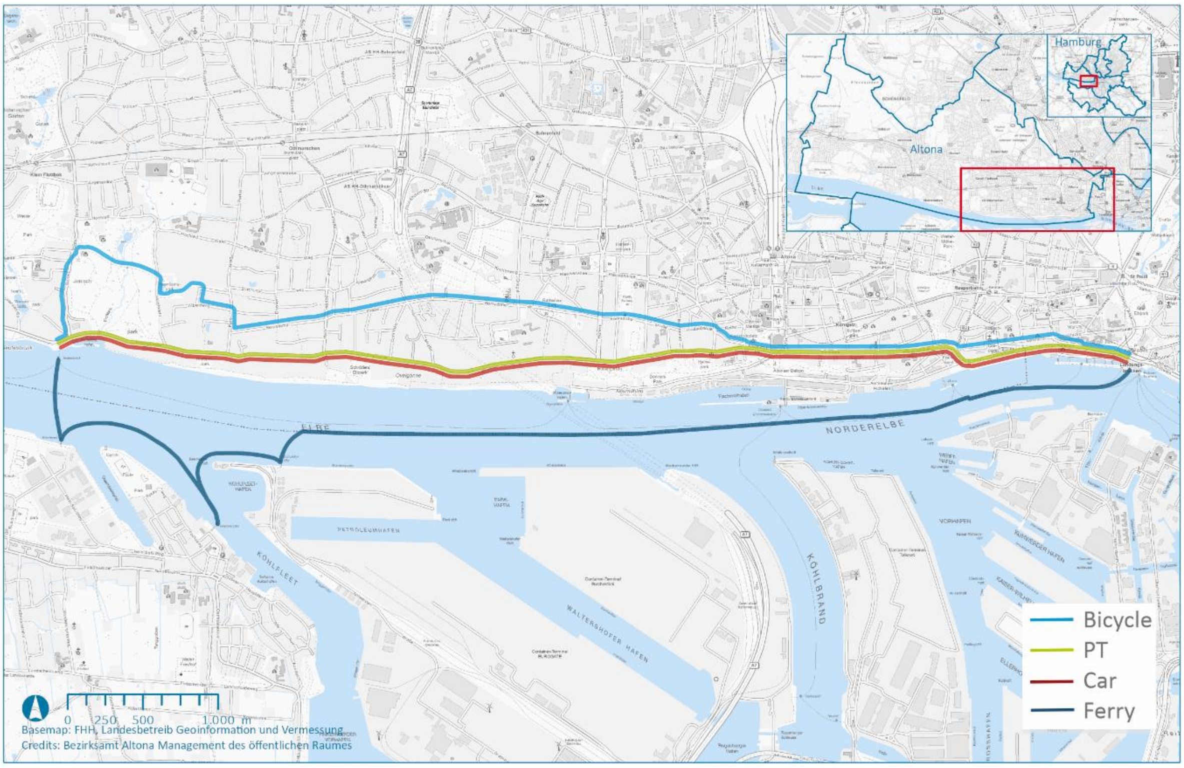

Figure 31: Route selection Alter Elbtunnel - Teufelsbrück (source: Bezirksamt Altona)

There is no direct ferry connection between Teufelsbrück and St.Pauli Landungsbrücken, so the route can only be covered with a change connected by ferry in Finkenwerder (other side/south side of the river Elbe). For example, the route from Landungsbrücken to Finkenwerder could be covered by ferry 62. This is possible daily between 05:15 and 19:15 every 15 minutes and between 19:15 and 23:45 every half hour. The ferry requires a travel time of 28 minutes. Between Finkenwerder and Teufelsbrück, ferry 64 runs between 05:17 and 06:47 every 30 minutes, between 07:05 and 08:47 every quarter-hour, between 08:47 and 14:47 every half hour, between 14:47 and 18:17 every 15 minutes and finally between 18:17 and 20:47 every 30 minutes. The ferry needs a travel time of eight minutes. Therefore, the entire distance from Alter Elbtunnel to Teufelsbrück can be covered in an ideal case (departure at 06:45 Landungsbrü-cken, stop at 07:13

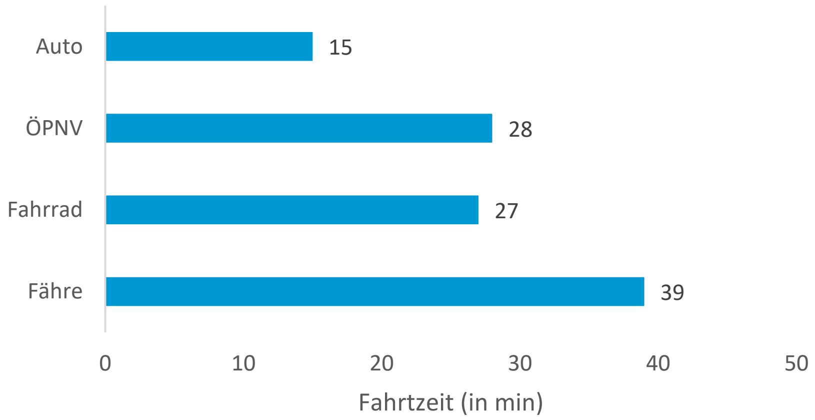

Figure 32: Fahrtzeit Teufelsbrück - Alter Elbtunnel (Quelle: eigene Darstellung, Planersocietät)

Finkenwerder, continuation at 07:16 and arrival at 07:24 Teufelsbrück) in a total of 39 minutes. It can be guessed that a direct ferry connection of the locations would result in a considerable time saving.

(I1) Linking bicycle and taxi

At present, there is little debate in major German cities about taking bicycles in cabs (currently, this is already possible on some buses in Hamburg). The problem is that most cabs do not have facilities for transporting bikes. Often the transport of bicycles is still undesired by cab drivers because of the higher effort. The goal should be to create a higher comfort and flexibility for cyclists with the combined offer because an integrated view and a related integration into the MaaS app offer numerous advantages. For example, cabs can be used when...

- the bicycle is damaged and must be taken to the workshop for repair
- the bike is only needed for the outward or return journey
- the weather conditions change
- the condition of the cyclist changes

The linking of transport modes should be promoted by cities. So far, Copenhagen (Share of bicycles in the modal share at almost 50 %) is an exception. In the Danish capital, the bicycle is part of everyday life, so that even the cabs have a standardized bicycle rack-mounted or are obliged to carry bicycles for a small surcharge. Furthermore, since 2010, Copenhagen has had the regulation that bikes can be taken along free of charge on commuter trains. However, the general carriage of bicycles on commuter trains can be problematic at peak times. Based on this fact and the additional scenarios mentioned above, the linking of bicycles and cabs represents another alternative that can be used daily and should be an integral part of MaaS in terms of the thought process.

(I2) Linking cycling and ferries

Likewise, a better connection between cyclists and the ferry represents an essential transport alternative with immense future potential in the port city of Hamburg. As described above, there is currently no direct ferry connection between the bottlenecks Alter Elbtunnel and Teufelsbrück, so that cyclists now have to change from ferry 62 in Finkenwerder to ferry 64 in the direction of Teufelsbrück. Due to the transfer and waiting time, this means of transport is currently not a natural alternative. A future direct connection should undoubtedly be examined.

In establishing a MaaS system in Hamburg, the connection of cycling with the ferry plays an important role, especially in Altona. An advantageous destination screen contains large digital display panels at the respective locations, on which the various options are displayed according to different categories. In addition to the conventional means of transport (bicycle, public transport, car), the ferry is also included as an option. The technological support tells the user how busy the capacity on the ferry is, how long the waiting time for the next ferry is, or warns of possible high water and

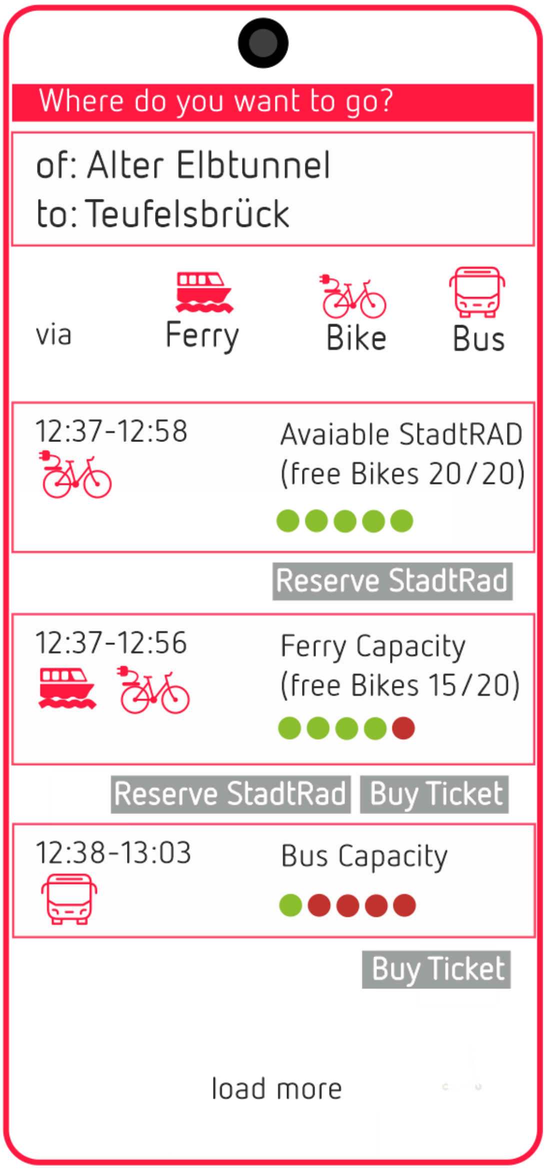

Figure 33: Options for travelling from Teufelsbrück to the old Elbtunnel (Source: own illustration, Planersocietät)

changing weather conditions. An additional display informs the users about these points[35]. In parallel to the screens, users are also informed via the hvv switch app.

C1 Tracked parcel delivery

Commercial traffic can be integrated into a MaaS system to a certain extent via the mobility hubs. Ultimately, however, the topic will only become an integral part of the platform and app in a user-oriented manner. International MaaS pilots are already well advanced in terms of integrating all modes of transport. The link to commercial transport represents a new area. "Tracked parcel delivery" means intelligent parcel delivery via data analysis of the users. MaaS records the daily routes of the users and can thus "predict" through AI at what time a user will be at a particular mobility hub. The package is thus stored here. Based on the data analysis, parcel delivery can be distributed over the city area so that the mobility hubs are equally approached by the cargo bikes, and the traffic is equalized.

C2 Cargo bikes

Traffic problems in Altona caused by delivery services can be reduced by e-load bikes. In Altona, the central inner-city residential neighborhoods with narrow, parked-up street spaces are particularly hard hit. The e-load bikes should be used specifically on the last mile between micro-depots and end customers to reduce overall motorized delivery traffic. In addition, surveying the online ordering behavior of Altona residents should provide information on how and how often they order so that an assessment can be made on the viable usability of e-load bikes. In addition to commercial transport, cargo bikes should also be increasingly offered for use by residents in the center of Altona.

[35] There is an illustration of this in the ITS report

A1 Reduction of IMT

Accompanying the introduction of MaaS in the Hanseatic city, measures must also be implemented to reduce motorized individual traffic in the city center. The focus here is on various push and pull measures. Thus, on the one hand, the environmental alliance and environmentally friendly modes of transport (public transport, sharing forms, walking, and cycling) must be further promoted and prioritized. On the other hand, further measures that specifically curb motorized individual transport must be implemented. These include, for example, the gradual removal of parking spaces and the associated conversion into a car-free public space or the expansion of parking space management.

A2 Improvement of cycling infrastructure

The entire bike path infrastructure in Altona also needs to be massively expanded, qualified, and modernized. A safe and attractive cycling network is an essential prerequisite for the regular use of bicycles as a means of everyday transportation. In addition, the infrastructural expansion of the network should be prioritized on the basis of the defined cycling routes. In this context, it is essential to consider the different target and age groups as well as the purpose of the route. In addition to the network concept, a consistently good, resilient, and safe infrastructure is required to do justice to the holistic promotion of cycling. For example, the increasing variety of models (cargo bikes, pedelecs, recumbent bikes, etc.) also places growing demands on a functional cycling infrastructure (e.g., safety, width, surface condition, maintenance). In the future, the Hamburger Deckel in Othmarschen/Bahrenfeld should be included in Altona's bicycle network. Planning for this is already underway. The Hamburg Deckel will provide new space by enclosing sections of the A7 motorway. The greening of the lid will at the same time reunite the districts previously cut up by the motorway and offer 25 hectares of new green and leisure space. In addition, a continuous green corridor could be created from the Volkspark to the Elbe. No residential or commercial buildings will be built on the lid.

5. Summary

The EU Interreg project HUPMOBILE (Holistic urban and peri-urban Mobility) promotes environmentally friendly and sustainable mobility concepts in urban areas, especially on active mobility and environmentally friendly mobilit. The project focuses on various aspects like harbours, logistics and traffic bottlenecks. Among other things, it focuses on the development of bike & car-sharing concepts. However, the approach is not limited to the transportation of people but also to that of goods.

MaaS embodies the mobility of tomorrow, as the focus is no longer on owning means of transport but on on-demand formats as a sharing system. As a result for the future, all available means of transport can be booked via a single platform and processed here by a payment provider. In addition, different mobility packages are offered, depending on preferences and target groups. In this way, MaaS overcomes the existing boundary between individual transport and public transport in favor of individual public transport. Overall, users can choose between public transport, shared vehicle fleets (car-sharing, bike-sharing, and scooter-sharing), cabs, ride-hailing, and ride-sharing services.

MaaS offers numerous opportunities for mobility turnaround in municipalities, but it also poses numerous challenges. In Germany, the most significant challenge currently appears to be the disclosure of all data. Helsinki's Act of transport clarifies that a state legal requirement for the use of MaaS is necessary. Current data protection precautions make the introduction of MaaS pilots in Germany a distant prospect.

This also becomes clear once again in the introduction and implementation of MaaS. In addition to the legal requirements, a comprehensive pre-analysis of the current situation must also be carried out and bring together the stakeholders to be integrated into the process. The selection and decision of a governance model represent the basis of any MaaS system. How much influence does the municipality want to exert, and which institution is the model operator?

In this report, a comprehensive status analysis was conducted for additional MaaS tools in Hamburg. It becomes clear that the current mobility offer is very diverse. In addition to public transport, the StadtRAD represents the backbone of the environmental network. With the app hvv switch and the physical hvv switch points, important structures have already been established. However, there is a lack of overarching integration of all transport providers. In addition, there is no legal basis for disclosing the data. For hvv switch to join the ranks of Whim and UbiGo, mobility packages must be offered in the future.

Furthermore, concerning the Interreg project HUPMOBILE, the report focused on bicycle and commercial traffic. The traffic counts at the Alter Elbtunnel and Teufelsbrück, as well as the survey of residents on online shopping, show that these two areas are highly present in Hamburg and show high potential for establishment in MaaS. In addition, the count at the Alter Elbtunnel, in particular, shows how high the bicycle traffic is within the port area. In particular, commuters from the surrounding area and Wilhelmsburg use this route to travel to Altona or St. Pauli. Cycling in the port is also a central topic in the HUPMOBILE project so that the cycling infrastructure conditions and planning responsibilities of the partner cities were surveyed. The situation in Altona is an example of traffic bottlenecks resulting from the conditions and effects of the port. The traffic generated by the port has a negative impact on the entire district of Altona, even though it does not directly include the port. In order to improve the traffic situation, massive infrastructure development for AM and PT is necessary in addition to restrictive measures for private vehicles. The network analysis and identification of relevant connections show further challenges for the increase of the cycling share in Altona, so the expansion and modernization of the existing cycling infrastructure facilities are an essential part of an overall concept that has the reduction of motorized private transport and the increase of active mobility as a target.

The results of the analyses flow together in the fields of action and measures. These are to be implemented across the board rather than selectively. The expansion of other mobility hubs and integrating all providers and means of transport in the hvv switch represent the essential next steps. Furthermore, innovative links between different means of transportation can be tested in pilot studies. In Altona, the focus must be placed more on AM and PT so that commuters voluntarily switch to the environmentally friendly means of transport, thus relieving the entire traffic situation.

The HUPMOBILE partner cities and also other cities can learn some aspects from the results of the work. MaaS will play a formative role in many urban spaces in the future. The partner cities can see from the Hamburg example which steps are necessary to implement MaaS. Furthermore, different modes of transport need to be thought together. An expansion of the active mobility infrastructure seems unavoidable for this. With the six fields of action listed, further important components for a future MaaS system are listed. These must be formulated individually in the partner cities or wherever.

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Annex

Pedestrian and Bicycle Counts Teufelsbrücker Platz

Count 10.05.2021

Time/Road User	Pedestrian	Bicycle (Communter)	Parking Bicycle
06:00	128	86	7
07:00	181	128	12
08:00	153	118	7
09:00	84	70	4
15:00	253	48	0
16:00	270	70	1
17:00	280	80	10
Total	**1.349**	**600**	**41**

Count 12.08.2021

Time/Road User	Pedestrian	Bicycle (Communter)	Parking Bicycle
06:00	145	149	1
07:00	129	337	7
08:00	119	351	16
09:00	40	118	5
15:00	286	303	7
16:00	367	396	12
17:00	331	274	3
Total	**1.417**	**1.928**	**51**

Cout 17.08.2021

Time/Road User	Pedestrian	Bicycle (Communter)	Parking Bicycle
06:00	59	65	16
07:00	157	165	25
08:00	147	155	20
09:00	30	39	0
15:00	295	86	12
16:00	335	87	52
17:00	286	120	51
Total	**1.309**	**717**	**176**