FRANKFURT UNIVERSITY OF APPLIED SCIENCES

ReLUT - Research Lab for Urban Transport

NEWSLETTER 01/2023

ReLUT RESEARCH LAB FOR URBAN TRANSPORT FRANKFURT UAS

Welcome!

The Research Lab for Urban Transport (ReLUT) is an interdisciplinary team of researchers in Frankfurt, Germany working on current and future challenges of mobility. Our research focuses on the development of economic and ecological solutions for new mobility models. In addition to the disciplines of transport planning and logistics, ReLUT combines a wide range of competencies: urban planning, social science, data science (Big Data), computer science (AI), geoinformation, law, automotive engineering, and economics.

The first half of 2023 has been very productive for us. From March 27-28, together with the House of Logisitics and Mobility (HOLM GmbH), we hosted a successful Urban Transport Conference with the moto, „Shaping the future of urban mobility and logistics in times of high energy prices." This event was a highlight of the year so far. We gathered experts from research and private companies, as well as public administrators, and hosted 2 keynote speakers and 16 presenters from 9 countries.

In May 2023, ReLUT celebrated it's 5th year anniversary with a wonderful celebration. Thank you to all of our partners and supporters who came to celebreate with us. We thank you for your continued support and collaboration.

In September, Petra Schäfer will be joining the German delegate at the SmartCity trip to universities in the United States and Canada. We are excited to have her representing ReLUT and are certain she will bring back many great ideas.

We hope you enjoy reading about all the projects our team has been working on and that our work inspires your work. We are always looking for areas of collaboration! Please reach out to us if any of our projects are of interest to you.

Best wishes,


Petra Schäfer


Tobias Hagen


Dennis Knese


Anne Lange

Faculties 1 & 3
ReLUT

Wissen durch Praxis stärkt

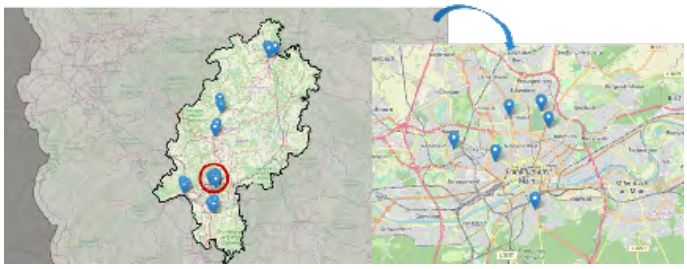
Digital interface to promote climate-friendly mobility concepts in freight transport

HESSEN
Hessisches Ministerium für Wirtschaft, Energie, Verkehr und Wohnen

Promoting cycling as part of a forward-thinking, climate-neutral and sustainable form of mobility is becoming a focal point for companies and municipalities in Germany as well as worldwide. The challenge is not only in changing mindsets, but also in addressing the logistical requirements needed to implement a cycling-focused strategy. Delivery concepts with cargo bikes in freight transport are being piloted in many large cities, especially in the field of courier, express, and parcel service providers. This alternative form of transport is already partially established in some areas, especially in connection with micro hubs.

There are different challenges when planning and implementing micro hubs. One of the main hurdles is overcoming communication breakdowns between various stakeholders. Both sides, municipalities and companies, describe the creation of suitable contacts as a large gap that can only be solved by a „neutral contact initiator." Due to these observations in communication and information challenges, a practical solution that enables both sides to identify potential collaboration partners is needed. This was the basis of DiMoG (Digital Mobility in Freight Transport).

The research idea for this project resulted from various discussions with municipalities and logistics service providers who identified outreach to potential partners as one of the main difficulties of micro hubs. These difficulties can be reduced or avoided by establishing a two-way communication platform. We examined the feasibility of a contact and communication platform for initiating sustainable logistics concepts, e.g. by means of cargo bike delivery. A trial version was created to enable municipalities and logistics service providers to more easily get in touch with one another in the future. Image 1 shows a demo version of a map within the platform with examples of potential micro depot areas. This means that suitable micro-depot areas for the implementation of cycle-logistics projects can be found, shared, and established in less time.



Source: OSM

We used different methods to collect information for the digital platform, such as basic research on micro hubs and successful platforms already in existence, identification of success factors and barriers, and literature research on requirements form the basic framework. Good practice examples for ongoing micro hub concepts were also part of the research and outcome of the project. Various municipalities and companies were interviewed as experts already conducting successful micro hub projects.

On the one hand, the platform makes it possible for municipalities or private companies to offer their logistics areas to include existing properties and other open spaces. On the other hand, logistics service providers would be able to search for available space on an interactive map. In addition, the platform contains a „knowledge area" in which the necessary steps for initiating and implementing micro depot concepts as well as good practice examples are listed. This provides an initial overview of options for action, particularly for companies and municipalities that have not yet dealt with this topic.

M. Sc.
Lukas Fassnacht
Research Assistant

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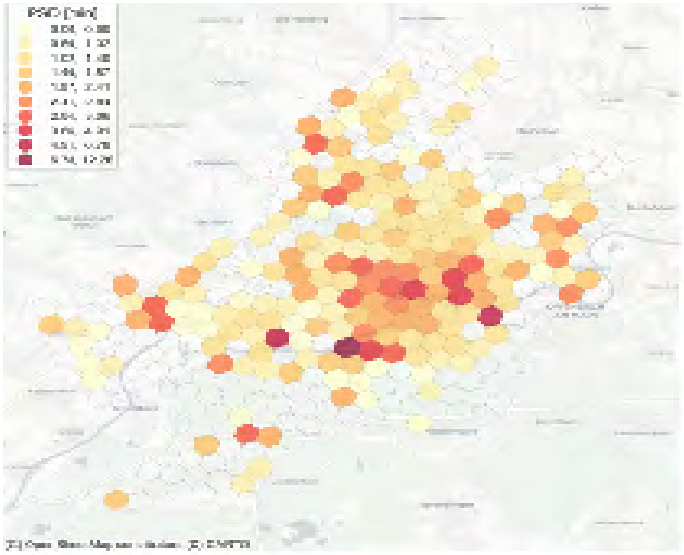
start2park -Measuring and Predicting Parking Search

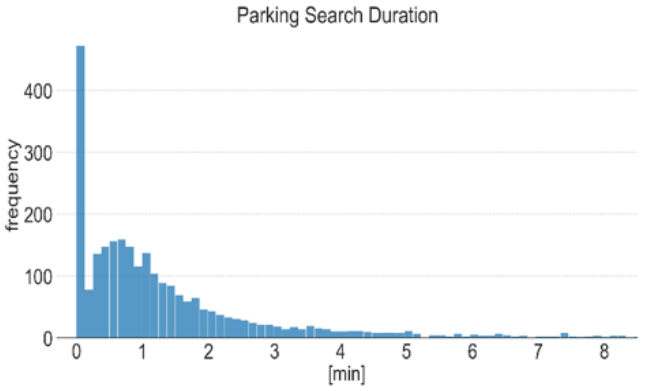
Gefördert durch:
Bundesministerium für Digitales und Verkehr
aufgrund eines Beschlusses des Deutschen Bundestages
mFUND
start2park

The start2park project incorporated more than 3000 trips collected by volunteers via the online app. This project aims to both understand the determining factors of parking searches and to be able to predict parking search durations. The data collection is ongoing with additional trips serving to enhance the model performance.

Analysis of the gathered data reveals that, on average, parking searches do not constitute a grave problem. Only a small number of trips require an extensive parking search, but those could well be the ones most remembered. The mean parking search with nonzero searching is roughly two minutes, with an additional one minute fifteen seconds spent walking to the final destination. On average, cruising for a parking spot covers 310 metres, with little over 100 metres of walking distance.

The data shows a correlation between increased search times for cost-free parking and paying for parking spots. This suggests that longer search times may force drivers to settle for paid parking. Most strikingly, parking search durations are strongly heterogeneous across space.





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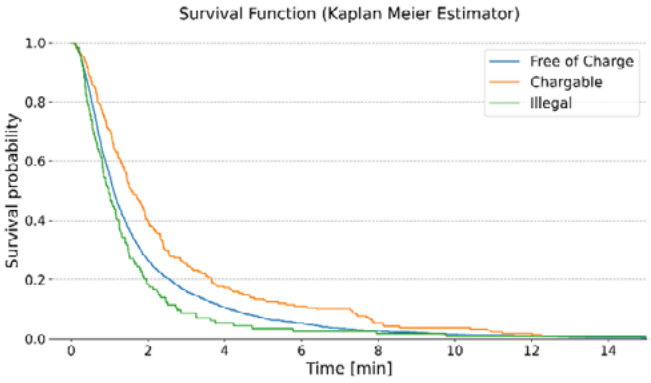
Outside central districts of major metropolitan areas, patience for average parking search durations diminishes quickly. Both in smaller towns and in rural areas, parking searches become a negligible problem. For medium-sized towns, the average parking search duration is slightly under a minute.



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Even within cities, parking search durations vary. For the city of Frankfurt, clusters of longer search durations can be found in the central business district and the old town area. Across all German metropoles, parking search durations in the city centres average at around three minutes. On the fringes of the city centres and on the outskirts of the cities, cruising for parking averaged one and a half minutes, respectively.

M. Eng.
Siavash Saki
Research Assistant

Building a simulation framework for traffic scenarios in the Rhine-Main area

The project ASIMOW (Agent-based simulation models for mobility patterns) evaluates the welfare effects of transport-related policies in the Rhine-Main area and aims at contributing to decision-making and the development of sustainable transportation policies using a scenario-based approach. The project's findings will inform policymakers, urban planners, and researchers who are helping to create transportation systems that prioritize public health and environmental well-being. The data could also be helpful for the future expansion and development of transportation systems. The project is funded by LOEWE of HMWK.

An increase in concerns about the emissions generated by different modes of transportation and their impact on the environment and public health have been noticed. As cities face high levels of pollutants due to fuel-burning mobility behaviors, it is becoming crucial to understand the consequences and predict the effects of traffic measures. Additionally, identifying groups of individuals who may be disproportionately affected by emissions and traffic measures is essential in developing strategies that mitigate negative impacts and promote sustainable transportation systems.

The ASIMOW project is dedicated to offering insights into these concerns. In ASIMOW, we utilize the agent-based traffic simulation with MATSim and data analysis to understand the effects of traffic measures on transportation choices, routes, and various groups of individuals. Our primary goal is to estimate and analyze the emissions resulting from different transportation modes. By quantifying these emissions, we aim to assess their impact on the local population. We also seek to predict how traffic measures can influence individuals' transportation choices and routes, considering factors such as costs, travel times, and health implications. By identifying the winners and losers of interventions, policymakers can develop strategies that optimize benefits and minimize negative impacts.

Figure 1

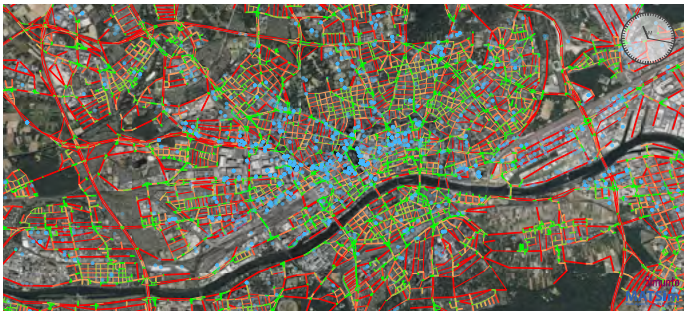

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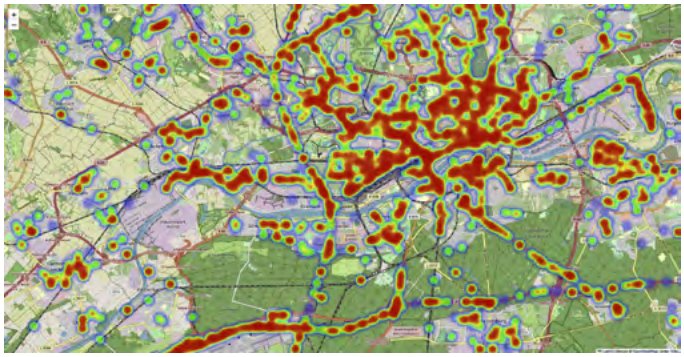
Figure 2



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We are programming traffic flows from external sources. We investigate the Rhine-Main area using OpenStreetMap (OSM) road network data and integrating General Transit Feed Specification (GTFS) for public transport connections. Moreover, we rely on some other external open-source databases such as BASt to improve traffic flow implementions. We also incorporate residence locations from the 2011 census, activity profiles inspired by mobility surveys, and destination mapping from OSM. Emissions are calculated using the Handbook for Emission Factors for Road Traffic (HBEFA).

The project simulates pollutant spread and estimates emissions based on agent locations. For this purpose, we are tracing the whereabouts of agents throughout the day. By comparing scenarios, we conduct agent-specific benefit analyses. This approach provides valuable insights into the impacts of mobility on the environment and individuals, informing sustainable transportation planning.

Figure 1 shows a simulated utilization of the road network

(lines) and locations of agents (each blue dot represents several agents) in Frankfurt. This network map with emission pollution provides insights into the specific transportation links contributing to high emission levels, enabling targeted interventions to reduce pollution. Figure 2 shows particulate matter pollution concentration map based on simulation (work in progress). These visual representations offer a glimpse into the ASIMOW simulation project's findings.

The current limitations include the route choice of cyclists which could be implemented at a later point. Additionally, we plan to include transit traffic and freight transport data to better understand the utilization of transportation networks. Future scenarios will also be explored, considering emerging mobility options.

B. Sc.
Yasaman Mashayekhy Fard

Third Annual Urban Transport Conference

The third Urban Transport Conference (UTC) was held at HOLM in Frankfurt am Main on March 27-28, 2023. The conference always highlights current topics, and the motto chosen for 2023 was: "Shaping the future of urban mobility and logistics in times of high energy prices."

The event is primarily targeted at scientists and companies who would like to share and further develop their concepts, ideas, and research results. For this purpose, the UTC offers e-bike manufacturers and consulting companies, especially energy companies and suppliers, the opportunity to present their current challenges and explain how they deal with them. The topic of e-mobility was an important point at our event. We also had scientists who discussed the consequences of high energy prices and how best to deal with them.

Although the conference was planned as a presence-only event, we unfortunately had to switch to the online format for the first day of the conference due to nationwide public transport strikes. The second day was then held in hybrid format. Despite these unfortunate circumstances, the conference was an informative and stimulating exchange.

Urban Transport Conference 2023

September 6th - 8th

Milan, Italy

This year's European Transport Conference 2023 will take place at the Milan Bovisa Campus of Politecnico di Milano. Tobias Hagen and his collaborators Amir Babaei, Yasaman Mashayekhy Fard, Lukas Fassnacht, Jonas Hamann, Nicole Reinfeld and Siavash Saki will be presenting.

Learn more about the 2023 UTC here.

ReLUT joins German Delegation to Canada

ReLUT is excited to announce that Petra Schäfer has been invited to join the German Research Foundation/ Deutsche Forschungsgemeinschaft (DFG) delegation for the Networking for Research (UDIF-HAW). At the end of September, Petra will join the Delegation Group for Smart Cities and travel with them to Seattle, Washington (USA), Vancouver and Calgary, Canada. The Smart Cities delegation will join other German and international collaborators. It is exciting that ReLUT will be represented in this international forum.

FLOBIDAS – Floating Bike Data Space

Gefördert durch:

Bundesministerium für Digitales und Verkehr

aufgrund eines Beschlusses des Deutschen Bundestages

mFUND

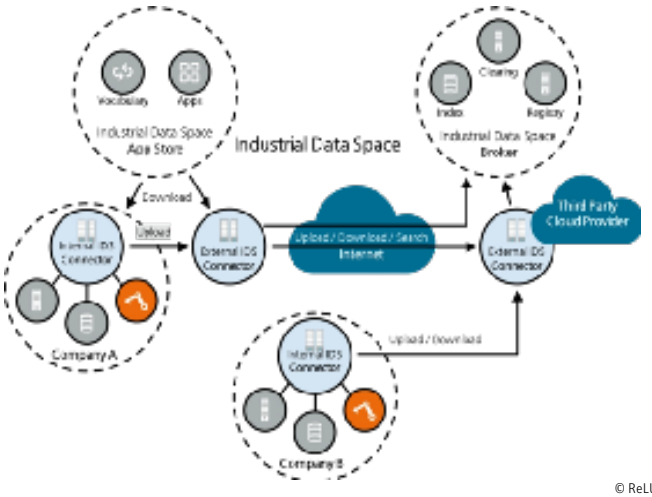
FLOBIDAS
FLOATING BIKE
DATA SPACE

Coping with and mitigating climate change requires a mobility transition away from privately-owned motorised vehicles. Cycling takes a key role in gearing our mobility behaviour towards sustainability. To properly establish the cycling infrastructure required for increased usage, however, sufficient and reliable data on the route choices and travel times of cyclists is required.

Mobile data collection via GPS units in smartphones or bicycles allows entire trips to be recorded with meta data. As seen in the illustration of a single trip in the city of Munich, the advantages of this floating bike data over data from stationary traffic counting systems are easy to infer. What is still needed, though, is to scale the available trip data to a significant level.

Data is already being generated by a vast number of private participants. What is missing is a single platform that collects and combines dispersed data to support research and planning efforts. The mFUND-funded pilot study FLOBIDAS trials a data space for floating bike data to demonstrate the feasibility and usefulness of the approach.

The project builds on the Fraunhofer International Data Space (IDS) approach, an ecosystem consisting of data



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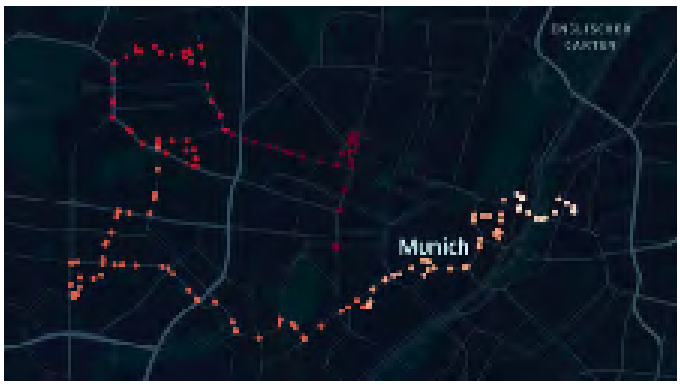

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providers and consumers as well as third party aggregators and brokers for the data. These third parties can shape the dispersed bicycle data into useful information for policy makers and researchers. This data can thus be commercialized and utilized while maintaining the strictest standards of data sovereignty.

After talking to experts and potential data providers in a series of interviews, it is clear that these features constitute the necessary condition for participation in a data space. Companies collecting bicycle data are serious about the legal questions of data protection, both to maintain their customers' trust as well as concerns about competition. The fixed costs of participating in a pilot study deterred data provision in FLOBIDAS. Once a data space was established and economies of scale were created, data producers would be more enthusiastic to participate.

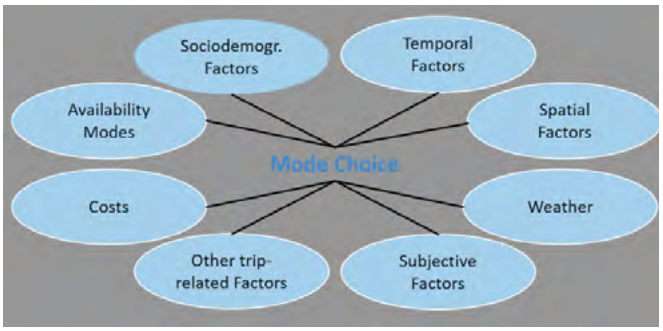
There is genuine and widespread interest in utilizing collected data on cycling statistics. While lack of profitability is a barrier to participation, financial reasons are not the primary driver. Participants are invested in speeding up the mobility transition with many willing to provide data to further this policy without immediate monetary renumeration. Moving forward, FLOBIDAS will have to show that it is possible and feasible to convert these intentions into data provision.

M. Phil.
Larissa König
Research Assistant

ModelRad – The status quo and development options for improving bicycle traffic

Gefördert durch:
Bundesministerium für Digitales und Verkehr
aufgrund eines Beschlusses des Deutschen Bundestages
mFUND
PTV GROUP

Data-based transport planning tools is a new field that is accelerating the transition towards sustainable mobility. These data-driven tools enable transport planners and municipalities to identify infrastructural needs and to build demand-oriented cycling infrastructure. Currently, however, the available data on bicycle traffic is low in comparison to models of motor vehicle traffic. The main reason is that the necessary data is not available. As a result, urban planners and transport modelers often use simplified approaches to model bicycle traffic, if cycling is considered in models at all. For example, models use aerial distances rather than actually



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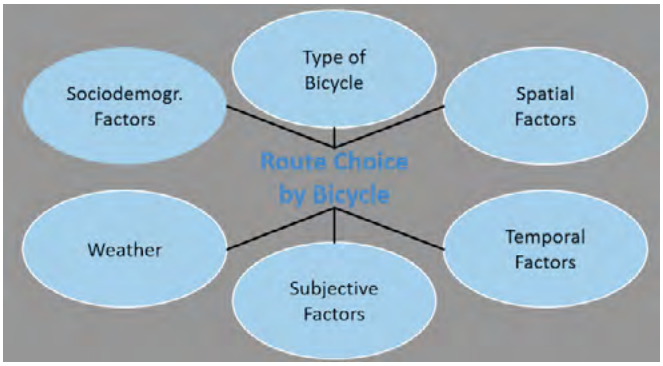
chosen routes. For a more realistic and easily adaptable modeling of bicycle traffic, planners require more data and parameters describing the behavior of cyclists.

In the project ModelRad, we identified influencing factors separately for mode and route choice based on existing literature. First, we compiled more than 800 statements on the most significant influencing factors. Next, we categorized the results and discussed the results with modeling experts and compared influencing factors with available data sources. We analyzed the models created by PTV Group in recent years with regard to the integration of bicycle traffic (e.g., multimodal traffic model Dresden, Augsburg, Munich, national passenger transport model of Switzerland, and transport model Münster).

How can transport modelers use the results from studies to derive parameters to model bicycle traffic? To answer this question, we developed a use case diagram regarding the influencing factor of topography. For the use case, the empirical results of six surveys were collected. The resulting parameter sets can be compared and defined as ranges that can be used for future traffic models.



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Based on interviews with experts and researchers on state-of-the-art survey methods, our results show that additional research is needed on the influence of personal and household characteristics, especially on income and education. With regard to transport modes, the data basis is not yet sufficient to model quantities of pedal electric cycles (pedelecs) and cargo bikes. Furthermore, it is not sufficiently evaluated whether pedelec riders spread their routes more widely and react less sensitively to certain parameters, such as topography, than users of conventional bicycles. The greatest need for research exists for time-related influencing variables. For example, the actual travel time for bicycling is unknown and derived using routing engines.

This research project has been running since May 2022 and is funded by the Federal Ministry of Digital Affairs and Transport (BMDV) through the mFUND program. It is planned to continue until the end of July 2023.

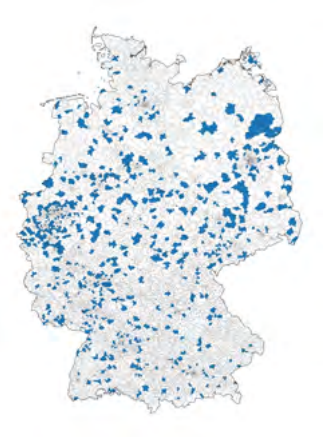
M. Sc.
Nicole Reinfeld
Research Assistant

Representative survey on mobility behavior of residents from residential neighborhoods outside major cities

Mobility Hubs, the combination of public transport and shared mobility in one physical or virtual station, are one of the main five mobility trends started from the Zukunftsinstitut in its Mobility Report 2024. Mobility Hubs are seen as the further development of our traffic system and a key instrument to moving people away from motorized individual transport and towards public or shared mobility, especially when the hubs are located in residential districts. Current research seems to focus primarily on hubs or sharing solutions within big cities, however 83% of the population live outside the boundaries of Germany's 15 major cities .

A representative survey was conducted in medium-sized cities aiming to understand the modes of transportation that people who are living outside of major cities are currently using. The goal was to better understand what experiences these individuals have had so far with public transportation and to gauge their willingness to use new mobility options. In total, a maximum of 54 questions could be answered via an online survey tool. A research associate of the Research Lab for Urban Transport (ReLUT) developed the questionnaire and an external market research institute (Norstat) then executed the survey. In total, 1.009 people participated in the questionnaire from 382 different medium-sized cities throughout Germany (see map).

The gender distribution was almost equal between male and female (50,5% female, 49,4% male and 0,01% divers). In total, most of the participants were in the age group of 30-49, followed by 50-64 and 65+. Less than 5% were under the age of 16 years old. The age scope was selected to understand how the aging population views new mobility options. For employment status, 47,3% are employed, 30% are retired, 9% are students, and the remainder are either looking for a job, stay at home, or are self-employed. For living arrangement, 57,7% are tenants and 55,3% are living in apartment complexes.



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The survey revealed that 90% of the participants hold a driver's licence and 90,39% of the participants had at least one car in their household. On average, the participants had 1,4 cars per household. In all three surveyed travel purposes, the dominating two modes of transport were "privately-owned car" and "walking." Less than 5% of the participants have used a shared vehicle. The main reason for those who have not used a shared vehicle option yet was that there is not an available car-sharing option close by (50%) and that they have never seen car-sharing as a mobility option for themselves (49%). However, 44,9% of all participants indicated a high (28,2%) or even very high (16,7%) willingness to use a multi-optional mobility hub if one were located close to their home. The willingness to use a car-sharing option appears to correlate with salary and educational achievement. Participants with a monthly salary above 2.600€ have on average a 10% greater willingness to use a shared mobility option than other participant groups. The group with the highest willingness to use (54%) was those with a bachelor's diploma.

The stated willingness to use car-sharing is promising. We are planning an accompanying research project to assess and identify which people would actually use a shared mobility hub. As part of this research, one district will be set up with a multi-optional mobility hub and one will be selected with no mobility hub. The goal is to identify, how the stated usage and real usage differ and which elements are key to convince current non-users to become users. For more insights, please look for the full article which will be published soon.

M. Eng.
Franziska Weiser
Research Assistant

Faculties 1 & 3
ReLUT

ReLUT celebrates 5 years!

The Research Lab for Urban Transport (ReLUT) celebrated its fifth anniversary in May 2023. In just five years, ReLUT has established itself as one of the most important research-strong institutes at Frankfurt UAS, significantly shaping the subject area at the university and addressing the challenges of transport and logistics of urban space. Almost 9.6 million euros (as of May 2023) have been raised in 60 third-party-funded research projects. For example, projects were carried out on the last mile of commercial transport, passenger transport, and big data analyses. This is exactly what we celebrated with over 100 guests. The celebration was welcomed by our executive director, Petra Schäfer, and our president and founding member Kai-Oliver Schocke. Thomas Ranft shook the guests up a bit with his keynote before selected partners could introduce themselves in a Pecha Kucha-like format. With finger food, drinks, and music, the marketplace was a perfect venue for internal and external partners to get to know each other. We thank everyone for coming and look forward to continued progress in the next five years.

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