

ReLUT - Research Lab for Urban Transport NEWSLETTER 01/2021



Welcome!

We are excited to introduce our new English-language newsletter, where we will be sharing our projects and research with our international collaborators. The Research Lab for Urban Transport (ReLUT) is an interdisciplinary team of researchers who work on current and future challenges of mobility. Our research focuses on the development of economic and ecological solutions for new mobility solutions. In addition to the disciplines of transport planning and logistics, ReLUT combines a wide range of competencies: urban planning, social science, data science, computer science (AI), geoinformation, law, automotive engineering, and economics.

It is this broad interdisciplinarity that distinguishes the ReLUT and makes it possible to analyze problems in mobility in a comprehensive and sustainable way. The team's expertise is complemented by the cooperation of national and international partners from research fields and the transport and logistic industries. As a result, we are able to study the challenges in transport and logistics worldwide and work toward developing solutions that improve the quality of life in cities and the surrounding areas, at home and abroad.

We hope you enjoy this newsletter and that you find our research motivating and inspiring for your own projects.

Stay healthy!



Petra Schaefer



Kai-Oliver Schocke

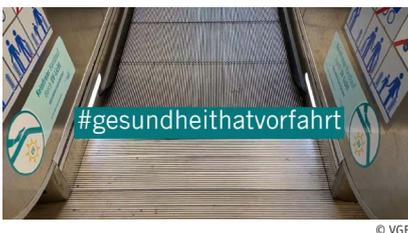


Tobias Hagen

Health has the right of way

The Covid-19 pandemic has caused a significant drop in the demand for public transport. The Rhine-Main transport association (Rhein-Main-Verkehrsverbund GmbH (RMV)), the Municipal utilities transport company (Stadtwerke Verkehrsgesellschaft Frankfurt am Main mbH (VGF)), and traffiQ Local Transport Company, Frankfurt on the Main (traffiQ Lokale Nahverkehrsgesellschaft Frankfurt am Main mbH (traffiQ)) implemented various measures to increase a feeling of hygiene safety when using public transportation in a joint project titled, "Health has the right of way." The goal was to increase user confidence in the hygiene safety measures on public transport and to win back those who previously used public transport but have stopped due to the pandemic. An online survey offered by RMV and a passenger survey aimed to subjectively evaluate the effectiveness and acceptance of each measure. The ReLUT conducted the passenger surveys in September and early October, 2020.

The first hygiene measure was an integrated UV-radiator on an escalator at the station 'Leipziger Straße' in Frankfurt. The UV light kills viruses on the revolving handrail. Stickers on the staircase were used to draw attention to the measure. The result of the survey is that most of the 36 passengers interviewed did not



notice the measure. However, 75 % of the passengers say that the measure brings an increased feeling of safety.

The second measure was to play video clips on the displays at the stop areas with information about the obligation to wear a mask in public transport vehicles and station areas. The short videos show how to wear mouth-nose protection correctly and detail when and where a mask is required (on busses and on trains, in the station area, on escalators, stairs and elevators, and on the platform). During the survey, 47 people could be asked

about the measure. Again, most passengers (62%) did not notice the measure.

Slightly more than half of the passengers surveyed think that wearing a mask is encouraged by the videos and that mask wearing reduces risk of infection in public transport vehicles and areas.



The third measure, an antimicrobial coating, was applied to the operating elements and grab rails of a lift at the „Konstablerwache“ station. This coating fights bacteria, viruses, and fungi and makes the surfaces safer to touch. Stickers in the area where used to mark this measure. The majority (72 %) of the 18 passengers interviewed did not notice the measure. The measure leads to an increased feeling of safety for about half (56%) of the public transport users surveyed.



The interviews took place at the stations of public transport where the measures were implemented. Passengers who have just used or are planning to use public transport were approached on the spot and were interviewed about the measures. Questions such as frequency of use of public transport during the week and during the day, the effectiveness and acceptance of the measures, and the general feeling of safety during the Covid-19 pandemic were surveyed.

The results of the survey show that the implemented measures were mostly unnoticed. However, the measures were assessed positively in terms of increasing the perception of safety in public transport stations.



M. Eng.
Elisabeth Lerch
Research Assistant

Driverless shuttles on the Main Quay



In the project, “Autonom am Mainkai – Driverless on the Frankfurter Main Quay,” two autonomously driving shuttles were scientifically researched on the Main riverbank of Frankfurt am Main from September 2019 to March

2020. The shuttles were granted a special permit for the test operation while the northern bank of the Main was closed to motorized traffic.

Both shuttles operated between the Untermain Bridge and the Old Bridge in the temporarily closed area of the Main Quay. The shuttles served three stops daily between 11:00 am and 5:00 pm. Passengers could board a shuttle at any time at all three stops without prior registration and free of charge. The test route had a total length of 700m. The highly automated electric shuttles operated at a maximum speed of 15km/h. This was the highest approved speed for this study, although the shuttles are able to travel at speeds of up to 45km/h.



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The goal was to identify and investigate user acceptance and operational challenges, as these datasets represent gap interdisciplinary research. Previous projects only allowed a few passengers the opportunity to test an autonomous shuttle for an extended period of time. These projects led to limited research results, which need to be followed by a more comprehensive project duration, which this research project provides.

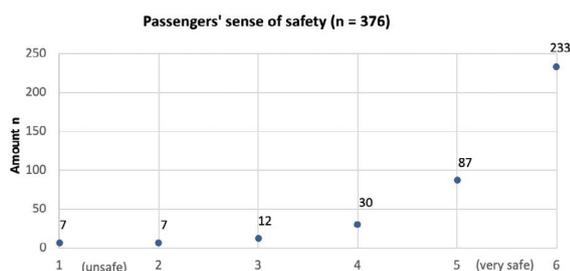


Figure 1: Passengers' sense of safety (Own illustration)

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All shuttle passengers had the opportunity to participate in a quantitative online survey. A total of 449 passengers were asked about their opinion and assessment of the topic of „autonomous shuttles“ using an online survey.

The evaluation of the passenger survey showed a high level of acceptance of the autonomous shuttles. There is also a great willingness to ride in the shuttles without operators and in public road traffic. The ratings were surveyed across several topic areas.

The managers of the two shuttles indicated that the main glitch during the test operation was unforeseen emergency braking. The emergency brake sensors were triggered by wind whirling objects such as leaves, birds, or other road users. Furthermore, there were frequent problems at the heavily-used crosswalk „Eiserner Steg“. People crossing the street caused the shuttles to reduce speed in advance, causing delays in operations. Despite the unforeseen braking, the operators and operations managers rated the technology as safe and reliable.

A walk-through of other autonomous shuttle test sites was also performed to provide an infrastructural and operational comparison, as well as to evaluate user acceptance. In the evaluations, essential topic areas were surveyed with the respective project managers. The analysis of the results shows important aspects that should be taken into account for the successful deployment of autonomous shuttles at other locations.

In the future, further investigation and testing of the optimal implementation in existing public transport services will be necessary. In addition, it must be examined whether autonomous shuttles should be used in a classic line operation or whether passengers will expect an on-demand function with autonomous shuttles.

HA-Projekt-Nr.: 815/19-135



M. A.
Philipp Altinsoy
Research Assistant

Effects of COVID-19 on mobility and transport

The ongoing COVID-19 pandemic has changed the mobility behavior of many people. In an initial study from June to September 2020, traffic data from different sources were evaluated. A survey was conducted in which citizens were asked to compare their current choice of transportation and purchasing behavior with their

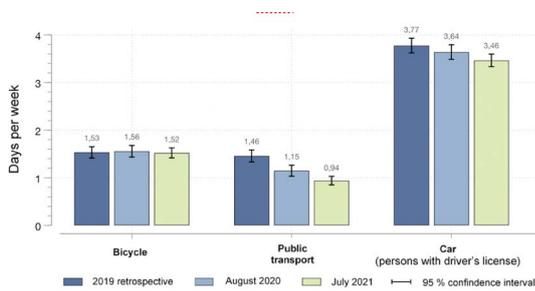


Figure 1: Use of different means of transport (Averages of the respective days per week)

pre-COVID 19 pandemic behavior and their expected post-COVID 19 pandemic behavior. One year later, at the beginning of July 2021, a second survey of citizens was conducted to evaluate how transportation choices and mobility behavior have actually changed and what the expectations are for future transport needs.

The results of the survey show that the mobility levels in 2020 and 2021 with regard to the three means of transport (bicycle, public transport, and car) are

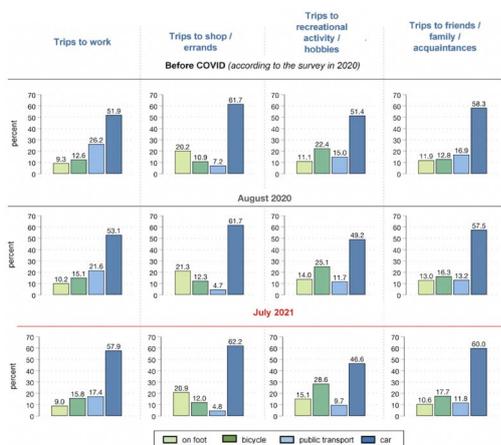


Figure 2: Relative frequencies of the main means of transport used for specific trips (in each case excluding cases with "does not apply")

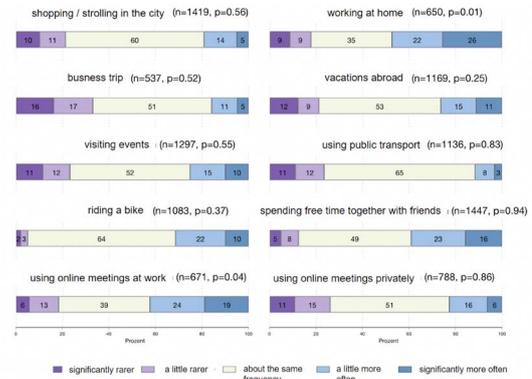


Figure 3: Intended behavior "post-Covid 19" compared to "pre-Covid 19" (without "does not apply" data; with number of cases and p-value for immunization status)

below the pre-COVID 19 level. In the case of public transport, there is a higher statistically significant decrease between 2020 and 2021 than for bicycle and car. In relative terms, it can be seen that bicycling is the „winner“ of the three modes of transportation considered in the study (Figure 1). Even across trip categories (work, shopping, leisure activities, friends/family), when asking for the main means of transport, cycling tends to increase in relative importance (Figure 2). In the pandemic, the car gains relatively in the modal split with the exception of leisure activities, which may have occurred in a smaller radius due to pandemic restrictions. The “loser” in the modal choice in July 2021 is again public transport. In particular, public transport has lost further importance compared to the 2020 survey for work commutes.

Similar to the 2020 survey, the July 2021 respondents would like to use bicycles more often in the future and it appears that people do not want to return to the 2019 level of public transport use (Figure 3). It is also worthy to note the high acceptance of working from home and the somewhat negative attitude toward business trips.



M. Eng.
Elisabeth Lerch
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Prof. Dr.
Marco Sunder

Park+Bike pilot test in Munich

The research project „Pilot test Park+Bike in Munich“ started in July 2020. In the project, the pilot test „Park+Bike“ in Munich was accompanied scientifically. The parking conditions were changed at selected Park+Ride facilities so that it was possible to park the car and then switch to a bicycle instead of public transport. The purpose of this project is to compensate for the reduced use of Park+Ride facilities caused by the overall decrease in public transport use while at the same time promoting intermodality, the use of different means of transport within one route.

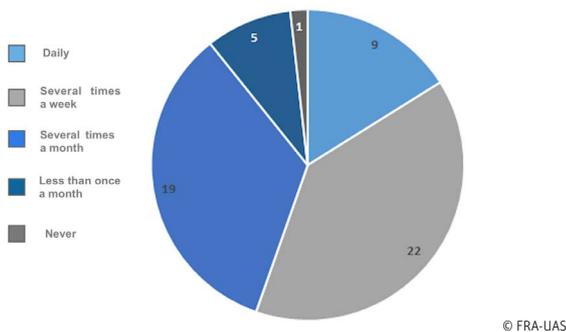


Users are reluctant to store bicycles in the currently existing bicycle parking facilities overnight or for longer periods.

During the interviews with the cycling commissioner of the city of Munich and the regional chairwoman of the ADFC Bavaria, further aspects of cycling in Munich as well as the integration of the new service into the existing one could be discussed. An analysis of tracking data of the rental bicycles of the Münchener Verkehrsgesellschaft (MVG) showed that the destinations of a large part of the trips are close to the respective starting point, which is the respective Park+Ride facility.

Overall, it can be seen that „Park+Bike“ can be an alternative to „Park+Ride“ in the future. The concept appears to be suitable especially under certain conditions, e.g. parking congestion at the final destination, and offers some advantages such as higher flexibility in mobility. In the course of the project, it became clear that the quality and sense of security of the bicycle parking facilities at the „Park+Bike“ lot is of high relevance. This is crucial for the success of the concept.

Figure 1 Frequency of bicycle use by potential users (n=56)



The aim of the research project was to gather data on users' opinion of this new concept of „Park+Bike“ facilities. An online survey was used for this purpose. The following research questions were asked: What is the potential for the new concept? What are the requirements for Park+Bike facilities? It was also important to find out which reasons exist for users not wanting to use „Park+Bike“.

The results of our online survey show that, in principle, the „Park+Bike“ concept arouses interest (Figure 1). However, many survey participants stated that the conditions for this are not yet optimal. This could be individual circumstances, e.g. the distance from the „Park+Ride“ facility to the final destination, but the equipment of the facilities was also frequently criticized.



M. Eng.
Dana Stolte
Research Assistant

Electrification of delivery traffic - ZUKUNFT.DE



Commercial traffic has been steadily increasing for several years and has increased even more in recent years.

In 2018, the courier, express, and parcel service (CEP) sector recorded a 4.9% increase in shipment volume, reaching a peak of 3.52 billion shipments. This means commercial traffic, especially in economically strong and centrally located regions, is of primary importance. In addition, ongoing discussions about diesel driving bans for cities are putting more pressure on commercial transport. These events are creating an increase of interest for CEP service providers to switch to alternative modes of driving. The integration of electric mobility into existing transport and logistics systems plays a key role in ensuring sustainable mobility development in the future.

The research project „ZUKUNFT.DE“ (customer-oriented delivery traffic with zero emissions and that is sustainable, flexible, and transparent) tested the electrification of parcel delivery vehicles on the so-called ‘last mile’ in practice with the spatial implementation focus in Baden-Württemberg, Hamburg, and Hessen. The joint project was funded by the Federal Ministry of Transport and Digital Infrastructure from January 2018 to December 2020. Local avoidance of emissions on the last mile, ensuring operational efficiency, and scaling up the use of electric drives in the CEP sector were the main goals of the model project. As part of the project, several hundred fully and partially electric transporters were used in various CEP companies for the first time. Most vehicles were of the 2.8 t and 3.5 t class, but also larger vehicle classes were tested. ReLUT, as a scientific partner in the project, was jointly responsible for the accompanying scientific research. The aim of this was to provide specially collected data and information to support the operational integration of electric vehicles at all potentially CEP depot locations. Furthermore, findings were generated that can advance the integration of electromobility into inner-city deliveries on both a technical and strategic level. Finally, recommendations

for action and strategic conclusions on the topic of electromobility for CEP depots should be developed. To implement electromobility, it was necessary to work on different tasks and topics. For example, the topic of charging infrastructure must be addressed. Various tasks and subject areas were worked on intensively in order to develop recommendations for electrifications in the CEP sector that were as exact and applicable as possible. Through qualitative surveys of depot managers and deliverers, as well as by inspecting several depots, it was found that the current short range and the low size of cargo volume of the current electric transporter models prevent the widespread use of electric transporters but can be used very well for tours in the inner-city area. Through traffic counting in Stuttgart, Hamburg, and Frankfurt am Main, and with the associated calculation of CO₂ emissions from the CEP industry, it was possible to determine that emissions from the CEP industry amount to one percent of the total traffic volume. As a result, complete electrification of the CEP industry cannot solve the current environmental pollution problem, but it is a beginning. The additional interviews with experts from politics, science, and business showed that the results collected in the project could be confirmed. They pointed out that the intensification of funding opportunities for the delivery industry and the provision and variety of electric vehicles are seen as crucial points for implementation.



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M. Eng.
Lola Freyer
Head of Research

Final report of Environmental Mobility Hub: Insight into the next steps



At the turn of the year, the Umweltmobilitätshub project (Environmental Mobility Hub), which was executed together with the city of Rüsselsheim am Main over a period of six months, was concluded. For the main part of the

project, a potential analysis was conducted for a new mobility platform that combines vehicle sharing with carpooling and ride-sharing functions and is customized to the needs of residential neighbourhoods in medium-sized cities (Mittelzentren). The analysis deals with all primary relevant disciplines that are necessary for a successful implementation of the underlying concept. These include transportation planning, logistics, law and economics.

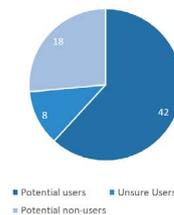


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environmental mobility hub in a neighbourhood selected together with the project partner. The survey was accompanied or promoted through different channels and through mobility booths set up on site (see photo). From the survey results, it was possible to derive tendencies regarding current mobility behaviour, willingness to use and pay as well as design wishes. For example, 62% of the surveyed participants stated that they could imagine using the solution if it were available in their neighbourhood. Of these potential users, 67% even stated that they would give up their own vehicle for the solution.

It was also possible to formulate assumptions about neighbourhood selection and neighbourhood-specific concept design. Thus, it was identified that a combination of vehicle sharing, the bring-along function, and an incentive system would have the highest perceived

benefits for participants. Further insights were gained on the preferred introduction order, willingness to pay, and preferred payment methods. Based on the previous mobility behaviour and the identified willingness to use, emission calculations (before and after) were carried out and a calculated savings potential was derived. The



Effects of the environmental mobility hub



potential analysis was rounded off by an investigation into legal challenges that could arise from the actual operation of the environmental mobility hub. Here, legal necessities were explained in detail.

Since only tendencies could be identified with the neighbourhood specific questionnaire, a representative study among inhabitants of medium-sized cities was executed during spring 2021. Its findings mainly support the first results from the potential analysis. In addition, ReLUT is scientifically accompanying the real life implementation of the individual services. Every new software functionality will be analysed with the help of several panel workshops from which the usability as well as the assumed value added will be analysed. All feedback will be processed and used to optimize the software development, a revised version will then again be tested and results will be monitored. The goal is to find out which challenges have to be solved and by which means in order to achieve the highest possible readiness for use.



M. Eng.
Franziska Weiser
Research Assistant

eCARE – integrated, technical, process-based charging management concept for e-car logistics

The automotive industry is in a state of upheaval. Stricter emission regulations are leading to an ever-increasing range of vehicles with alternative drive systems. Until now, research for electromobility has focused on component development or the creation of charging infrastructure for end customers. However, with increasing sales of e-vehicles and, at the same time, increasing global production, there is also a need for optimized logistics that take into account the specific characteristics of the vehicles with battery or fuel cell. Incorrect handling can lead to functional impairment or even endanger employees, as well as disrupt operations. The aim of the project eCARE is to redefine the processes in distribution and also for fleet operators of e-vehicles. The handling and, in particular, the charging management concepts must be process-safe and efficient in order to ensure optimal availability of the vehicles during trans-shipment.



M. Sc.
Lukas Fassnacht
Research Assistant

+++ SAVE THE DATE +++

Urban Transport Conference

14th and 15th of March 2022

Lunch-to-Lunch-Event

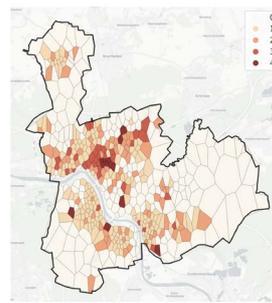
The Urban Transport Conference (UTC) is an international conference with worldwide experts from research sectors, private companies, public administration, and politics. Speakers and participants support various sustainable transportation solutions and urban challenges and deal with innovative approaches in the field

More information about UTC can be found on
<http://utc-frankfurt.com/>



ClusterMobil

An intelligent municipal mobility management system requires information on how many motorized vehicles are travelling, the category of drivers, the purpose of travel, and the specific part of the city. Surveys on people's mobility are time-consuming and costly, often not representative of real-time, and not sufficiently up-to-date and accurate. This new project titled ClusterMobil addresses these problems by using machine learning algorithms. The goal is to segment geographic areas in cities and cluster motor vehicle traffic flows. This will provide a picture of where which „groups“ (clusters) of



Background Map: © OpenStreetMap, www.openstreetmap.org/copyright

motor vehicles are going, why they are going there, and for what purpose they are going to certain geographic areas of cities. To gather this information, GPS data from motor vehicles and geospatial information

from OpenStreetMap are analyzed. The scope of GPS data is significantly larger than in existing studies, which allows for more detailed analyses. Furthermore, for the first time, a joint clustering of traffic flows and geographic areas by machine learning will be carried out to account for interdependencies. In addition, a model is created that allows overlapping of geographic clusters, i.e., the boundaries between, for example, two geographic areas do not have to be fixed but can be (more realistically) fluid (approximately continuous).

This research project, funded through the promotion program „Innovations in logistics and mobility“ of the state of Hessen, has been running since May 2021 and is planned to continue for the next 20 months until the end of December 2022.



M. Eng.
Siavash Saki
Research Assistant

Digitilizing Park+Ride spaces for more convenience



The Frankfurt RheinMain region offers around 28,000 Park+Ride spaces at various rail stations. Currently, road users do not know if free parking spaces are available at a Park+Ride until they arrive at the parking lot, at which time it is difficult to plan alternative parking options. This inconvenience should be changed to optimize usage

of the Park+Ride system. The success of recording and forecasting parking space occupancy at Park+Ride lots is currently being investigated as part of a project led by the Frankfurt University of Applied Sciences and the Society for Integrated Traffic and Mobility Management and with the help of artificial intelligence developed by Urban Mobility Innovations (B2M Software GmbH), Smart City System GmbH.

The ongoing PundR-Aktuell project is funded by the German Federal Ministry of Transport and Digital Infrastructure (BMVI) as part of the Modernity Fund („mFUND“).

In cooperation with the cities of Eschborn and Eppstein, Park+Ride parking lots are being equipped with sensors to determine parking space occupancy as part of a pilot project. The aim is to be able to link current occupancy information at P+R facilities to mobility information services, such as the P+R platform of the state of Hessen.

By means of a data-based and analytics-based model, data will be collected, analyzed, and evaluated for optimal and economical information retrieval.

By evaluating the data, far-reaching prognosis models and transferability to other places can be created. The project aims to strengthen P+R facilities as part of clean air planning by promoting public transportation usage and reducing private vehicles in city centers.

Safety impact of parking violations in bike lanes



ParkRight



Stopped and parked vehicles in bike lanes pose a substantial hazard to cyclists, causing them to swerve into moving traffic in order to avoid the obstruction in their bike lane. In 2018, there were over 88,000 accidents involving cyclists in Germany, an increase of more than 10.8% over the previous year (DeStatis 2019).

The National Cycling Plan describes illegal stopping and parking on bike lanes as high risk for the safety of cyclists (NVRP 2020).

As part of the ParkRight project, image inspections are to be carried out and driving data history used to identify illegal stopping and parking in a comprehensive and traceable manner. Patterns in infractions will be identified based on vehicle type, traffic infrastructure design, and other factors of the analyzed area. For this purpose, data will be applied that is partly available in the mCLOUD and derived from the image traffic data with the help of a labelling procedure. A web application will also be developed to make the analysis results accessible. The web application will make it easier for transportation planners to prioritize potential actions and evaluate impact relationships using an interactive map view.

The goal of the project is the systematic quantification, as well as the identification and evaluation of factors that promote illegal stopping and parking in bike lanes. The Germany-wide transferability of the results is to be achieved by recording image traffic data in several major cities (Berlin, Munich and Frankfurt).



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iLaPark - advancing electromobility



iLaPark

The iLaPark project, funded by the German Federal Ministry for Economic Affairs and Energy (BMWi), is designed to advance electromobility in urban areas. The goal is to establish more charging stations in parking garages and to

optimize use for e-car drivers and electrical grids. ReLUT is working with SyroCon AG, EDAG Engineering GmbH, Hsubject GmbH, Intilion GmbH and House of Energy to develop intelligent parking and charging concepts for parking garages in Frankfurt. In order to determine the charging infrastructure needs of parking garages, parking and charging behaviour as well as parking garage environment are being analysed. For this purpose, parking garages and charging stations are combined into virtual clusters using a software platform and app from SyroCon and EDAG to achieve optimal occupancy of the charging stations. This platform enables parking garage operators to offer their customers parking availability and payment options in a digital format.

For the trial, Hsubject and Intilion are developing a portable battery-based charging infrastructure that will enable parking garage operators to test charging infrastructure and concepts. For the first time, urban typological factors are being considered and AI-based parking + charging is being investigated.

If e-car drivers could detect via an app which charging stations are



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available, the traffic of electric cars could be targeted. In this way, grid-serving charging and optimal utilization of the infrastructure are achieved.

Project-mo.de enters its final year

project-mo.de How can various user needs be integrated into the design of new, sustainable mobility services? This is the question project-mo.de addresses by conducting interdisciplinary research into concepts for planning and designing mobility spaces, infrastructure, processes, and products. The focus is on personal mobility within the respective transportation system and its infrastructure.

“project-mo.de” has been funded by the LOEWE research cluster “Infrastructure – Design – Society” for three years and entered its final year in 2021. HfG Offenbach University of Art and Design, Frankfurt University



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of Applied Sciences, Goethe University Frankfurt, and Technical University Darmstadt have been exploring the design requirements for a new networked and multimodal mobility system

in the Rhine-Main area. ReLUT is working on the sub-project transportation planning and defined several work packages for the final project year.

In the first phase of the project, the user-friendliness of map displays and cycling flows are analyzed using data from the initiative “Stadtradeln” and the app “Komoot”. In the second phase, an analysis of bicycle parking facilities in the study area of Frankfurt-Rhine-Main was conducted in order to illustrate gaps in the region and to gather opinions from experts concerning future development.

The third phase deals with the infrastructure requirements of cargo bikes and develops an assessment vehicle with the purpose of testing the infrastructure. The fourth phase deals with mobility hubs. Moreover, ReLUT acquired a focus group in the beginning of the project and plans a tour of the Frankfurt-Darmstadt cycle path to assess its’ user-friendliness. At the conclusion of the project, there was a workshop to evaluate the method of using a focus group during the project in September.

project-mo.de tours Frankfurt-Darmstadt cycle highway

project-mo.de On 19.08.2021, as part of the LOEWE research cluster “Infrastructure – Design – Society,” 15 members from the long-running focus group of project-mo.de tested the Frankfurt-Darmstadt cycle highway. Petra Schäfer and Nicole Reinfeld were responsible for the organization and moderation of the event. Antje Quitta from the Regional Association took part in the tour as an external speaker and as a contact person for the feasibility studies of cycle highways in the region.



The purpose of the study was to test the quality of the cycle highway for the purpose of commuting. Before the test ride began, the participants were briefed on the study and asked to imagine that they are using the cycle highway daily as a commuting route and to ride accordingly at a brisk pace and not to chat with one another. One of two stops followed, the first at the service station at Erzhausen S-Bahn station, where first impressions could be exchanged and the experience up to that point could be discussed. The participants reported a few obstructions, such as a sign in the middle of the road, a sharp edge, and an intersection with a road. Positive factors were the width of the lane, handholds at the crossing, and the lighting. Overall, the riding experience was praised and viewed as a viable commute.



Before the tour concluded, Antje Quitta gave a short talk followed by a Q&A session. In her presentation, she discussed the future development of cycle highway projects, along with the general framework conditions required to build a cycle highway.



M. Sc.
Nicole Reinfeld
Research Assistant

User acceptance of autonomous shuttles in Pretoria

Currently, research on user acceptance and implementation of autonomous shuttles in public transport in African countries is limited. Since South Africa is the most industrialized economy on the continent, it is plausible that the introduction of automated shuttles in Africa will begin there before expanding to the continent as a whole. Therefore, it is critical to understand user acceptance and the factors that influence it in South African cities.

In studies of user acceptance, some researches have already shown that it is dependent on both nationality and culture. It has been observed that residents of lower-income countries are more open and thus more likely to accept autonomous vehicles than their higher-income counterparts. This study aims to determine the evaluation or perception of autonomous shuttles by users in Pretoria. To gather data, a comprehensive online survey of potential users in Pretoria was conducted.



The key findings of the survey are that user acceptance among Pretoria residents was high, with a 97.69% acceptance. Respondents’

intention to use the BRT (Bus Rapid Transit System) for the first and last mile by autonomous shuttles was significantly higher (75.40%) than other public transportation modes (40.00%). The most influential factor was fear of terrorism and system hijacking. Based on the findings, an additional conceptual operating model for integrating autonomous shuttles into the public transport system in Silver Lakes, a suburb of Pretoria, was also presented. The Silver Lakes model presents a solution in which shuttles operate in dedicated, bidirectional lanes under human supervision. This concept takes users’ perceived usefulness and acceptance of autonomous shuttles into account.

Click [here](#) to view the complete article published with The World Academy of Science, Engineering and Technology.

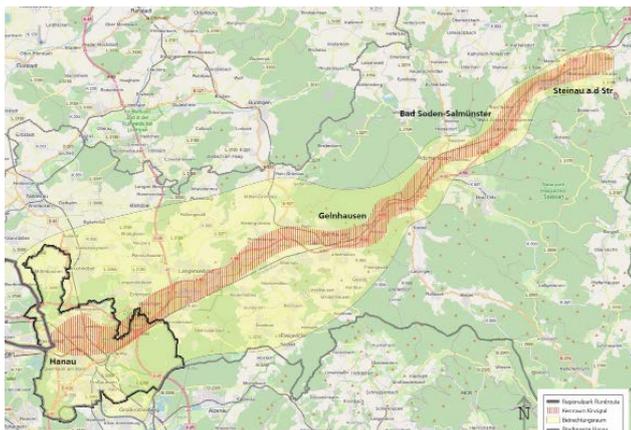
NaTourHuKi – A Concept for Sustainable Tourism



The population is growing in the Rhine-Main area of Germany, an area already busy with tourists interested in hiking and biking. The combination will increase the demand for regional recreational opportunities in the area. An increase in recreational activities will also create increased disruptions in transport and traffic patterns in the coming years, but also introduce conflicts between the interests of tourism, nature and landscape conservation, as well as agriculture

and forestry.

The research project „NaTourHuKi“ started at the beginning of 2020. It deals with the development of a sustainable tourism strategy for the landscape area „Kinzigtal“ from Hanau to Steinau an der Straße in the Main-Kinzig district. The project wants to develop resilient forecasts, usable potentials, and attainable goals for regional tourism.



In the first year of the project, the ReLUT collected and analyzed existing traffic data, strategies and concepts for the study area. For the study area, there is little to no data available for short-distance mobility and recreational traffic.



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For this reason, a tourism-related traffic analysis will be done in future phases of the project. For example, the development of selected points of interest, and the usage frequency of biking and hiking trails will be analyzed, as well as attraction points and peak times of visitors. The focus is largely on mobility in the areas of local recreation and day trips.

In a potential analysis, possible implementation projects should always be assessed with a focus on cross-modal offers. The focus is particularly on the topics of local mobility and public transport.

The project is funded by the BMBF funding measure „Stadt-Land-Plus“. In addition to the Frankfurt University of Applied Sciences, the TU Darmstadt, the Heilbronn University of Applied Sciences and, as practice partners, the city of Hanau, Spessart Tourismus und Marketing GmbH and Regionalpark Ballungsraum RheinMain GmbH are involved in the project. The project will run until February 2023.



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start2park

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des Deutschen Bundestages



start2park



When calculating travel time with navigation apps, the time needed to find a parking space is neglected. Therefore, the benefit of private car use compared to other means of transport appears higher than it actually is. Implementing parking search time in navigation apps could reduce unnecessary traffic caused by searching for parking spots. This would be associated with reductions in emissions, traffic volume, and travel time. Moreover, previous studies show

that parking search time (cruising for parking) has not been convincingly measured yet and empirical results so far vary greatly. These result differences are due to specific local conditions in research areas, different times of recording, as well as different survey methods.

Our research project start2park closes a research gap by precisely measuring parking search time based on collecting data via an app developed for this purpose. In particular, we are able to precisely determine the starting time of cruising for parking. The start2park-App has been developed in collaboration with our practice partner Fluxguide (Austria, Vienna) and provides a state-of-the-art mobile interface that is fine-tuned for ease of use while driving. In this way, average parking search times can be determined according to urban district types and time of day. Moreover, by using Google Maps estimates of trip times, the effect of the parking search on the travel time is calculated. One research goal of the project is developing a model to explain parking search time to identify public traffic-planning options.

App-based data will be combined with big data by our practice partner Bliq (Berlin, Germany). Using data mining and statistical analysis, cruising for parking will be explained by possible determinants, e.g., traffic density, date, and time. Using machine-learning algorithms, a parking search time prediction model will be developed in

order to implement real-time forecasts of parking search time in navigation apps.

If you are located in Europe, you are invited to support us by downloading the free start2park-App on your mobile phone and regularly recording your cruising for parking. By doing so, you support sustainable mobility research and get an insight into your parking search times. The app is available in the app stores from the end of August 2021. Information is also available at www.start2park.com. The research project, which is funded by the German Federal Ministry of Transport and Digital Infrastructure, started in July 2020 and runs until June 2023.



Dr. Sabine Scheel-Kopeinig
Senior Researcher



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Presentation by Sabine Scheel-Kopeinig at the virtual Polis Conference 2020

The virtual Polis Conference 2020 took place from 11.30.20 to 12.3.20. The program served as a platform for cities and regions to present their transport achievements to a large audience of mobility experts, practitioners, and decision makers.

Sabine Scheel-Kopeinig presented in the session, „Getting ready for the next decade of parking policies,“ explored the possibilities and limits of determining temporal distributions of parking demand with data from parking space management and GPS-trip data. The title of the presentation was „Novel approaches to estimate the temporal distribution of the demand for parking space“. The next Polis Conference is scheduled at the Lindholmen Conference Centre in Gothenburg, Sweden, for 12.2021.



Dr. Sabine Scheel-Kopeinig
Senior Researcher

Cycling Professor leads the way

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Dennis Knese has started as a Professor for Sustainable Mobility and Cycling at the Frankfurt UAS in January 2021. The professorship is funded by Germany's Federal Ministry of Transport and Digital Infrastructure (BMVI) in order to strengthen the role of cycling topics in education and research. It is part of the newly published National Cycling Plan 3.0 which aims to give greater

attention to the interests of cyclists in the future – from infrastructure planning to mobility management and cycling-friendly legislation. More than 30 universities applied for the seven professorships that were posted nationally. The decision to award Frankfurt University of Applied Sciences and ReLUT with one of the endowed professorships attests to the university's high-quality profile in the field of sustainable mobility. The universities are funded with a maximum annual amount of 400,000 euros per professorship. In the case of Frankfurt, the premium bicycle manufacturer Riese + Müller is adding a 50% share of the funding for a research fellow.

Prof. Knese has started his position with the aim of increasing interest in cycling matters for as many students as possible and, ideally, preparing them for their subsequent careers, possibly as transport planners, cycle path designers, or cycle logistics experts. Furthermore, he wants to support partners of the public sector, the economy, and civil society through research work and projects. Research provides the arguments that are urgently needed for transforming transport. This includes i.e. evidence-based data on the benefits of more cycling and innovative solutions in planning, logistics, or politics. After having an initial cycling workshop with representatives of municipalities, associations, and the business community, it became clear that the demand for well-educated professionals is very high, and the need to close the research gaps is urgent.

At the Frankfurt University of Applied Sciences, the professorship is docked to the departments "Architecture,

Civil Engineering, Geomatics" as well as "Economy and Law". First courses which have been offered to students dealt with intermodal connections between cycling and public transport, cycling logistics and engineering projects on walking and cycling. The offers were well received by the students. Further, Prof. Knese has supported different bachelor's and master's theses on cycling topics in a national and international context. In the longer term, it is planned to integrate active mobility topics in study courses from different disciplines. Also, a new master's program on sustainable mobility is being developed, where students can choose a specialization in cycling.

In the first months, the professorship gained a lot of attention in the media, and Prof. Knese appeared in several press releases, radio interviews and TV reports. Further, he presented his ideas at different conferences like the German National Cycling Congress. He and his team also organized a virtual session for mobility experts with a focus on electric two-wheelers. More than 80 participants discussed the increasing importance of electric bicycles and new requirements on infrastructure and legislation. Currently, the cycling team of the ReLUT is working together with several partners on different project proposals in order to establish a diverse research



**We could use
the bicycle more
on short routes**

Mobility is a key factor
for sustainability

Professorial Chair of
Sustainable Mobility and Cycling

Learn more about Professor Knese



... in a March 2021 interview with
Riese & Müller

RIESE & MÜLLER

... in a May 2021 interview with
Transformative Urban Mobility
Initiative



Benefits of OpenStreetMap data for transport planning

Planning transportation and logistics inherently involve matters of space: Where are the points of interest? What are the main connecting railways? How far is it from point A to point B? Which bus route runs in that direction? There is hardly any study on transport which does not include space. So, obtaining spatial data is crucial to all research in this field.

There are a few common ways to access spatial data. Two of these will be compared here: government data and OpenStreetMaps data.

Accessing spatial data from city or municipal governments is not always trivial. Especially in federally organized countries like Germany, the jurisdictions for spatial data vary from state to state and are not freely available or quickly accessible. In addition, the data is only updated every three years or when required for specific event-related use (Geoportal Baden-Württemberg, 2021). The spatial accuracy of municipal data is, however, extremely precise. In Germany, it is about 3 mm (tagesschau.de, 2021).

OpenStreetMap (OSM) is a collaborative open source project to create a free, worldwide, geospatial database. With millions of contributors, it is updated multiple times a day with varying spatial accuracy. Due to the many contributors in Germany, the spatial accuracy here is in the range of meters. Various application programming interfaces (API) allow continuous free downloads.

Table 1 shows a comparison of these two data providers. The green and red cells symbolize which of the two

perform better or worse. The two areas in which government data outperforms OSM data are spatial accuracy and coverage. Though the spatial accuracy of government data is more precise, the OSM data spatial accuracy is more than sufficient for most transport requirements. Although the coverage of government data usually is complete, the information that is relevant to transport planning such as political boundaries, streets, transit systems, building footprints, parks, pedestrian and bicycle infrastructure is included in OSM as provided by Boing. Non-road related data varies from region to region (Boeing, 2020). The points that are summed up in Table 1 show that OSM data has many benefits for transport planning and even outperforms official government data in multiple instances.

Many researchers and urban planners use OSM data for various causes. Wenz et. al. (2021) calculated fuel consumption of diesel and electric buses in Ecuador using OSM data. Schocke et. al. (2020) found tram stops that are suitable for streetcar parcel delivery in OSM data. Boing (2020) describes multiple further uses for OSM data. Most current ReLUT projects utilize the OSM data and plan on contributing to it so that the general public and future researchers can profit from the knowledge that, in part, evolved from using this beneficial data source.



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Table 1: Comparison of spatial data providers

	Government data	OpenStreetMap data
Spatial accuracy	< 5 mm	Roughly < 5 m (in Germany)
Coverage	complete	dependent on contributors
Temporal accuracy	every 3 years or event related	daily
Costs	fees involved	free
Accessibility	days of processing time	constantly

European Summer University Logistics and Mobility

The European Summer University Logistics and Mobility (ESU), which began in 2012, offers a practice-oriented approach to the topic of logistics and mobility with excursions and company visits. It addresses students of the master's program Global Logistics at Frankfurt University of Applied Sciences (Frankfurt UAS) and a selected partner university from another European country. The internationalization of mobility and logistics studies combined with an intensive academic program enable students to gain first-hand international experiences. Various cultural and social events offer the participants an opportunity for networking and exploring different aspects of mobility and logistics.

Due to the Covid pandemic, the 2020 ESU program was cancelled and postponed to this year. The first week of the two-week program, which started at the end of May in Bayonne, was moved to an online format. Prof. Dr. Kai-Oliver Schocke and Prof. Dr. Benjamin Bierwirth, heads of the degree course Global Logistics and both members of the Faculty of Business and Law at Frankfurt University of Applied Sciences (Frankfurt UAS), planned and conducted the virtual program together with Dr. Gisèle Mendy-Bilek from the French partner university, Université de Pau et des Pays de l'Adour (UPPA). The second week of this year's ESU began on June 27th and was hosted by the same team in Frankfurt. The 40 participating students from Bayonne and Frankfurt engaged in discussions on logistics together. The agenda included, for example, the (pharmaceutical) supply chain, the inner-city transport route, and the digitalization of logistics processes. The



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participants prepared and presented seven project topics from the logistics sector. The event was wrapped up with a series of lectures and discussions with important players in the industry, including representatives from Dachser, Air Cargo Community Frankfurt e.V., Contargo Rhein-Main GmbH, and Biontech SE.

The Summer University was financially supported by the „Stiftung Flughafen Frankfurt/Main für die Region“. As Aquitaine is Hessen's partner region, Axel Wintermeyer, Minister of State and Head of the Hessian State Chancellery, and Mark Weinmeister, State Secretary for Europe, met at the House of Logistics and Mobility (HOLM) at the Frankfurt Airport and discussed with all participants the important topics of logistics and mobility in Europe.

To round off the successful program, the German participants were able to make up for the week in Bayonne they had missed due to the pandemic and visit their counterparts there from September 11th 2021. Although this week's program mainly included recreational activities and non-academic excursions, on September 15th the group visited Bordeaux and was able to have discussions with a representative of the Nouvelle Aquitaine Region. We are looking forward to another successful program in 2022.



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Kombinom

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The introduction of flexible forms of service in rural areas shows great potential, especially in the area of demand-oriented services. In the research project „Kombinom - Data modeling for the use of autonomous minibuses in rural areas for the combined transport of passengers and goods,“ an analysis for the potential use of autonomous

minibuses in rural areas for the combined transport of passengers and goods is developed. The approach of combined transport means the vehicle is usually available for other transport tasks during times of low passenger transport demand, capitalizing on ecological and economic savings potentials (synergies). To this end, autonomous driving enables an additional cost reduction by reducing personnel costs.

The aim of the simulation study is to compile data used to analyze growth potential and to identify the spatial, temporal, and economic potential of autonomous minibuses in rural areas. As a first step, access to existing data sources in the field of public transport will be reviewed and freight transport in rural areas will be

evaluated. Also, success factors of demand-responsive service forms will be identified and the usability of statistics regarding the utilization of autonomous minibus systems (especially in off-peak times) in rural areas will be increased. Finally, an analysis concerning the potential of a data-based application (simulation) will be created in order to combine the previously mentioned data and to systematically identify corresponding potentials.



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+++PUBLICATIONS +++

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CargoErgo

By analyzing the intralogistic processes at two companies in the air cargo handling sector, the project „CargoErgo“ aimed to identify potential for improving the ergonomics and efficiency of air freight and cargo processes.

In the first phase of the project, the processes of the project partners were analyzed from both an ergonomic and efficiency point of view. Some inefficiencies in the existing processes were uncovered, with a lack of data availability and digitization being the primary cause. In addition, an initial ergonomic analysis has already shown that the consolidation of freight onto different load carriers is in particular characterized by a high proportion of manual work, which leads to employees frequently adopting ergonomically stressful postures.

In a further course of the project, a detailed analysis particularly critical of ergonomic work processes will be carried out. Based on this, a concept for the ergonomic and economic improvement of the existing processes will be developed which will aid future digital technologies available on the market.



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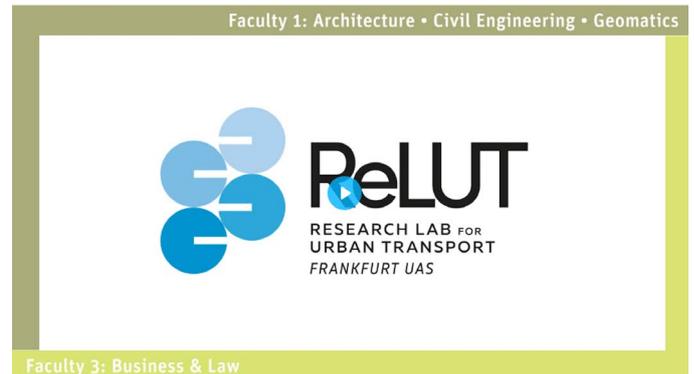
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+++ PUBLICATION +++

The bilingual research report (German/English) of Frankfurt UAS is available with detailed information about the manifold activities of all researchers of the Frankfurt UAS.

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