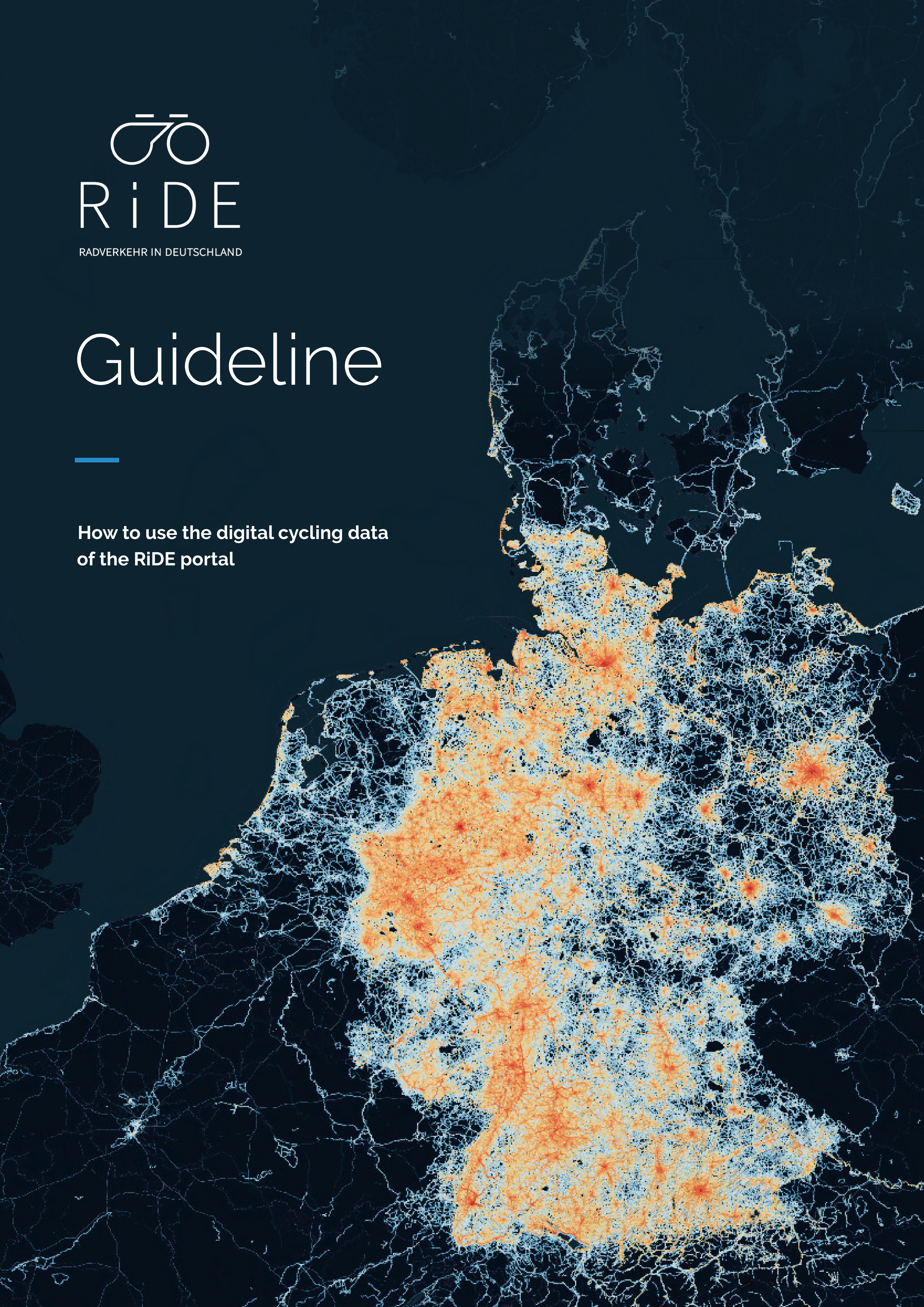

RADVERKEHR IN DEUTSCHLAND

# Guideline

**How to use the digital cycling data of the RiDE portal**

**Guideline — How to use the digital cycling data of the RiDE portal**

Dresden, April 2023

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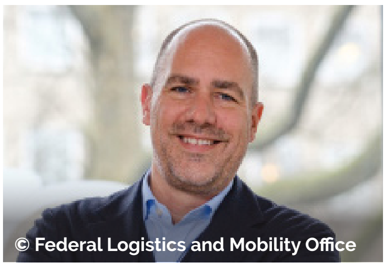
Dear Reader,

As the project administrator of the Federal Ministry for Digital and Transport (BMDV), we, the Federal Logistics and Mobility Office (BALM), consider the promotion of cycling an important task entrusted to us on the road to more sustainable and environmentally friendly mobility in Germany. In recent years, we have already observed and achieved significant progress in the promotion of cycling through our project management. At the same time, we are aware that there are still many challenges that we need to address together with the federal states and municipalities, citizens' initiatives, research institutions and the private sector.

To further increase the percentage of daily trips accounted for cycling, it is very important for transport planning – from federal to municipal level – to have reliable and comprehensive data available. Data is an indispensable tool in further promoting and improving cycling in Germany. Only on the foundation of a valid pool of data can sound decisions be made and the right measures taken.

Data on cycling helps planners to better understand the needs and requirements of cyclists and to take specific action to improve infrastructure and road safety. Until recently, however, there was no comprehensive data on cycling in Germany. Based on the research project MOVEBIS, data on cycling in Germany has been continuously collected, processed and made available for municipal cycling planning since 2018 via the RiDE portal, which was created after the MOVEBIS project was completed. In our management of the follow-up project MoveOn, we as the project administrators ensure that data collection and data processing are further improved, and that cycling data will remain available for municipal transport planning via the RiDE portal.

This guide provides an overview of possible uses for the RiDE portal, its range of functions, and examples of how it can be used as a tool in cycling planning. We as the Federal Logistics and Mobility Office are convinced that this data and its use play an important role in cycling planning and will continue to do everything in our power through our project management to improve cycling in Germany and to establish data-based planning throughout the country.




**Christian Hoffmann**
President – Federal Logistics and Mobility Office

RiDE
RADVERKEHR IN DEUTSCHLAND

Dear local representatives,

we hope that the RiDE portal is of interest to you! Would you like to use the digital cycling traffic data for your municipality after participating in the CITY CYCLING campaign? Then sign up now:

https://marktplatz.radverkehr-in-deutschland.de/registrieren

In our custumor portal, you can configure and order relevant data, visualisations and additional services. Thanks to funding from the German Federal Ministry for Digital and Transport, some of the use cases are even available to German CITY CYCLING municipalities free of charge.

We look forward to your registration!

Your team Radverkehr in Deutschland

More information (in German only): radverkehr-in-deutschland.de

flow.d

CLIMATE ALLIANCE

VISION VELO

*in cooperation with*

CITY CYCLING
Cycling for a better climate

# RiDE – The Partners

The RiDE partnership was set up on the basis of the research project MOVEBIS to collect cycling data throughout Germany and to make this data available to those involved in cycling planning. The partnership includes the following stakeholders:

flow.d

Using state-of-the-art data processing technologies, the flow.d GmbH has been providing municipalities, federal states and engineering firms with new kinds of data for digital cycling planning since 2021. This allows customers and partners of flow.d to make marked improvements to cycling in Germany through cost-efficient planning and demand-oriented infrastructure development. For customers and partners, flow.d develops and operates a platform under the partner brand RiDE that represents a marketplace for the supply and purchase of data-driven and interactively visualised information and enables specifically tailored services.

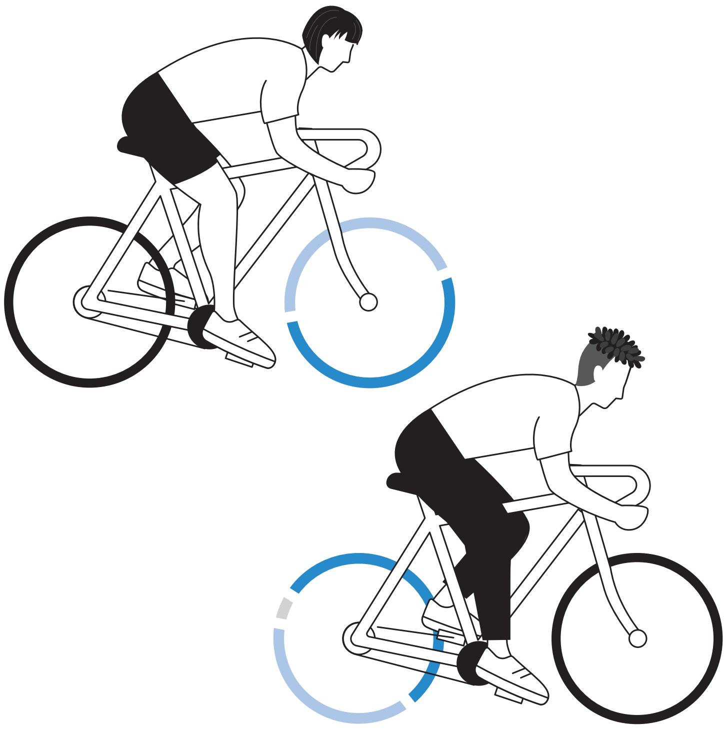
CLIMATE ALLIANCE

Climate Alliance is the largest European network of cities committed to comprehensive and equitable climate protection, combining a local approach with global responsibility.
Its campaign CITY CYCLING has now become the world's largest cycling campaign, with around one million cyclists from over 2,500 municipalities taking part. Through the possibility of recording the cycled distances via the CITY CYCLING App, a comprehensive database on cycling can be collected. In order to optimise this data, Climate Alliance invites municipalities and cyclists to participate in the campaign and to use the app.

VISION VELO

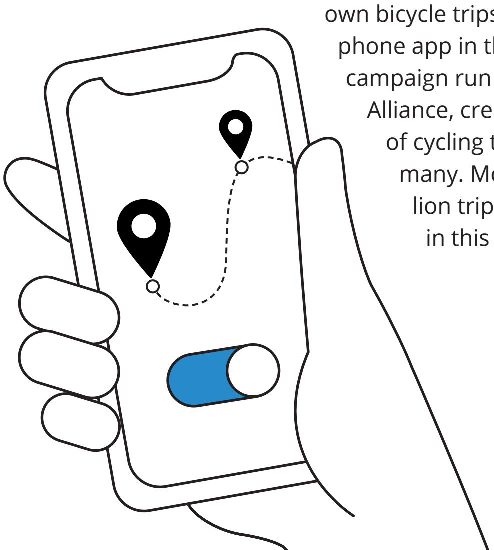
The team of Vision Velo UG – a spin-off from the Faculty of Transport Sciences at TU Dresden – boast many years of experience in transport sciences and cycling research. Their expertise lies primarily in their innovative approach to planning based on digital cycling data as well as in the collection, processing and analysis of cycling data and cycling behaviour. Vision Velo's main contribution to the RiDE partnership is in providing support, advice and the development of the use cases. The engineering office assists in the analysis and interpretation of cycling data and offers in-depth data analyses, the evaluation of measures as well as the conceptual development and implementation of research projects.

# From Cycling to Data



To carry out cycling planning effectively, transport planners require knowledge about the spatial distribution of cyclists within the transport network. For many years, this information has been gathered using data collection methods such as traffic counting or surveys. These approaches can sometimes involve a great deal of time effort and, however, do not always deliver all the necessary information. Simple traffic counting, for example, only produces data at a few selected points, while surveys usually lack a connection to the routes used. Traditional methods are often very costly due to the relatively high deployment of personnel required and thus inhibit the ability of municipalities to build up sufficient base data – and this is not only true for financially weaker municipalities. In contrast, the collection of GPS data by citizens is clearly superior to conventional approaches not just in terms of cost, but also in terms of information content.

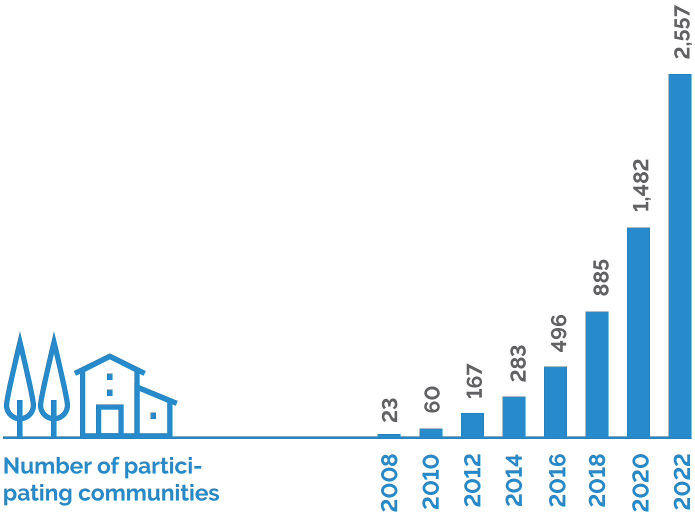
The conditions for extensive recording and use of data for cycling could hardly be more favourable: thanks to increasing digitalisation and the widespread use of smartphones, virtually every cyclist already has access to the data collection tool necessary for recording cycling data. Some past national and international campaigns have demonstrated the willingness of cyclists to record their trips in impressive fashion: for example, every year cyclists record their own bicycle trips via a smartphone app in the CITY CYCLING campaign run by the Climate Alliance, creating a picture of cycling throughout Germany. More than 5 million trips were recorded in this way in 2022.

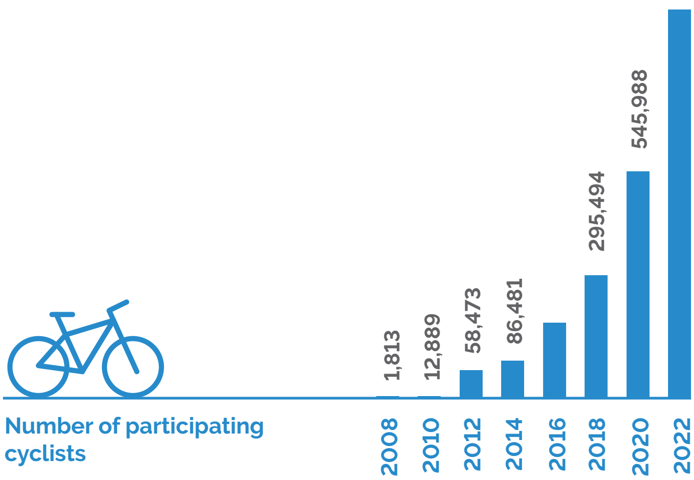


The information collected represents a huge treasure trove of data for transport planning, and this is constantly growing thanks to the advancing digitalisation of society, as well as citizen science approaches and citizens' readiness to participate in such campaigns.

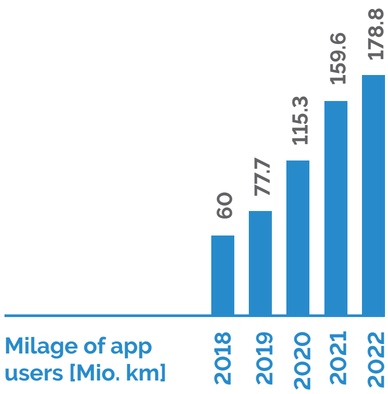
The data used and processed in the RiDE portal originates from the CITY CYCLING campaign by the Climate Alliance. One of the key objectives of CITY CYCLING is to raise public awareness and support active mobility as a measure in the fight against climate change. During the annual campaign period, participating municipalities call on their citizens to make as many of their everyday trips by bicycle as possible. To record the distances travelled by bicycle, a smartphone app was developed on behalf of the Climate Alliance for Android and iOS operating systems. Citizens participating in CITY CYCLING can download this app and use it to record their trips during the campaign period. Cyclists can start the recording at the beginning of their ride and stop it at the end. Once recording has finished, the user is shown the route travelled, the number of kilometres cycled are documented, and the recorded GPS track is uploaded

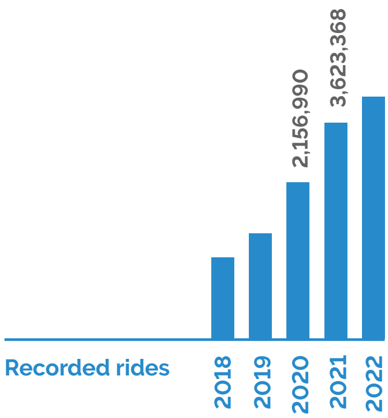
## Development of CITY CYCLING

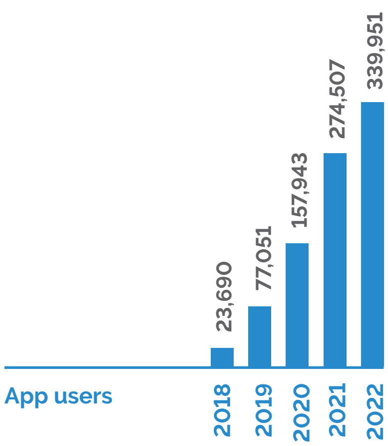



## Scope of the recorded Data



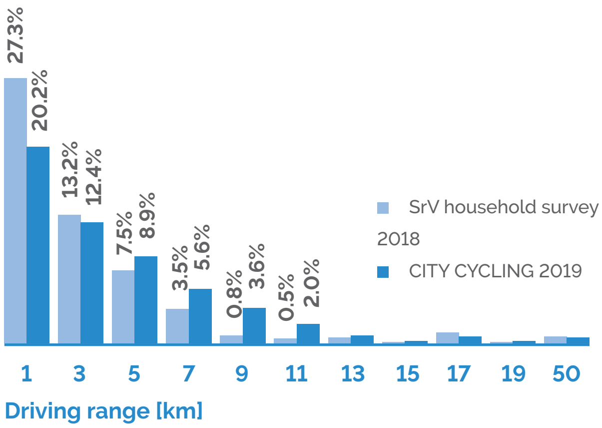
to a distributed cloud. Both trip-related data and a small amount of personal data are collected. The latter is particularly important for assessing the representativeness of the data, as the collective data gathered (in anonymous and aggregated form) can be compared against the population of a municipality. The recorded and transmitted raw data only represents a usable dataset for transport planners, however, after complex cleaning, processing, aggregation and anonymisation have taken place.

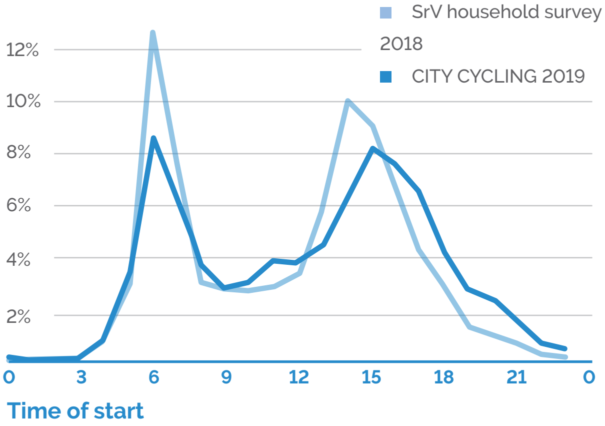
An initial plausibility check of the data collected reveals that two major problems arise when data is collected by CITY CYCLING participants. Participants do not always stop recording their trips when they have actually finished cycling. In some cases, this means that parts of a trip not travelled by bicycle are recorded. The recording of trips made using modes of transport other than the bicycle is therefore an additional challenge. Although these cases are relatively rare, with a total of 5 million trips recorded they occur too frequently to be corrected manually. Therefore, a multi-level decision tree model was developed and implemented by the TU Dresden in the MOVEBIS project. Using this technique, all uploaded GPS tracks are automatically checked as part of the data processing and, if necessary, segmented into individual trips and activities.

In addition to the data collection problems mentioned, there are also technical challenges. Due to measurement inaccuracies (±10m) and signal interruptions – in densely built-up areas with lots of glass façades, for example – the recorded GPS points are never located exactly on an element (e.g. a link) in the network model. The clear assignment of each point to a link is, therefore, a complicated matter. If the trips cannot be clearly assigned to the network links, this is problematic if, among other things, the trips that actually take place on the links can be aggregated into traffic volumes. Given the large number of routes recorded by CITY CYCLING, manual assignment would take a disproportionate amount of time and would not be feasible. Therefore, automatic assignment of the points to the network elements in the network model is used. This process is realised via map matching to an OpenStreetMap (OSM) network model..

As the GPS data can in principle be assigned to individuals, further steps are necessary to ensure that processing complies with data protection requirements. The quality of anonymisation required is defined in the General Data Protection Regulation (GDPR) of the European Union (EU). According to this regulation, route data must be anonymised in such a way that it cannot reasonably be assigned to an individual with the means

Representativity of the Data

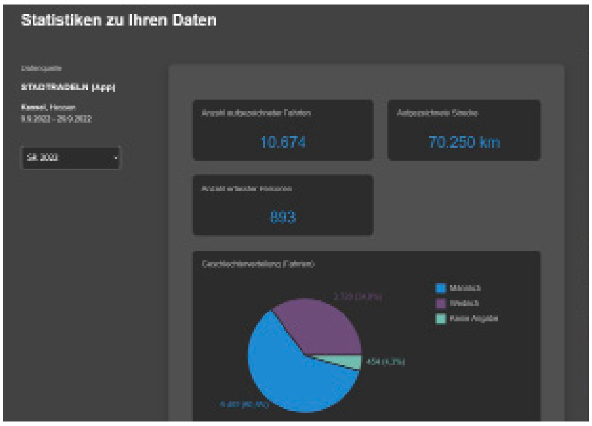


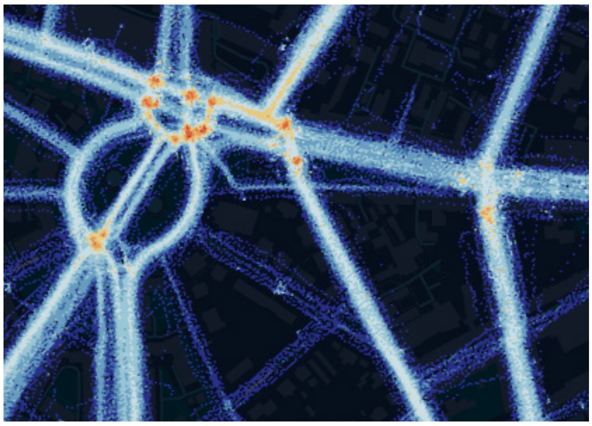

currently available and with a justifiable expenditure of time and money. If this is the case, it counts as technical data, which can be provided and used without data protection concerns. Following the recommendation, an anonymisation procedure was developed and implemented that anonymises the GPS tracks and goes far beyond the legally required degree of anonymisation.

# The RiDE Portal

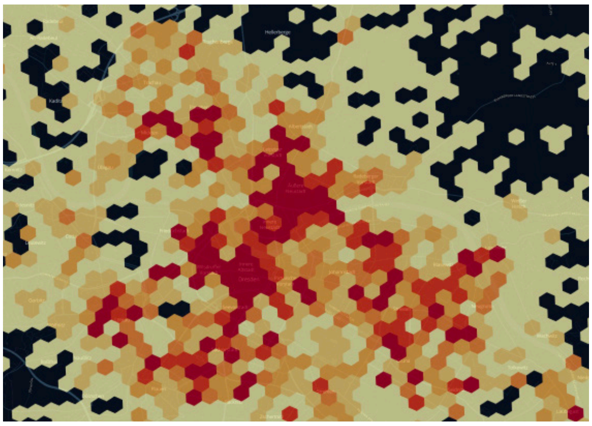
The RiDE portal is designed as a web GIS. Its basic operation aims to be as intuitive as possible, with the portal's structure based on that of common geographic information systems (GIS). The portal features the following information levels:




The statistics dashboard summarises all descriptive statistics for trips in the area examined and thus provides an overview of the sample and also the representativeness of the data. The dashboard shows the number of trips and the people recorded, in addition to the total distance recorded and the gender and age distribution.

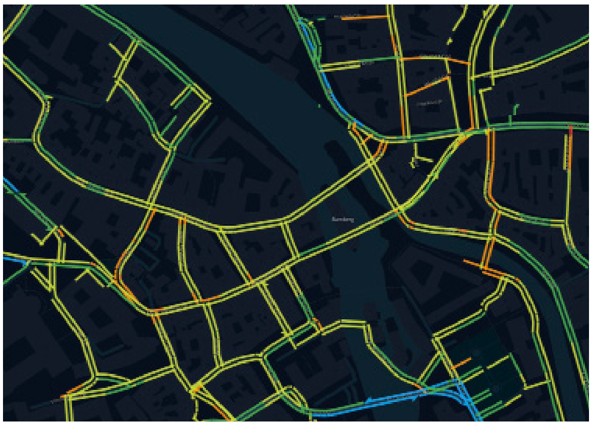


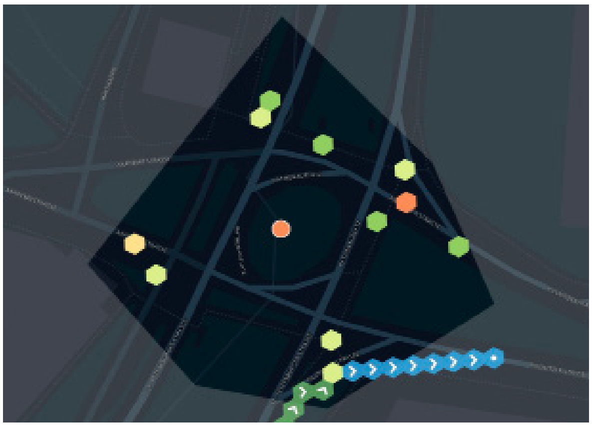
The heat map represents the total number of GPS points in the bicycle trips recorded during data collection within an area. Brightly lit areas of the map represent many GPS points recorded; less brightly lit areas represent few GPS points. The heat map therefore offers an initial overview of the distribution of cycling within the municipality. The heat map can also be used to identify network sections cycled on where cycling is not actually permitted under road traffic regulations, but which are nevertheless used by cyclists because they offer the shortest route.



The map of bicycle traffic volumes visualises the sum of all bicycle trips on the elements of a traffic network within the three-week campaign period. These network elements include roads, cycle lanes, footpaths, etc. The map of bicycle traffic volumes can provide an impression of the spatial distribution of cycling in a city. Based on the presentation of absolute bicycle traffic volumes on the map, the visualisation can be used to evaluate measures, for example by comparing link occupancy in different years. All trips that have taken place in the area are shown.

The visualisation of origin-destination relations covers both origin traffic (start of trips) and destination traffic (end of trips). The absolute traffic volume is shown – in other words the number of bicycle trips – and its distribution across the municipal area. The data collected and visualised can serve as an input for strategic cycling planning decisions and help to align supply more closely with demand. For the implementation of cycling measures, such data and visualisations can therefore provide excellent guidance in the planning process.





The visualisation of speeds in the network shows the average speed travelled on individual route sections separated by direction of travel. The different colours can be used to identify sections of the traffic network in which high average speeds are travelled or in which cyclists could only travel at relatively low speeds. This can be used, for example, to check whether the average speed of cyclists increases after routes are improved.

In the waiting times use case, all waiting times for cyclists at intersections are displayed. A distinction is made between average and maximum waiting time per intersection and a classification of the intersections by quality level is shown (A-F – based on the German technical manual for the design of road traffic facilities, HBS). Furthermore, the waiting times are broken down according to the direction of travel and the turns cyclists make at intersections. This can be used to evaluate the effects of measures implemented to speed up cycling, for example.

# Use of the RiDE Data – Examples from the Municipalities

The data and visualisations given above can be used in a variety of ways. In the following, five real-life examples are used to illustrate how the data is used to resolve issues concerning municipal bicycle traffic planning.

## Munich – building the Arnulfsteg bridge for bicycle traffic

Munich, the capital city of the German state of Bavaria, is actively driving forward improvements in conditions for cyclists. To promote cycling, the city authorities have come up with a number of measures. Some of these are still at the planning or implementation stages, and some have already been put into practice, such as a new link between the residential and commercial areas to the north and south of the railway tracks in the centre of Munich, to the west of the central station.

**Starting point**

The set of railway lines running from east to west, whose western end terminates at Munich central station, is so wide that there are very few ways to cross it. This has a significant divisive effect on bicycle traffic. For instance, until late 2020, in order to travel from Marsstraße, in the northern district of Arnulfpark, to Schrenkstraße, in the southern district of Schwanthalerhöhe, cyclists had to use one of two bridges: Donnersbergerbrücke to the west or Hackerbrücke to the east. However, the existing routes involved large detours, the Donnersbergerbrücke route being 1.7 times longer than a straight-line measurement between the two points, and the Hackerbrücke route being 2.1 times longer. Apart from their indirectness, these routes were unattractive to cyclists due to their high volumes of motor traffic and the lack of separation between motor and bicycle traffic, resulting in deficiencies in safety.

**Aim and measure**

The main aims of the city authorities were to enable foot and bicycle traffic to cross these tracks directly, and thereby provide a better connection between the residential and commercial districts on either side of the railway lines. The crossing needed to be safe, accessible to disabled users, and separated from motorised private transport.

To meet these requirements, a new bridge was planned and built. Now, as of 23 December 2020, the Arnulfsteg connects the Schwanthalerhöhe in the south with the Arnulfpark in the north, providing a convenient and safe way of crossing the tracks.



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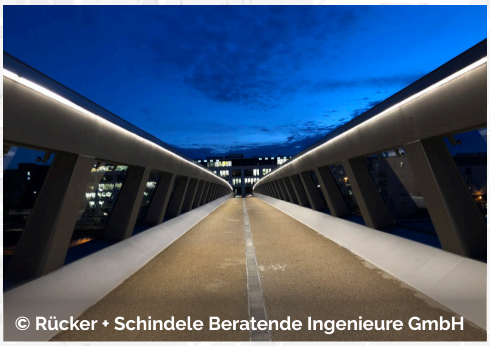
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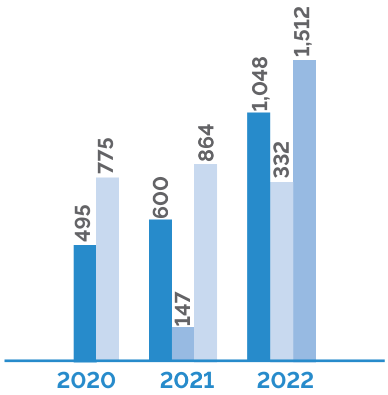
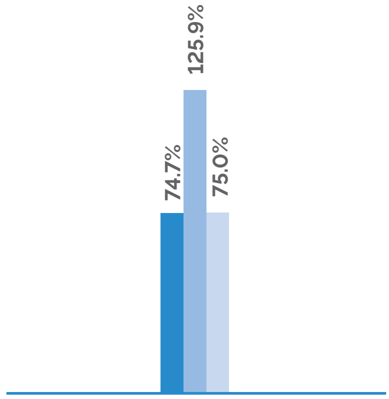
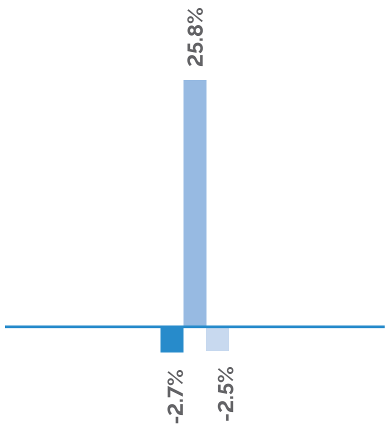
Construction and finished bridge „Arnulfsteg“




Cycling traffic volumes on the three bridges




Development of cycling traffic volumes 2021 - 2022




Relative gain/loss on corridor traffic from 2021 to 2022

- Donnersbergerbrücke
- Arnulfsteg
- Hackerbrücke

**Evaluation of the measure**

It is very valuable, from the municipality's perspective, to evaluate the measure that has been implemented in order to be able to estimate the impact of the measure and thus gather experience for future measures. The main focus is the issue of whether and to what extent the bridge is accepted and used by cyclists, and to what extent it influences them to relocate from neighbouring bridges (Hackerbrücke and Donnersbergerbrücke). The evaluation can therefore also permit conclusions to be drawn regarding whether the intended aims have been achieved.

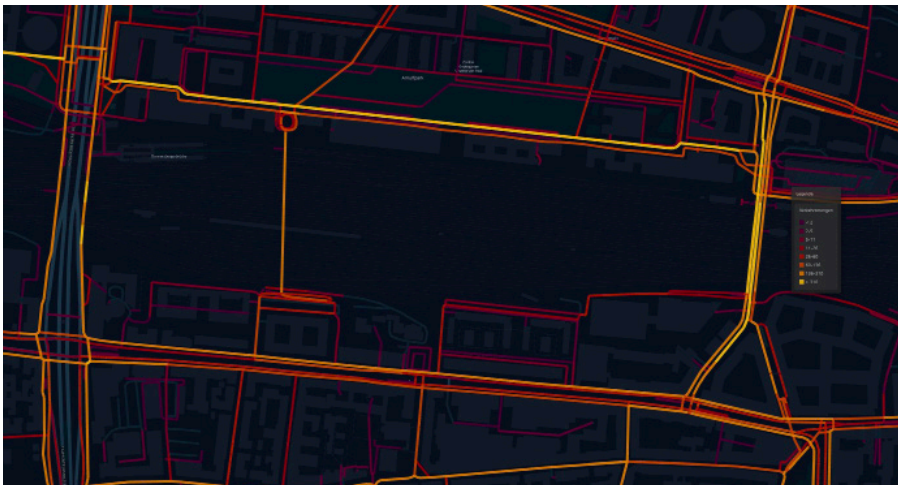
**Method and data used**

The data available in the RiDE portal from the map of traffic volumes can be used for the evaluation. In our real-life example, bicycle traffic volumes from 2018 to 2022 were taken into account for all routes in the area under consideration. As the Arnulfsteg was completed and approved for use by cyclists at the end of 2020, it makes sense to compare the bicycle traffic volumes and their development in 2020, 2021 and 2022.

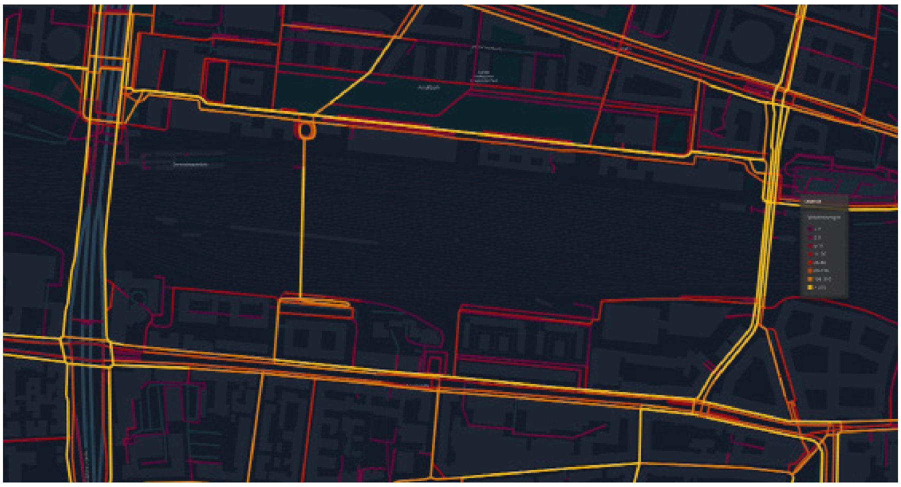
An initial look at the traffic volume map shows that the bridge has clearly been accepted by cyclists, and has grown in popularity from year to year. This impression can be confirmed by the recorded bicycle traffic volumes. While in the year after its opening (2021) around 147 trips were recorded on the Arnulfsteg, in 2022 this figure more than doubled to 332 trips.

However, looking at the bicycle traffic volumes in isolation does not take into account the increase in bicycle traffic due to developments taking place in parallel, such as a general rise in cycling, an increase in participants in the CITY CYCLING campaign or a higher number of trips being undertaken by CITY CYCLING participants. In order to balance out these effects and more effectively tease out the differences between the bridges, it makes sense to compare the relative values involved.

It turns out that the number of cyclists on the Arnulfsteg has risen disproportionately in comparison to the other bridges. While a rise in bicycle traffic of 74.5 % can be recorded on the Donnersbergerbrücke and 75.0 % on the Hackerbrücke between 2021 and 2022, the bicycle traffic volume on the Arnulfsteg rose by 125.9 % in the same period. The city-wide comparison of bicycle traffic volumes in the network shows a similarly large increase to that found on the neighbouring bridges (around 75 %). Therefore, the disproportionate growth on the Arnulfsteg cannot be explained



**Cycling traffic volumes in the year after completion and release for cycling (2021)**



**Cycling traffic volumes in 2022**

by the city-wide increase in trips undertaken, but can instead be attributed to the measure itself.

This becomes all the clearer when calculating the relocation of traffic from the neighbouring bridges onto the Arnulfsteg. If we regard the overall number of trips on all three bridges as the sum of all crossings in this corridor, then we can calculate the proportions of all crossings and their development between 2021 and 2022. The result is that the two neighbouring bridges have lost 2.7 % (Donnersbergerbrücke) and 2.5 % (Hackerbrücke) of the total number of crossings in the corridor under investigation. In contrast, the proportion of trips taken across the Arnulfsteg has gone up by 25.8 %, from 9.1 % (2021) to 11.5 % (2022).

**Conclusion**

The Arnulfsteg is accepted and utilised by cyclists as an additional way of crossing the railway. Since its opening, a significant increase in bicycle traffic volumes can be observed, as well as a disproportionate growth in trips within this corridor (taking all three bridges together). The reasons for this strong absolute growth can be attributed to greater bicycle traffic overall (more trips both within this corridor and city-wide). However, the strong relative growth on the Arnulfsteg points to its attractiveness to cyclists. This is further confirmed by the relocation of bicycle trips from the neighbouring bridges onto the Arnulfsteg.

# Offenburg – opening the one-way street Okenstraße to bicycle traffic

In the city of Offenburg, cycling has traditionally been accorded a very high status. The city advertises cycling intensively and, since the 1980s, has drawn up and implemented a wide range of schemes for its promotion. In the third phase of the current 'Masterplan Verkehr' (transport master plan), several experimental 'pop-up' measures were adopted. The aim was to test each measure for a limited time as a traffic experiment, and to assess its effect.

**Starting point**

Okenstraße, located near the railway station in the centre of Offenburg, is an important connecting link for city-wide cycling. It is mainly used by cyclists travelling from north to south, as the section of Okenstraße between Rée Carré and Freiburger Platz is normally signposted as a one-way street for both motor and bicycle traffic. Nevertheless, the street was also used unlawfully in the wrong direction due to its important connecting function. Forbidding the use of Okenstraße to travel from south to north meant that its potential as a connection for cyclists was not being fully utilised, resulting in a gap in the network.

**Aim and measure**

The aim of the Offenburg city authorities was to close the existing gap in the cycle network and create more space for all road users. The goal here was to guarantee safe and lawful cycling on Okenstraße in both directions.

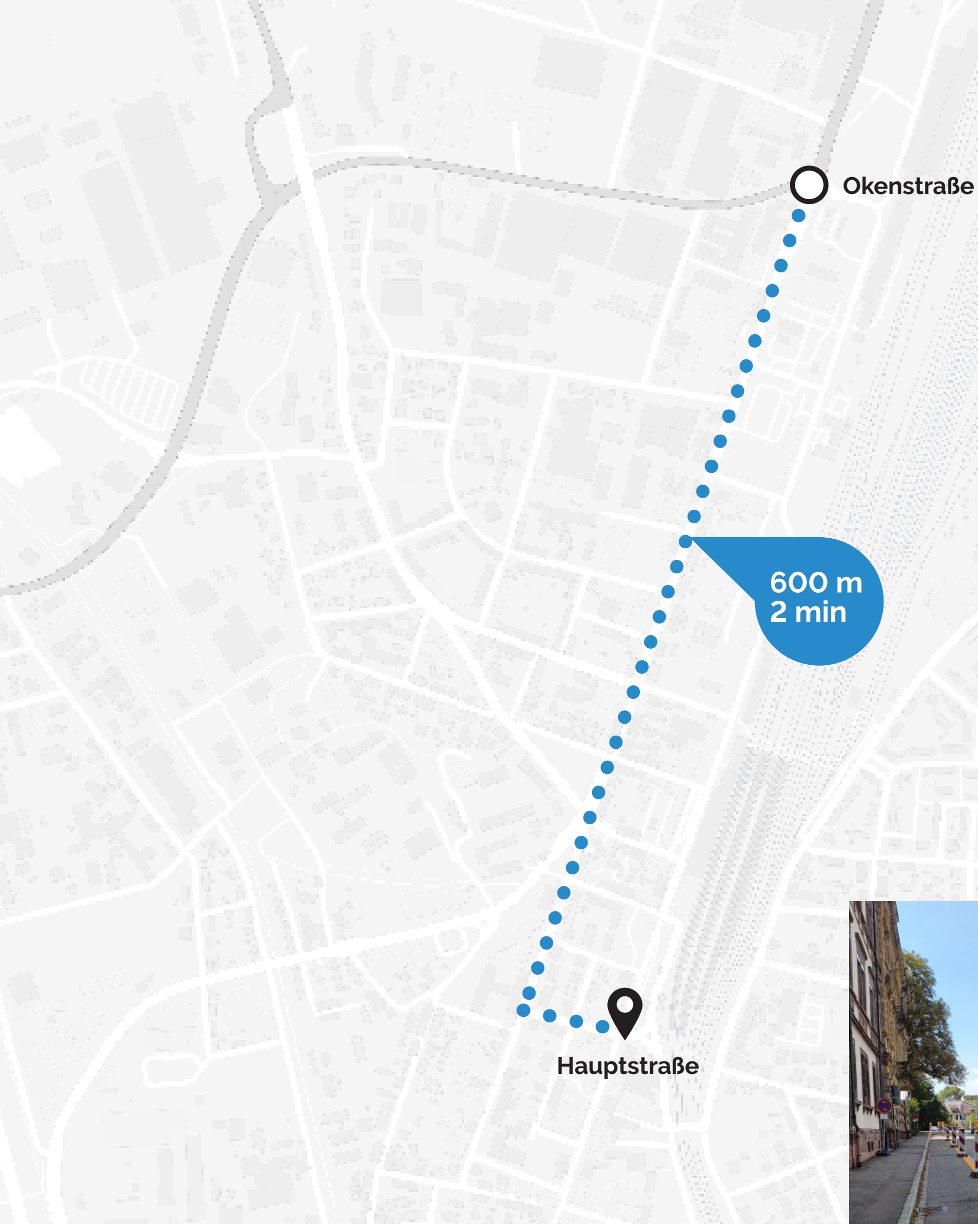
In order to determine the potential of the measure under consideration and to assess its effect on bicycle traffic, the city authorities opened a temporary cycle lane in Okenstraße in August 2021. This pop-up cycle lane was operational between mid-August and the end of October 2021, running from south to north from Rée Carré to Freiburger Platz, against the usual north-to-south direction of traffic. The measure involved turning over the second motor vehicle lane, as well as a few existing parking spaces, to bicycle traffic. This part of the road was then used as a broad pop-up cycle lane, intended to enable safe cycling from south to north. In order to increase safety still further, the speed limit for motor traffic was reduced to 30 km/h.

**Evaluation of the measure**

The Okenstraße cycle lane was a temporary measure that the city authorities wanted to use to gain experience and gather further ideas. It is, therefore, very necessary to evaluate it taking various factors into account. For the municipality, the main question is to what extent this measure closed a gap in the cycle network, albeit temporarily. In addition to the quantity of bicycle traffic (e.g. increased use of Okenstraße from south to north), the quality of travel (e.g. safer cycling or improved quality of connection due to the higher speeds and thus shorter travel times) also plays a decisive role.

**Method and data used**

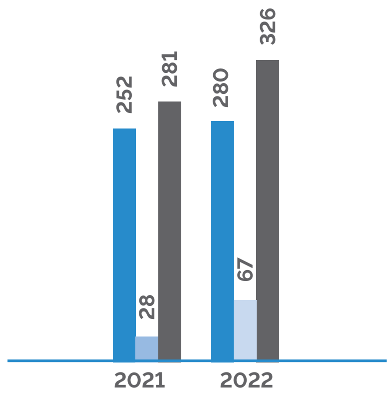
In order to evaluate the effect of the temporary measure in Offenburg, we need information on the bicycle traffic from before the measure was put in place, for comparison. Information from immediately after its implementation and throughout its existence is also



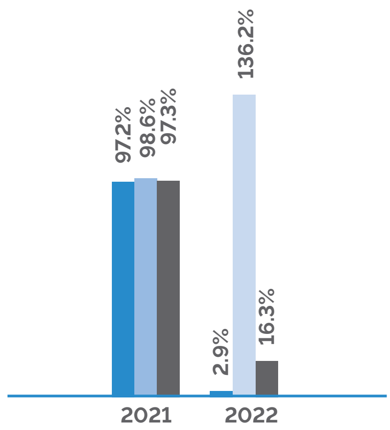




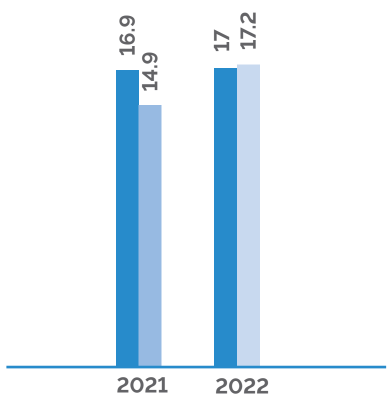

Implemented pop-up cycle path in the Okenstraße




traffic volumes




Growth of traffic volumes




speeds [km/h]

South North Total

required. As RiDE data exists for the city of Offenburg in 2021, and as the pop-up cycle lane was put into place immediately before the CITY CYCLING 2022 campaign began there and lasted for its entire duration, the RiDE data can be used to evaluate this temporary measure.

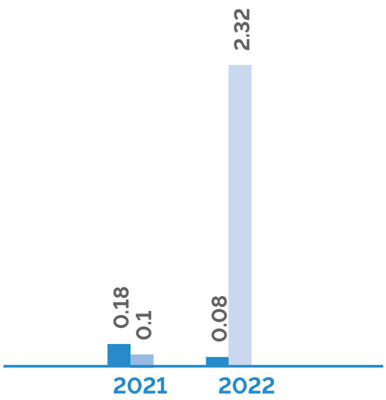
Bearing in mind the question above, the data recorded in the RiDE portal on the directional bicycle traffic volumes and speeds can make a particular contribution towards the evaluation. To this end, data from 2021 and 2022 was used and Okenstraße was divided into several segments. Finally, for these two years when data was collected, the directional bicycle traffic volumes were considered as well as the speeds achieved on those sections of Okenstraße. With the aid of the data extracted on those individual sections, the development of the average bicycle traffic volume and speeds for the entirety of Okenstraße going from north to south and from south to north can be investigated and compared.

Observations of bicycle traffic data for Okenstraße in 2021 show that the street was relatively well used by cyclists. For instance, during the three-week CITY CYCLING 2021 campaign, almost 300 trips were recorded on Okenstraße. Considerably increased bicycle traffic volumes (>300 trips) were seen only on sections that ran alongside major routes that are predominantly used for transit traffic or for commuting in and out of the city. The directional volumes on Okenstraße reveal very distinct differences. The bicycle traffic from north to south (in the direction of the one-way street) made up the largest proportion of cyclists on Okenstraße, at 90 %. Around 10 % of trips were made against the direction of the one-way street in 2021, against regulations. On average, cyclists travelling in a southerly direction rode at 16.9 km/h. Cyclists contravening the one-way system were only able to achieve an average of 14.9 km/h.

Once the one-way street had been opened to bicycle traffic, the use of Okenstraße changed considerably. Bicycle traffic volumes rose by 16.3 % overall. This growth can be largely attributed to the opening up of the one-way street to bicycles travelling the opposite way. While only 2.9 % more cyclists used Okenstraße to travel from north to south, bicycle traffic volumes grew by 136.2 % in a northerly direction. This represents more than a doubling (factor 2.4) of bicycle traffic volumes travelling against the one-way-street regulations previously in force. Thus, the proportion of cyclists riding from south to north doubled to 20.4 % of the


Proportion of total traffic volume per direction

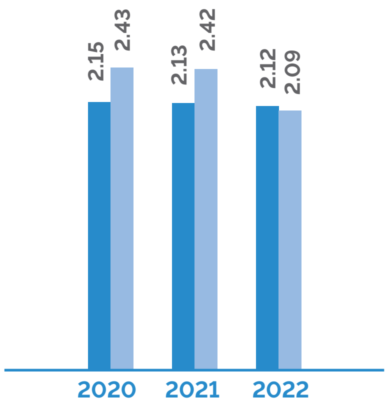
total bicycle traffic volume. The opening up of the one-way street in a northerly direction has also clearly had the effect of increasing average speeds and reducing the average travel times within Okenstraße. While speeds in a southerly direction remained more or less constant between 2021 and 2022 at 17.0 km/h, speeds in a northerly direction rose by about 2.3 km/h to 17.2 km/h. This also resulted in a reduction in travel time on Okenstraße from 2.4 minutes to 2.1 minutes.




Increase of speeds [km/h]

### Conclusion

Opening up the one-way street led to a rapid and disproportionately high growth in bicycle traffic volumes from south to north. The measure also resulted in a significant rise in average speeds from south to north, meaning that travel times along the street could be considerably reduced. On the basis of these results, a permanent implementation of this measure can be discussed and decided upon.




Travel times per direction [Min]

South North

# Freiburg and Leipzig – use of data for traffic modelling

One way for a city to promote cycling is to plan a broad range of infrastructure in the hope that this will encourage more widespread and frequent cycling among its citizens.  An economically efficient alternative is demand-oriented planning. This means that infrastructure should be, as far as possible, designed in such a way that it continues to be accepted by the existing cyclists and improves the quality of their experience, as well as generating further demand as more people take up cycling. This means that the measures should preferably be implemented where the need is currently greatest, or where it will increase considerably in the future. For these predictions, as well as for assessing the effects of measures, which form the basis of forward-thinking and efficient planning, transport demand models can be used.

**Starting point**

In the transport demand models that currently exist in many cities, bicycle traffic has so far been insufficiently taken into account, or not at all. This is mainly due to the fact that to date little data has been available, and what there is has been inadequate for modelling bicycle traffic. Using conventional methods to gather the required data (e.g. information on traffic flow or on the distribution of trips between origin and destination districts) is generally very costly.

The low availability of data currently makes it difficult to analyse and model bicycle traffic. This makes it hard to predict future transport demand and to calculate the various scenarios that are designed to assess the impact of measures. Typical tasks involved in this focus on determining the volume of bicycle traffic (‘How many trips start and end in which parts of a municipality?’), investigating modal shift (‘Which trips can be undertaken by bicycle that would previously have been made by motorised private transport?’) or the change in the resulting traffic flow (‘Which routes are being used by cyclists?’). Insufficient data means that the opportunities to answer the above questions are generally very limited at present, with corresponding effects on bicycle traffic planning.

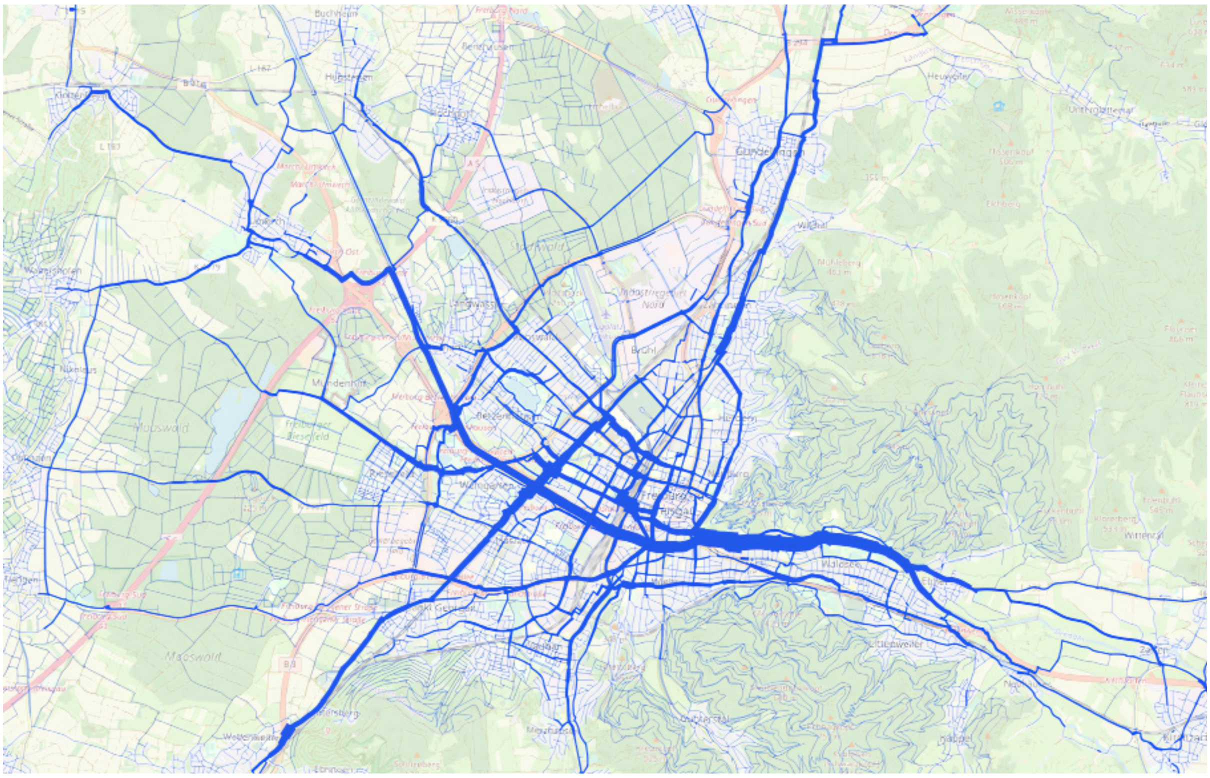
**Aim and measure**

Many cities aim to construct their own bicycle traffic model, or to better integrate cycling into the city’s transport demand model. When it comes to the use of the RiDE portal, this begs the question of to what extent the data meets the requirements of modelling. Therefore, cities like Freiburg and Leipzig, for example, are currently checking the usability of the data for topic-related questions (predictions, effects of measures, etc.), and thus to what extent it can be used for model estimation and calibration and/or the validation of model results.

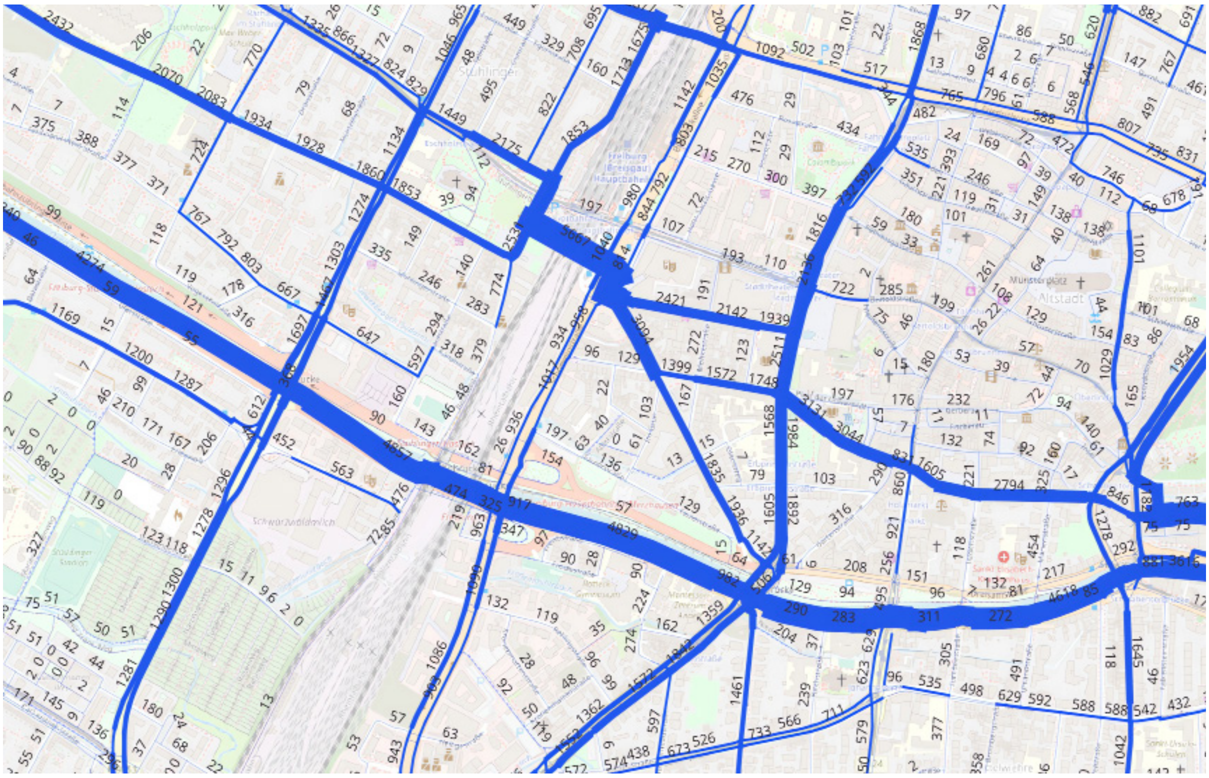
In order to make use of the data for modelling, preliminary consideration is first given to deciding in which steps – in a conventional 4-step model, such as within traffic generation, traffic distribution, mode choice and traffic assignment  – the data can be used. Based on this, a concept for integrating RiDE data into the traffic model can be drawn up, and the data can be utilised.

**Method and data used**

The RiDE data can be used for modelling bicycle traffic either as input data or as a dataset for model validation and/or calibration. These different uses are explained in the following for every step of a transport demand model.



**Modeled cycling traffic volumes in the Freiburg urban area**



**Modeled cycling traffic volumes in the city center of Freiburg**

| Model step | RiDE Data | Use |
|---|---|---|
| **Traffic generation** | Origin-destination data | • Incidence of traffic (number of trips) per origin and destination cell<br>• Input: Number of trips as direct input if traffic generation is not modelled<br>• Validation: Number of trips as a reference or target variable for traffic generation models (comparison and calibration) |
| **Traffic distribution** | Speeds and waiting times at intersec-tions | • Determination of cost (travel times)<br>• Input: Speeds achieved within the network and waiting times at intersections in order to determine the travel time. This is an important input variable for determining the cost invol-ved in travelling between the cells; it influences the choice of destination |
| | Origin-destination data | • Bicycle traffic volume (number of trips) for all origin-destina-tion relations<br>• Input: Number of trips per origin-destination relation as a direct input for subsequent steps in the model, if traffic dis-tribution is not modelled<br>• Validation: Number of trips for all origin-destination rela-tions as a reference or target variable for traffic distribution |
| **Mode choice** | Speeds and waiting times at intersec-tions | • Determination of cost (travel times)<br>• Input: Speeds achieved within the network and waiting times at intersections in order to determine the travel time. This is an important input variable for determining the cost invol-ved in travelling between the cells; it influences the choice of mode of transport |
| **Traffic assignment** | Speeds and waiting times at intersec-tions | • Determination of cost (travel times)<br>• Input: Speeds achieved within the network and waiting times at intersections in order to determine the travel time. This is important in order to determine the characteristics of route alternatives for that origin-destination relation; it influences the choice of route |
| | Bicycle traffic volu-mes | • Bicycle traffic volumes (trips within the network)<br>• Validation: The bicycle traffic volumes resulting from the traffic model can be compared with the traffic volumes shown in the RiDE portal and calibrated using the transport demand recorded |

For **traffic generation**, the most relevant data is that relating to origin and destination traffic (outgoing/inco-ming trips). This data can be used directly as input data for the steps described below (e.g. traffic distribution), e.g. if traffic generation is not modelled or cannot be modelled. In addition, the data can be drawn upon as reference or target values for the validation of traffic generation models, on whose basis the modelled bicy-cle traffic volume can be compared and calibrated.

**Bicycle traffic demand in the RiDE portal**

When modelling **traffic distribution**, the data on the speeds achieved and waiting times accrued can also be used, along with the origin-destination data. The speeds achieved in the bicycle traffic network at the network links as well as the (average) waiting times at intersections can be used to determine travel times between origin and destination cells. Travel times are an important input variable in determining the cost of travelling between traffic cells, which has  a considerable influence on the choice of destination. The information available in the RiDE data regarding the number of trips per origin-destination relation can firstly be used as a direct input for the model steps that follow (e.g. traffic assignment) if traffic distribution and mode choice cannot be modelled. Secondly, the information on the number of trips can be utilised as a reference or target variable for traffic distribution models, which can then be used to compare and calibrate the modelled distribution of bicycle traffic volume.

In order to model **mode choice**, the speeds achieved within the network as well as waiting times at intersections can also be relevant inputs. As in the traffic distribution step, these factors can be used to determine the travel times between origins and destinations. These costs can, in turn, have a considerable influence on the choice of mode of transport and therefore also on the modelling of bicycle use.

The speeds achieved within the network as well as waiting times at intersections are also significant when it comes to **traffic assignment**, as the travel times on the various route alternatives available between origins and destinations are an important criterion when choosing which route to cycle. This means make a considerable contribution towards determining the characteristics of route alternatives. The information on the bicycle traffic volumes can be taken as a reference value for comparison with the bicycle traffic volumes resulting from the travel model, and thus used for the validation and calibration of the assignment models.

In order to make use of the data for modelling, the user can utilise the download function in the portal (see online handbook). This allows individual data packages to be exported. Furthermore, individual origin-destination matrices can be generated for each municipality via a process of matching and by uploading shape files with their own administrative limits. The cities of Leipzig and Freiburg are currently examining how they can expediently use the data for modelling bicycle traffic.

# Dresden – resurfacing the Körnerweg cycle path

Dresden, the capital of the German federal state of Saxony, is aiming for continual structural improvement to conditions for bicycle traffic. The development of new cycling infrastructure, the safe design of intersections and the establishment of routes where cyclists have priority are a few of the large number of the city's measures to promote cycling. Some of these projects are still at the planning or implementation stages, and some have already been carried out. One of the measures that has been put in place is the upgrade/refurbishment of the Körnerweg cycle path, part of the urban portion of the Elberadweg in the eastern part of the city.

**Starting point**

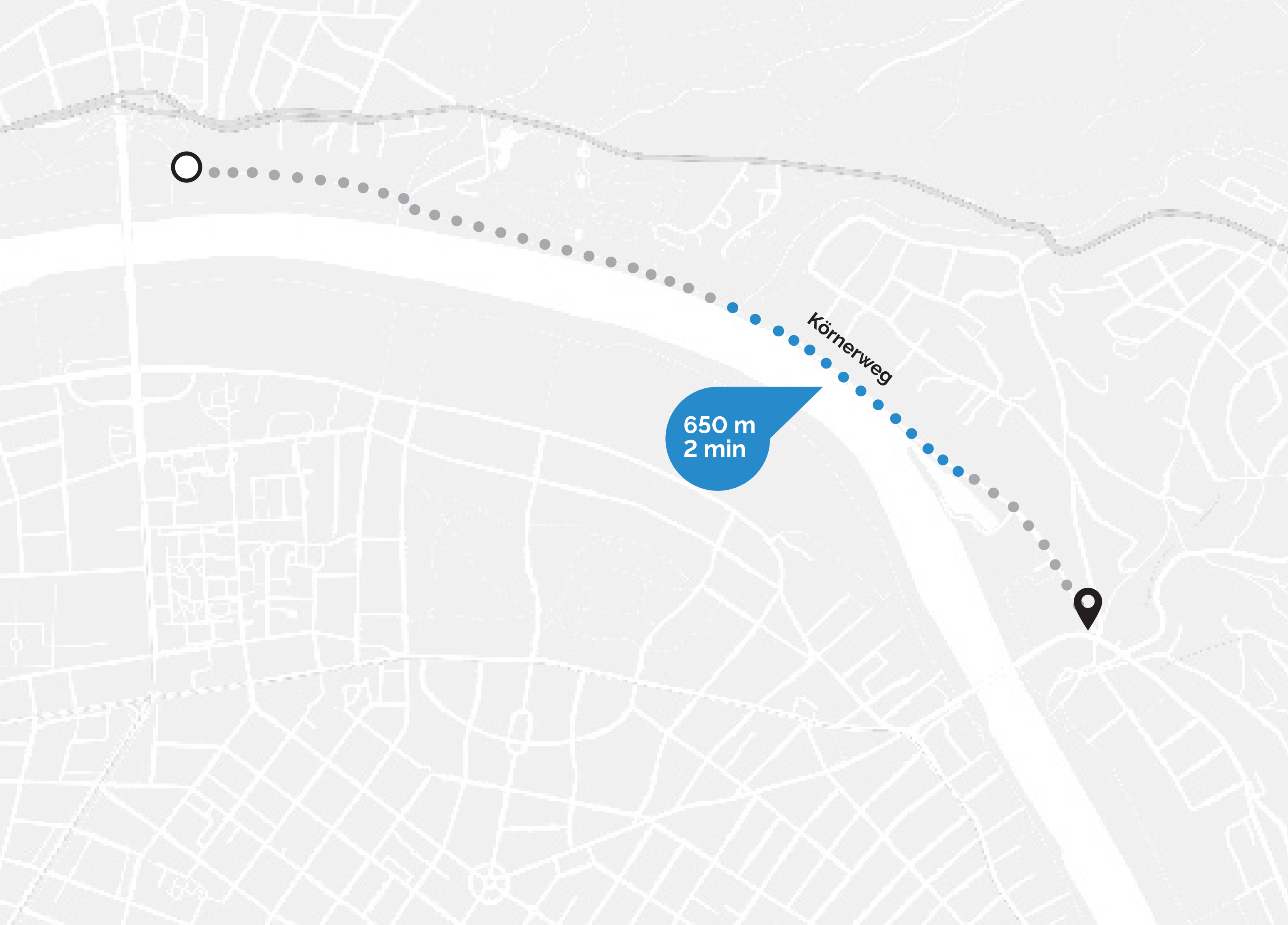
The Elberadweg (Elbe cycle route) is an important trans-regional cycle route. Apart from its significance as an attraction for cycle tourists, it is an important traffic artery for everyday travel within the city. Most of the urban portion of the cycle route is laid on both sides of the River Elbe  and asphalted. There was an exception, however, until early 2020, in the form of a section in the east of the city. On the part of the route on the right bank of the Elbe, between the 'Blaues Wunder' bridge and Heilstättenweg, there is a 650 m section of the Körnerweg cycle path that was, until the start of 2020, paved with large cobblestones. Cyclists could only use it at greatly reduced speeds and it was very uncomfortable to ride on. The parallel section of the Elberadweg on the opposite bank, however, was covered with asphalt. The connection quality of the origin-destination relations on the right bank of the Elbe between the Blaues Wunder bridge and the suburbs of Radeberg to the west of it therefore left a lot to be desired. As the cobblestone surface of the historic towpath, together with the retaining wall and slope alongside it, was designated as a heritage asset, permanent asphalting of the surface has not been possible to date.

**Aim and measure**

The aim of the city of Dresden was to create a safe and attractive path along the whole of Körnerweg that would also comply with conservation regulations. Construction work being carried out on the Blaues Wunder bridge offered the opportunity to investigate the impact on demand among cyclists of improving infrastructure for bicycle traffic. A temporary asphalt layer was laid over the entire length of the cobblestone surface. This was primarily intended to protect the cobblestones from construction vehicles driving over them, but also aimed to benefit cyclists. To this end, the surface was upgraded in early 2020 (laying a layer of asphalt over geotextile to protect the cobblestones), and it remains in this state today. In the future, this section is planned to receive a long-term solution using cut sandstone slabs that are commensurate with its status as a heritage asset.

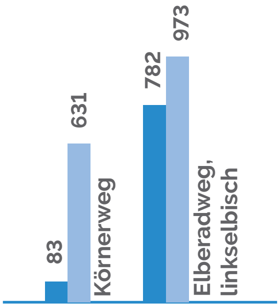
**Evaluation of the measure**

The measure that has been put in place is valuable for an impact analysis from the city's point of view. The most interesting point here is to investigate the influence the measure has on cycling behaviour and whether this stretch of the cycle route is used by cyclists. Bicycle traffic volumes and the average speeds achieved on this stretch can be used as proxy variables to assess their acceptance of the measure. Evaluating

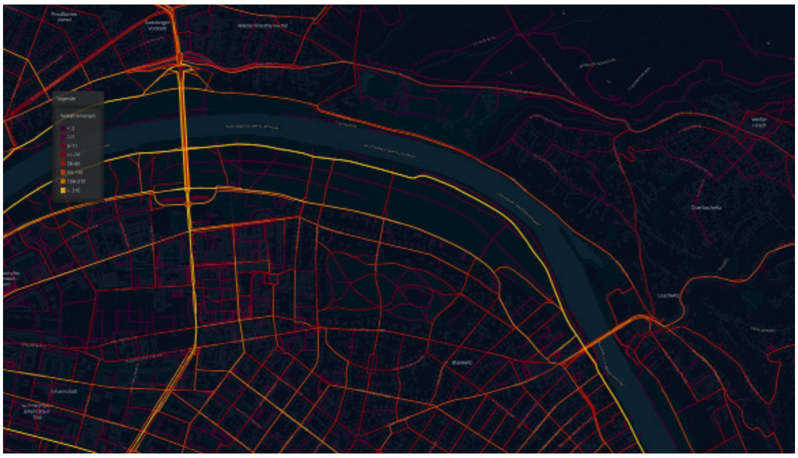




Cobblestone surface before the construction project (above)
Implementation of the measure and asphalted surface after measure implementation (bottom)



Average traffic volume


Cycling traffic volumes in 2019


Cycling traffic volumes in 2020

these parameters allows conclusions to be drawn on the success of the measure.

**Method and data used**

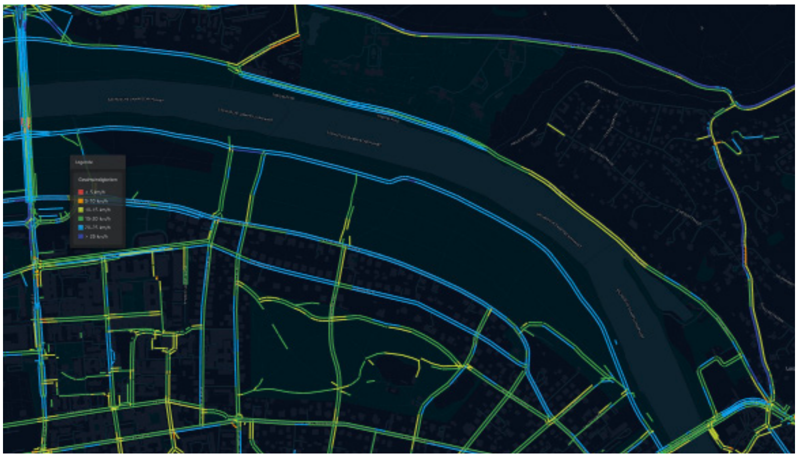
The most relevant factors when evaluating the upgrade of the cycle path surface on Körnerweg are the bicycle traffic volumes and average travel speeds. When evaluating the measure, it makes sense to compare the datasets from before and after the measure was implemented. To this end, the evaluation used data from 2019 and 2020.

A comparison of speeds gives an idea of the extent of the additional cost and discomfort caused by the cobblestones: the average speed on Körnerweg rose from 12.7 km/h in 2019 to 21.8 km/h in the following year (2020). When comparing this with the speed of 22.9 km/h on the parallel stretch on the left bank of the Elbe, we can state that the travel speeds on Körnerweg have become aligned with the local level.

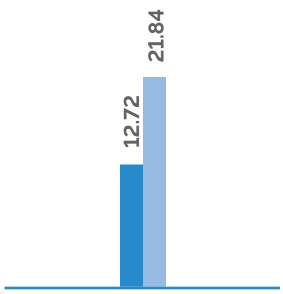
The comparison of bicycle traffic volumes for Körnerweg in 2019 and 2020 also reveals considerable differences. The number of recorded trips on this section of the cycle path rose from 83 in 2019 to 782 in 2020. This represents an 842 % increase in bicycle traffic volume.

Here, as in the Arnulfsteg example, these numbers are only partly due to the actual impact of the measure. To some extent, they can be traced back to other trends (e.g. increase in CITY CYCLING participants). In order to take this overlap with other external effects into account, it makes sense to compare the bicycle traffic volumes for Körnerweg with those from the Elberadweg on the left bank of the Elbe. In the same period, there was an increase in recorded trips from 631 to 973, i.e. a 54 % increase, although here we can potentially assume that some traffic has relocated to the cycle path on the right bank.

This hypothesis is also supported by a comparison of the transport demand on both sides of the Elbe:



Average speed of cyclists on network links in 2019




Average speed [km/h]

2019 2020

Average speed of cyclists on network links in 2020

in 2019, only 12 % of all trips were taken on the right bank, while in 2021 almost half of trips took place on the formerly cobblestoned section. This disproportionate increase in bicycle traffic volume can not only be attributed to external factors such as more participants in the CITY CYCLING campaign or an overall increase in bicycle traffic volume, but is also clearly associated with the upgrade to the cycle path surface.

**Conclusion**

The measure on Körnerweg was evaluated with the help of the bicycle traffic volumes and speeds taken from the RiDE portal. This example of an evaluation makes the negative impact of surfaces that are inadequate for cycling impressively clear. The upgrade to the surface of a 650 m section made the cycle path on the right bank much more attractive. Striking gains were made in terms of both bicycle traffic volumes and speeds. The disproportionate rise shows the relevance of the measure and, moreover, the importance of this section of the route for bicycle traffic in the eastern part of Dresden. Analysis of what is happening in bicycle traffic on the basis of recorded bicycle data can supply pertinent information to aid in decision-making relating to refurbishments that are compatible with cycling. This can even apply to difficult situations in city planning, such as when weighing up the sometimes conflicting demands of cyclists and heritage conservation.

# Hamburg – the development of Veloroute 7

The Hanseatic City of Hamburg aims to become a city of cyclists. While at the moment 15% of all journeys are already undertaken by bicycle, the city authorities intend that figure to rise to one in four in the future. An important strategic element in achieving this aim is to offer cyclists an attractive cycle network, both for everyday use and for leisure.

**Starting point**

Back in the 1990s, with a special focus on everyday travel, a network of 14 cycle routes was planned, arranged in a star shape leading towards the city centre. Construction and/or expansion of all the routes is to be completed by 2025. In planning out the routes, particular emphasis is placed on safe, rapid and attractive connections between the periphery and the centre of the city.

**Aim and measure**

One of the cycle routes is Veloroute 7. At 14 km long, it runs from Hamburg's Rathaus (city hall) in the north-east, via Wandsbeck, all the way to Rahlstedt. The initial investment measures were implemented along the course of the route back in 2015. Completion of all the measures is expected in 2025.

The package of measures comprises a total of 19 projects along its entire length, of which the majority have now been completed. These have included the reconfiguration of intersections and sections of the route in favour of bicycle traffic, in order to be able to offer high-quality infrastructure along the entire origin-destination relation .

**Evaluation of the measure**

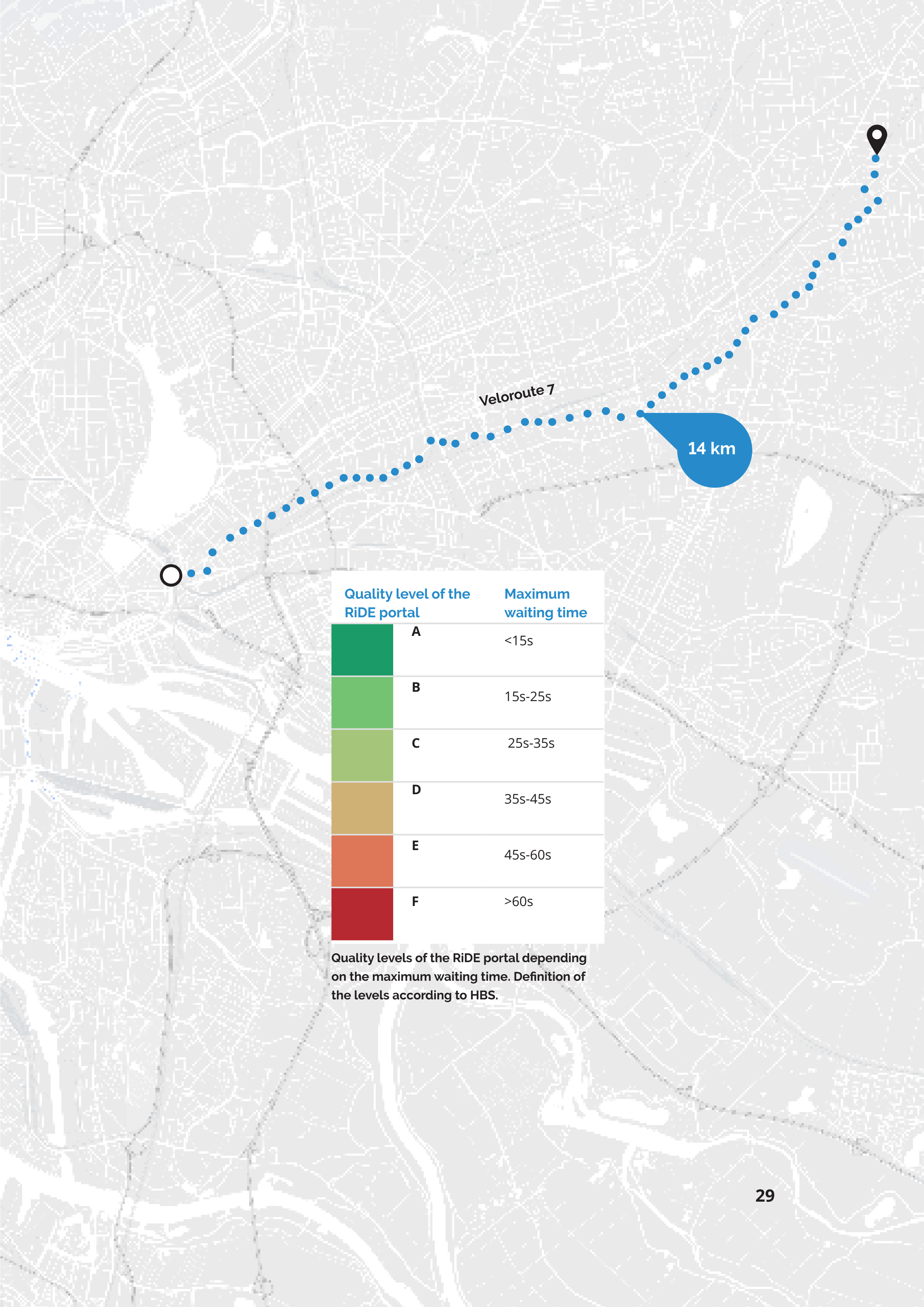
The advanced state of completion of Veloroute 7 invites us to take stock at this stage in order to evaluate both the acceptance of the cycle route and its quality.

The acceptance of the route can be investigated in a similar manner to the Munich example, via an analysis of bicycle traffic volumes. A major aim of the measure was the reduction of travel times for that origin-destination relation. In order to check whether the aim of speeding up bicycle traffic on that route has been achieved, it makes sense to look at the average travel speeds achieved as well as the average waiting times.

The German technical manual for the design of road traffic facilities (HBS), a rulebook issued by the German Research Association for Roads and Traffic (FGSV) specifies a standardised procedure for judging the quality of a road traffic installation – including using the maximum waiting times to assess the quality and determine the quality levels of intersections . Based on this classification, the RiDE portal offers the option to display the quality levels of intersections based on the average waiting times.

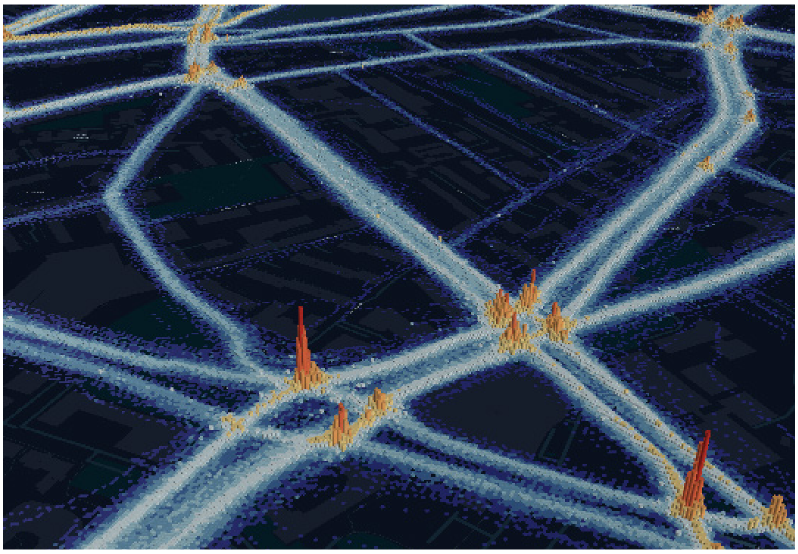
**Method and data used**

There are two applications within the RiDE portal that can be utilised to identify impedances at the intersections: the heat map and the average waiting times. When investigating impedances, an initial glance at the heat map gives a brief initial overview of where cyclists may have to allow for longer waiting times. If a lot of GPS points appear in one area, that might indicate a



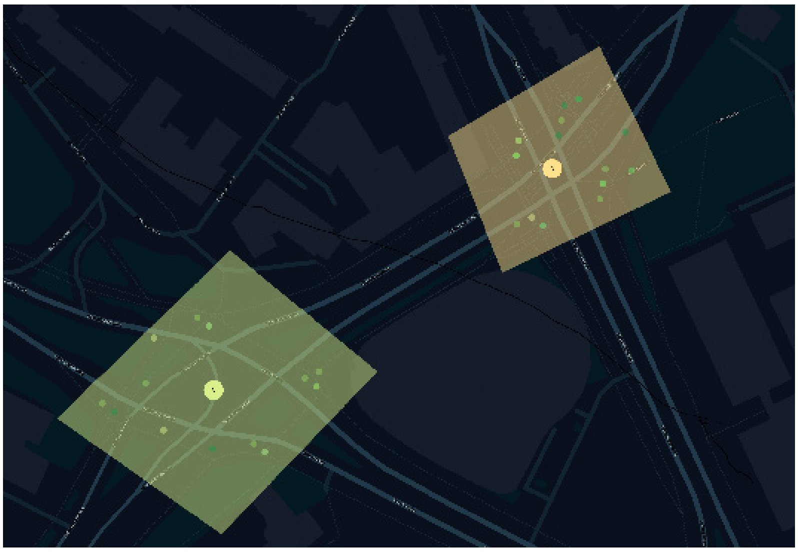

| Quality level of the RiDE portal | Maximum waiting time |
|---|---|
| A | <15s |
| B | 15s-25s |
| C | 25s-35s |
| D | 35s-45s |
| E | 45s-60s |
| F | >60s |

Quality levels of the RiDE portal depending on the maximum waiting time. Definition of the levels according to HBS.



**Many GPS points can indicate high waiting times**

**Intersections and their quality levels along velo route 7**



**Stops at the intersections**

**Relations of waiting times at the intersections.**

longer stop due to traffic lights. The heat map in the RiDE portal can be displayed in either two- or three-dimensional form. In the three-dimensional version, the concentration of GPS points is indicated by the height of the columns as well as their colour.

The impression given by these factors can be confirmed statistically. Firstly, the intersections along the route are created in the waiting times use case. Then quality levels, based on the HBS quality levels, are calculated for every one of the intersections that has been created. In order to avoid implausibilities, the average waiting time is used as an indicator.

The analysis of waiting times for Veloroute 7 shows that a majority of the intersections are rated at level C or better. Three intersections got level D. After this first macroscopic evaluation, the intersections with longer waiting times (D or worse) can be examined microscopically to determine to what extent the increased waiting times affect cyclists on the bicycle route itself or cyclists crossing the route. This will be pointed out with one of the intersections rated with level D:

The intersection Adenauerallee/Kreuzweg is rated with quality level D due to a relation with a mean waiting time of 37 seconds in a sample of 18 waiting events. However, the turning path causing this is not part of Veloroute 7. For an isolated evaluation of the bicycle route, this turning relation is therefore not relevant. The examination of the other two intersections with quality level D shows a similar picture: Here, it is the inbound and outbound bicycle traffic flows that are the reason for the slightly lower grade.

**Conclusion**

Overall, it can be concluded that there is a good or even very good level of waiting times along the entire cycle route. The evaluation showed that at the intersections along Veloroute 7, there is not a single intersection with a waiting time at an unacceptable level. The waiting time level D, which can be found at three intersections is only caused by cyclist turning on or off Veloroute 7.

After completion of the last three sections, it is recommended to re-evaluate the waiting times, but also the traffic volumes and average speeds.

# Use of the RiDE Data

## Examples from the Private Sector

Contracts for the planning of cycling infrastructure are often awarded to private companies. These companies use the RiDE data to prepare cycling concepts or to conduct impact assessments for individual measures. The following selection provides some examples of how a number of renowned German engineering firms use the data.

*'The tool can be particularly helpful when recording and planning cycle networks in municipalities and gives us information about which routes cyclists use in their everyday lives. This is relevant information that we as planners do not have in some places.'*

**— David Philipps, project manager**

Planungsbüro VIA eG from Cologne is creating an integrated mobility concept for the city of Troisdorf. To this end, it is designing a cycling destination network as a framework infrastructure plan. The data on traffic volumes and speeds forms the basis for the definition of new network elements such as cycle lanes or cycle priority routes.

*'The CITY CYCLING dataset allows us to include routes that are located away from the main roads and are already used by the population in our network concepts.'*

**— Jonas Gröber, project manager**

Planungsgemeinschaft Verkehr PGV Alrutz GbR is developing a cycling concept for the district of Peine. Existing network concepts at municipal and regional level will be incorporated into the development. Furthermore, the problem of parking facilities at important origin and destination points is taken into consideration. For network planning, data on traffic volumes, speeds and origin-destination relations is particularly relevant.

*'We as Team red have already been using the Stadtradeln data for several years to track for municipal cycling concepts which routes are actually used by cycling. In the case of cycling coordination for the Steinburg district, the RIDE portal helps with conceptual further development and marketing for cycling. The map of source-destination relationships illustrates the range of bicycles and provides arguments for promoting cycling.'*

**— Thomas Möller, project manager**

The district of Steinburg become the first district in Schleswig-Holstein to put the coordination of cycling promotion out to tender as a service instead of creating its own position. This task has been taken on by team red Deutschland GmbH in cooperation with the RegionNord office. The main focuses of the bicycle coordination are marketing and information, coordination and communication as well as infrastructure planning and implementation.

*'Analysing the RiDE data as part of the status analysis for the "Mobility Concept for Climate Neutrality on the Island of Fehmarn" proved extremely valuable, as it revealed, among other things, both the routes currently preferred and the routes clearly avoided by both everyday cyclists and cyclists motivated by leisure and tourism, meaning that the latter routes can be improved in the future.'*

**— Roman Parzonka, project manager**

Working with a project partner, spiekermann ingenieure GmbH is developing the 'Mobility Concept for Climate Neutrality on the Island of Fehmarn'. The concept pursues the objective of climate-neutral mobility for all residents, workers and guests on the island of Fehmarn by 2030. One special feature of the concept is that it considers boat and ship traffic as well as horse riding, beyond the usual modes of transport.

*'We use the RiDE portal when developing cycle network concepts for various municipalities and districts. Usage-generated data allows us to better adapt cycle networks to the needs and route preferences of local cyclists. Network gaps and inconsistencies in the existing network can be easily identified and the data can be drawn upon in order to set priorities.'*

**— Philipp Böhme, project manager**

IGS Ingenieurgesellschaft Stolz mbH is devising a cycling concept for the city of Cottbus. Data from the RiDE portal is used to identify deficiencies and then to create a concept of measures for network development.

# Outlook

With the research project MOVEBIS (2017-2020) initially laying the foundations for secure and continuous recording, processing and visualisation of CITY CYCLING data, the stakeholders behind RiDE have been striving for a continuation of the work since the portal was set up in 2021.

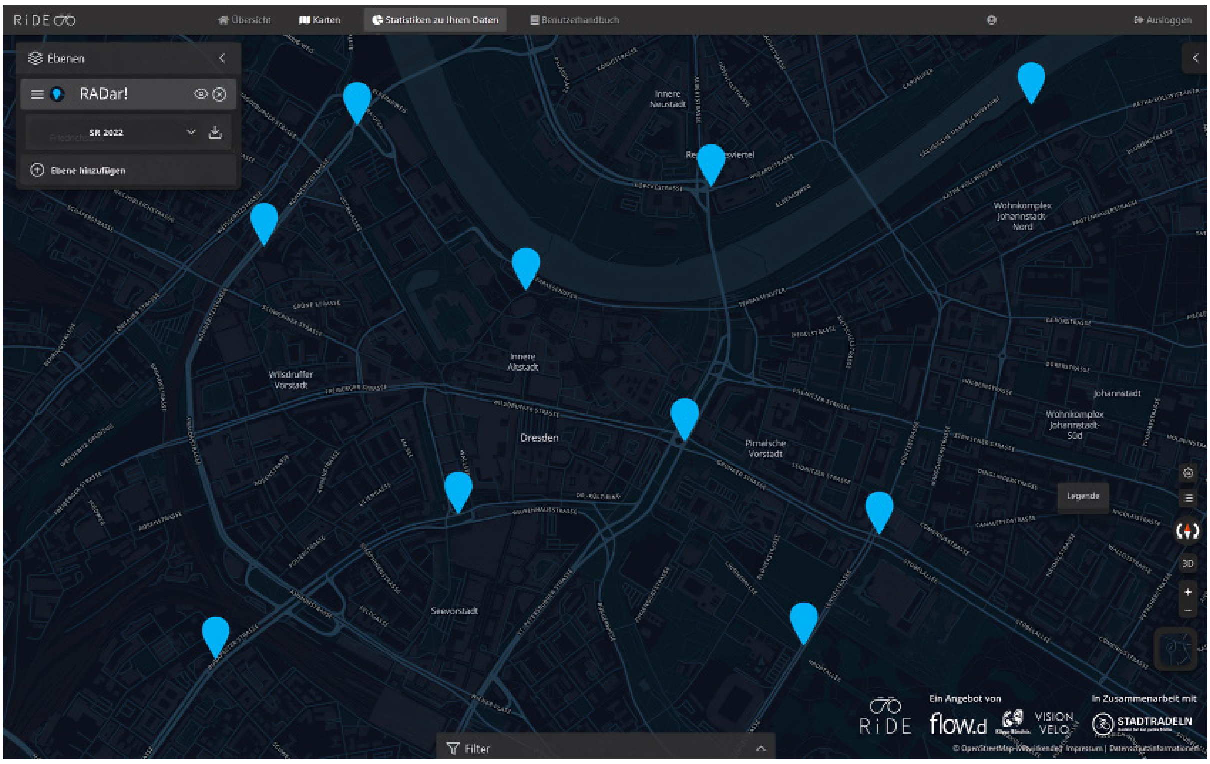
One important component of this is the current funding of the research project MoveOn by the Federal Ministry for Digital and Transport (BMDV). As part of the project, the current data processing and visualisations of cycling data are being revised. This means, in particular, further development of the use case 'waiting times' (further development of waiting time identification and validation of the results), the use case 'origin-destination' (improvement of visualisation) and the use case 'traffic volumes' (validation of results).

One additional, essential component is the further development of data processing content as well as the information provided. For example, studies are currently being conducted on the representativeness of the cycling traffic volumes, and different methods are being explored for how to scale the RiDE traffic volumes to average daily cycling traffic. The aim is to use the data obtained in the collection period (three weeks) to extrapolate the average daily cycling traffic in one year. For this purpose, data from existing counting devices nationwide is collected and enriched with secondary data. This is then used to create several extrapolation models with different spatial resolutions.

Furthermore, possible options for the standardisation of cycling traffic volumes between two different data collection years will be examined, to enable a direct comparison of, for example, traffic volumes between these points in time. Here, it is important to include the campaign development (CITY CYCLING), both numerically (cyclists) and spatially (participating municipalities in the surrounding area) to compensate for any distortions. This will allow more precise statements to be made about the actual impact a measure has on cycling demand. The data can also be used to create difference maps, which can greatly simplify the evaluation.

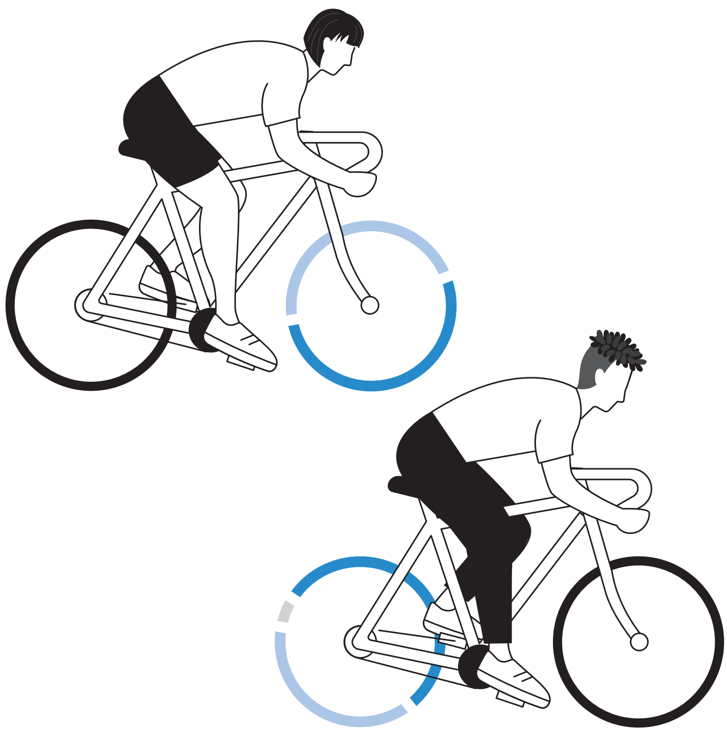
The above-mentioned and relatively extensive projects are to be supplemented by additional elements. The integration of information reported via RADar! into the RiDE portal is under consideration, for example. At the same time, additional information on the collected data will be listed in the statistics dashboard, to increase the overall information content of the data and improve users' options for assessing the data quality (keyword: representativeness).

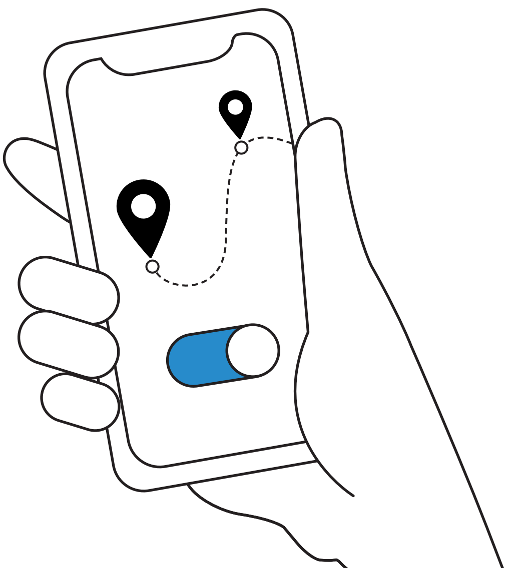
Further developments in the campaign itself and with regard to the target groups are also being considered. For example, possibilities for supporting and promoting the cycling campaign in suburban and rural areas are being explored to generate comprehensive cycling data in these locations as well and to provide basic data for cycling planning. Talks with numerous and varied target groups (e.g. municipal transport planners, engineering firms, NGOs, research institutions, etc.) will also help to improve and expand offerings, so that the RiDE data can be made available to different target groups for cycling promotion and the varying needs of the target groups can be met.




**Exemplary integration of RADar! data into the RiDE portal**

As RiDE partners, we are striving for a continuation of the processes, so that the collection and provision of cycling data as well as support in terms of content and further development will continue to contribute to more effective promotion of cycling in the future.





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