



**SMARTER  
TOGETHER**

Smart and Inclusive  
Solutions for a Better  
Life in Urban Districts

# Mobility Stations

Deliverable D4.5.1

Version 1



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## Glossary

SWM	Stadtwerke München GmbH - Munich City Utilities
MVG	Münchner Verkehrsgesellschaft mbH – Public Transport Company
MGS	Münchner Gesellschaft für Stadterneuerung mbH
API	Application programming interface
WiFi	Wireless fidelity
FAQ	Frequently asked questions

## SMARTER TOGETHER BENEFICIARIES

N°	Organisation name	Short name	Country
1	Lyon Confluence	SPL	France
2	Lyon Metropolis	GLY	France
3	HESPUL Association	HES	France
4	Toshiba	TSF	France
5	Enedis	END	France
6	Enertech	ETC	France
7	City of Munich	MUC	Germany
8	Bettervest	BET	Germany
9	G5-Partners	G5	Germany
10	Siemens Germany	SIDE	Germany
11	Spectrum Mobil	STA	Germany
12	Securitas	SCU	Germany
13	City of Vienna	VIE	Austria
14	BWS Gemeinnutzige	BWSG	Austria
15	Wiener Stadtwerke	WSTW	Austria
16	Kelag Wärme	KWG	Austria
17	Siemens Austria	SIAT	Austria
18	Sycube Informationstechnologie	SYC	Austria
19	Austrian Post	POST	Austria
20	Fraunhofer	FHG	Germany
21	Austrian Institute of Technology	AIT	Austria
22	Energy Cities	ENC	France
23	Gopa COM	GPC	Belgium
24	University of St Gallen	UNISG	Switzerland
25	Technical University of Munich	TUM	Germany
26	Deutsches Institut fuer Normung	DIN	Germany
27	Algoé	ALG	France
28	City of Santiago de Compostela	STC	Spain
29	City of Sofia	SOF	Bulgaria
30	City of Venice	VEN	Italy
31	Régionale d'HLM de Lyon	HLM	France
32	Wavestone	WAV	France

## Executive Summary

A total of eight new e-mobility stations have been implemented in Munich Neuaubing-Westkreuz. Four of them were going in operation in July 2018, the remaining four in December 2018 and January 2019. At the big information columns customers can get helpful information about the e-mobility stations with an interactive touchscreen or with the Munich Smart City App. These stations contain different shared mobility offers such as bikes, e-bikes, e-trikes with cargo bike functionalities, e-charging stations, e-cars from Stattauto (STA) and shared district boxes. The shared district boxes are the first ones of their kind with frozen, chilled and non-chilled compartments. This development enables companies to easily deliver their goods to a central location, accessible to consumers 24/7 and also allow the deposition and sharing of items among neighbours.

This report illustrates all relevant aspects of the implementation of Munich's e-mobility stations within the project SMARTER TOGETHER: starting with the aim, followed by the planning steps, an overview of the mobility components, the integration of the components in digital services, ending with an outlook on development and conclusion.

This report reflects only the author's view, neither the European Commission nor INEA is responsible for any use that may be made of the information it contains.

## 1. Introduction of SWM/MVG

With its energy supply, outstanding services, integrated local public transport system and many public swimming pools, SWM (Munich City Utilities) makes an enormous contribution to the standard of living in Munich. Customers receive all necessary infrastructure services from one reliable partner which offers total dependability and competitive prices.

MVG, the Munich Public Transportation Company, is a full subsidiary of SWM. Due to the dense transport network in Munich, it takes only a few minutes for citizens to make use of offers from MVG. Almost every household lies within 400 meters of an underground station, a tram station or a bus stop. Already 450 million customers every year have chosen mobility services provided by MVG in an environmentally friendly way.

Over the years, MVG has grown from a traditional public transport corporation to an integrated mobility service provider, which offers more than just underground train, bus and tram transportation. This includes for example on-demand services, digital developments, a bike-sharing system in the whole City of Munich and several surrounding communities as well as multimodal mobility stations with different mobility options.

## 2. Aim of e-mobility stations

The City of Munich is experiencing a phase of reurbanization with a significant increase in population and also in the number of jobs and commuters. Citizens are experiencing the effects of such increases especially in public transport. Consequently, more efficient means of transport need to be fostered due to the scarcity of space. Therefore the City of Munich encourages citizens to make more use of all transport modes, instead of their own private car on day-to-day trips. Shared mobility is one option to offer a vehicle when necessary, while using walking and using public transport on a daily basis.

Mobility stations, as implemented within SMARTER TOGETHER, provide a versatile range of mobility offers in different spatial contexts.

As a result, the distance to mobility offers per inhabitant shall be reduced, as well as the cost for mobility per household.



## 3. Planning of e-mobility stations

### 3.1 Station planning

Mobility stations implemented within SMARTER TOGETHER consist of the following components: e-car sharing, charging infrastructure for private and shared e-cars, bike-sharing, including normal bikes (MVG Rad), e-bikes (MVG eRad), e-trikes with cargo bike functionalities (MVG eTrike) as well as information columns. In addition, shared district boxes have been built at two locations. The spatial connection of the different offers is essential for user-friendliness. All mobility stations should be fitted with the same components in order to maximize their usability in the project area.

The location of mobility stations at macro level has been determined to be close to typical interchanges of public transport, but also to densely populated residential areas. Hence, it has been stipulated that all five S-Bahn (suburban railway) stops of the Neuaubing-Westkreuz district should be supplemented with a mobility station. Thus, this has made possible to investigate how the linkage of different public transportation offers affects their use. In addition, three more mobility stations have been spread in the district to create a network of mobility stations (see Figure 1 below). One of these stations is directly located in a residential area on private ground.

Once the locations had been determined at the macro level, the exact locations of the mobility stations could be determined at micro-level. These locations have been chosen with regards to different aspects and framework conditions. Of central importance has been the accessibility and visibility of the mobility station. In this context, transport planning and safety had to be considered, as mobility stations are typically located on public property. The implementation of further framework conditions and regulations, such as fire protection, was essential. In addition, Mobility stations should use as few car parking spaces and green spaces as possible to avoid conflict of interest.

A multidisciplinary working group for the location of mobility stations examined eight potential locations with regard to different framework conditions, whereby especially competing space claims were taken into account. Site inspections were carried out with all involved actors from the administration and district committee. The core working group was composed of representatives from the administration departments of the City of Munich like Department of Construction, Department of Public Order, Department of Urban Planning and Building Regulations and SWM/MVG.

For the e-mobility station on private property, many meetings with the owner took place. After months of negotiations, a licence agreement between the owner and SWM/MVG has been signed in which the conditions and duties are determined.

The coordinated location variants of the mobility stations were handed over to an engineering office for further planning, which was selected by tender in February 2017. The engineering office for road planning measured the locations and prepared the draft planning. The design plans of the mobility stations in public space went through a final legal approval process. During this procedure, the design plans were sent to numerous addressees involved in matters of public interest like several divisions, fire protection authority, and police departments.

As part of the final legal approval process, specific conditions or objections have been raised, such as certain distance spaces for fire protection. In consultation with SWM, the engineering office checked conditions and objections and found solutions together with objectors. When there were no objections left, the planned location was accepted and realized (see Figure 1). Alternatively, re-planning according to the described process was required. Then, the engineering office drew up construction plans for the structural implementation.



Figure 1 City map with eight e-mobility stations in the district

### 3.2 Overarching reconciliation

In the early phase of SMARTER TOGETHER, citizens of the district were invited by TUM and MGS to discuss their ideas on how the Smart City may offer and provide transportation. The results of this co-creation process done with five workshops (T4.2) had subsequently been included into the planning of mobility stations and transportation offers. Moreover, during the implementation process citizens were asked for their opinion at events. For example citizens could participate in deciding which e-vehicles they wish for the district (postcard survey).

Prior to the purchase order for mobility components and the construction phase, a wide range of decisions with diverse stakeholders had to be made. One of the most important decisions was on the design of e-mobility stations and their components. Due to the fact that seven e-mobility stations were built on public ground, different city departments have been involved in design reconciliations. In order to achieve an agreement, a working group with numerous representatives was established, including participants of other mobility station projects in other areas of Munich (with partially different components). SWM/MVG commissioned an independent agency

which created design concepts for mobility stations in Munich that meet the guidelines for objects at public ground. In the working group, stakeholders discussed proposals and decided for one design concept, that each mobility component had to comply with (e-bike, e-trike, shared district boxes, etc.). Therefore, a lot of reconciliation with manufacturers, marketing agencies, city departments and other stakeholders took place.

Further topics of the working group were for example the marking, signage and communication in order to create a unified picture and understanding of the mobility stations.

### 3.3 Construction phase

For the construction of e-mobility stations a civil engineering firm has been commissioned, for which a tender was carried out in March 2018. Civil engineering activities varied from one mobility station to another. Basically, power and data cables must be laid, as well as foundations for the individual components of the mobility stations. In some cases, the attachment of green areas and the structural adaptation of the street space were required. In addition, markings of the subsurface were made. The construction of the e-mobility stations (see Figure 3) is limited to the frost-free months, which results in a significant time restriction. Due to the numerous actors involved, the construction required extensive coordination and supervision by a project controller, who was in direct contact with the planner and the project management. After the necessary construction work, the individual components were assembled and put into operation.



*Figure 2: Construction site of an e-mobility station*

## 4. Components of e-mobility stations

### 4.1 Bike-sharing system MVG Rad (bikes) and MVG eRad (e-bikes)

Currently, there is a well-developed bike-sharing system in Munich and several surrounding communities with over 3.000 non-electric bicycles from MVG. However, the project area of SMARTER TOGETHER is located on the outskirts of Munich and so there was no bike-sharing system until SMARTER TOGETHER started.

To expand the bike-sharing system to the project area Neuauubing-Westkreuz/ Freiham, bicycle stands and bikes which are compatible with the existing bike-sharing system have been commissioned and IT implementation processes have been carried out. The construction phase of bicycle stands started in June 2018 and bicycles were delivered in July 2018. The bicycle hire system implemented within SMARTER TOGETHER is station based. This implies that customers can rent bikes at e-mobility stations and either bring them back to one e-mobility station or to one MVG bike-sharing station or just leave the bike at any location in the defined free-floating area.

E-bikes (see Figure 4 below) have been included exclusively at the bike-sharing system in the project area Neuauubing-Westkreuz/ Freiham, and in one additional location in the city center (within another pilot project). Customers have to bring back e-bikes at one of the e-bike stations to charge batteries. E-bikes enable the user to cycle longer distances easily. But, an important development effort was necessary to offer e-bikes at each mobility station. First, the research included market analysis as well as analysis of user experiences and interviews with users and target groups. Additionally, an operational concept has been developed and architects worked on the IT aspects.

The operational concept included the creation of terms and conditions, privacy policy, a product page, FAQ and pictures. Another part of the concept was to plan and coordinate all resources to build up the station, create a backend system for

billing, customer service and rental data, followed by the creation of an app for the users, which was thoroughly tested.

After all requirements were defined and described, a call for tender has been executed. The compatibility of e-bikes to the already existing bike-sharing system was one of the main requirements. Then, offers were evaluated and the order was awarded in May 2018. Shortly after the award, the IT was integrated in the existing sharing system (Mobile application “MVG more”) and the stations and MVG e-bikes were delivered and installed (see Figure 4).

Like many projects, MVG e-bike also faced several challenges, especially regarding the on time delivery of e-bike stations as well as the e-bikes.



*Figure 3: One e-mobility station in the project area*



*Figure 4: Bike-sharing system*

## 4.2 E-Trikes with cargo bike functionalities (MVG eTrike)

MVG e-trikes are cargo e-trikes for transporting objects and enabling easy use for mobility impaired citizens (see Figure 5 below).

Until the delivery of all e-trikes, extensive development steps and organization had to be performed. During the research phase, several analyses were accomplished regarding the market, as well as user experiences. An operational concept had to be developed and the architecture of the IT was created. Further challenges were the planning of the app, the frame and lock system, the engine and charging. The process of research ended with interviews of users and target groups.

Based on an already existing e-trike prototype from the EU-funding project *Civitas Eccentric*, requirements for the present implementation have been defined and described. Requirements for the procurement comprised the integration of e-trike components for bike-sharing, testing and improving the components, the integration of the e-trike in the mobility modal context in Munich and the testing of the e-trike prototype in the living lab with potential users.

Similar to the MVG e-bike, terms and conditions, privacy policy, a product page and FAQs for the MVG e-trike had to be created. Planning and coordination for the station build up, creating a backend system for billing, customer service and rental data, as well as a user app formed a large part of the concept.

Several suppliers worked closely together with MVG on this project part. One company was responsible for the battery and the engine, another for connecting the electric components of the e-trike. A third one was responsible for the manufacturing of the e-trikes and service and operation of the e-trike was performed by another company.

The implementation of the project part encompassed ensuring of battery safety, managing charging cycles and the electric lock system, product design, providing robust board computers, testing and integrating bike components for sharing and integrating of all components and the backend system. The biggest challenge was the reception of batteries due to delivery problems of the battery industry.



The app, the customer portal and background system were successfully integrated and MVG e-trikes gone live in January 2019.



*Figure 5: E-trike with cargo bike functionalities*

### 4.3 Shared district boxes

At the initial planning phase, several internal and conceptual workshops with city representatives and Saint-Gallen University (UNISG) were held to define the shape and business model of shared district boxes. The idea was to develop shared district boxes similar to a parcel box, which is always accessible and independent of opening hours of stores. Moreover, a survey with potential users in the district was carried out. The participants could mention for which purposes they want to use such a shared district box and what delivery of goods they are interested in.

Due to the fact that this concept was completely new in Munich, a design had to be created for the boxes and to be matched with the design concept of mobility stations.

After the planning phase, the requirements of the shared district boxes (hardware and software) were collected. Then, agreements on location (one box is located on public space and one on private property), installation time and requirements for the shared district boxes were reached. The call for the tender was published in October

2017. Different IT customer processes were described in the tender to define more than one service and to find a suitable manufacturer and contractor for the boxes.

emmasbox GmbH won the bid and delivered the hardware (see Figure 6 and 7) with corresponding software. Afterwards IT customer processes were coordinated to involve stakeholders (for example local economy via external online shop and its integration in the shared district boxes). Meetings with potential cooperation partners, an e-marketplace provider and large grocery store chains, took place to conclude cooperation contracts. In the first phase of operation, one cooperation partner, the online supermarket Getnow New GmbH (delivery from the local grocery store chain), got involved and signed a contract.

With the application programming interface (API) to external online shops, these shops can deposit ordered goods in the box to be picked up by customers. The box consists of integrated non-chilled, chilled and frozen compartments to enable deliveries of all groceries. By delivering goods to the box and not to different homes, transport routes are expected to be shortened and consequently CO<sub>2</sub> emissions lowered on the delivery. Moreover, customers can receive goods at any time and do not have to wait for the delivery service or at cash desks in supermarkets anymore.

Citizens as well as tourists can also use the box as lockers for anything they want to store or lock in. Another option for private persons is to exchange several objects with each other by placing them in a compartment and giving the code to a friend or a neighbour. So there is an easy possibility to share objects in the neighbourhood or among friends if it is not possible to meet in person.

For the access of customers the boxes have a touchscreen and barcode scanner, an age verification terminal for age-restricted products and are further accessible for people with reduced mobility.



Figure 6: Shared district box front side



Figure 7: Shared district box side and rear side

#### 4.4 E-Carsharing from STA

STA and MGS coordinated a survey with postcards to elaborate what type of e-cars citizens would prefer. The citizens were especially interested in the small car Renault Zoe, middle class Nissan Leaf and haul truck Nissan e-NV200.

Before ordering these e-cars, STA had to wait until the completion of the charging stations was foreseeable. E-cars are equipped with a special board computer and incorporated in the booking system. For the technical design of the board computer, several meetings took place to determine the access technology for the board computer. Moreover, STA determined a special tariff for e-carsharing-cars to provide incentives for citizens in the first operational phase.

Shared e-cars from STA are station based (see Figure 8), so the customer has to return the car where he/she rented it, to guarantee a parking lot with charging infrastructure.

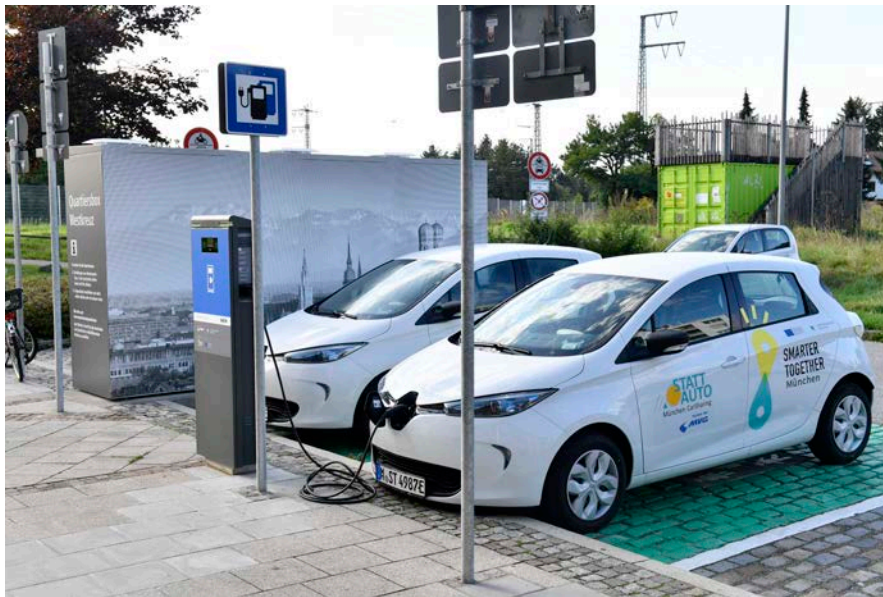


Figure 8: E-Carsharing from STA

## 4.5 Charging infrastructure

Each e-mobility station is equipped with a charging infrastructure for electric vehicles (see Figure 9). Charging stations provide up to 22 kW with a Type 2 connector to any vehicle. STA has permanently assigned parking spaces at all mobility stations with a minimum of one corresponding charging point. At six e-mobility stations, there is also the opportunity for citizens to charge their private e-vehicle at the remaining charging point.

In November 2017, the charging stations were ordered, IT implementation processes were finalised and requests for electricity were made. During the construction phase, electricity was installed below surface and solid foundations were set.



Figure 9: Charging station

## 4.6 Information columns

The center of each e-mobility station forms the information column. On the one side of the column, there is an interactive touchscreen where people can find information about the mobility offers and further services in the vicinity (see Figure 10). More information about the services of the interactive screen is provided in sections 5.1 and 5.2.

On the other side, there is a display case with information about the renting process for the bikes, e-bikes and e-trikes in German and English (see Figure 11). Additionally, the information column shows the name of the e-mobility station and the icons for mobility offers that are available at this station at the top.



Figure 10: Information column with interactive touchscreen



Figure 11: Information column with display case

## 5. Integration of mobility components in digital services

### 5.1 Smart City App

The Smart City App has been developed within the scope of SMARTER TOGETHER. It includes several services from three stakeholders: The city of Munich (MUC), their subsidiaries SWM/MVG and Portalgesellschaft muenchen.de.

The app has been released in two versions, for iOS and Android respectively.

Within the app, there are different services available:

- Mobility services with departure times of public transportation, and information on locations of bike- and car-sharing, charging stations, shared district boxes and mobility stations and their availability.
- Services of city administration which are categorized into different sections such as family, work, health and many more.
- Yellow Pages with more than 5000 entries of restaurants, sights, WiFi spots, events and many more.

The Smart City App is the digital companion for citizens, commuters and visitors of the City of Munich and downloaded approx. 300.000 times.

### 5.2 Smart City Webapp

The huge success of the Smart City App led to the development of the Webapp, which is an application for the information column at the mobility stations (see Figure 12). The Webapp is a customized version of the Smart City App with a focus on finding the needed information quickly at the digital touchscreen.



Figure 12: Information column with the Smart City Webapp



## 6. Further development and conclusion

### **Bike-sharing offers**

If the new offer of e-bikes and e-trikes is well accepted in the test area, it is desirable to extend these mobility options to the entire urban area of Munich. Moreover, the number of (e-)bikes can then be increased as well.

Furthermore, e-trikes use a modular sharing system, which is transferable for all electrical mobility services/vehicles. This means that it can be extended to other forms of mobility too, for example pedal-scooters.

### **Shared district boxes**

In the future, more online shops can be added via a standardized application programming interface (API) to deliver a variety of goods in the box. Also it is conceivable to integrate further processes in the future, e.g. package delivery, cleaning service. Attention was paid to scalability, if there is a need to increase the number of shared district boxes, e.g. in the downtown area, it is feasible.

### **E-Carsharing**

If the monitoring and evaluation phase shows that e-cars are rented frequently and are reliable in use, it is planned to integrate more e-cars in the carsharing fleet of STA. Thereby big steps for the environment and climate change mitigation can be achieved with respect to the Sustainable Development Goals and the European 2020 strategy.

### **Smart City App and Webapp**

The Smart City App and Webapp have to be developed further because new services such as new carsharing providers need to be included into the app. Furthermore, the app should be extended with further functions, such as individualization in regards to user interests like neighbourhood services. The app is going to have a registration/login with the benefit of saving different favourites to individualize the app for user's needs, e.g. showing only events of user's favourite band.

In general it can be said that the deliverables and measures of SMARTER TOGETHER have been challenging and it has been difficult to meet the timeline. However, numerous experiences have been gained, cross-functional working was supported and without SMARTER TOGETHER it would not have been possible to develop these new mobility offers in such a short time. Experiences and processes can be used for further e-mobility stations in Munich and other cities like the Follower cities of Sofia, Venice and Santiago de Compostela, with which there is a regular exchange. Hopefully, in the monitoring and evaluation phase, e-mobility stations will be used frequently by citizens and thus, decisions will be made to expand further e-mobility stations in Munich.

## References

For more information about the Smart City App and Smart City Webapp, the report [Deliverable 4.5.2 e-mobility and smart mobility management](#) is available on SMARTER TOGETHER website<sup>1</sup>.

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<sup>1</sup> <https://www.smarter-together.eu/deliverables>