ReLUT - Research Lab for Urban Transport
NEWSLETTER 02/2022

RELUT
RESEARCH LAB FOR
URBAN TRANSPORT
FRANKFURT UAS

Welcome!

The Research Lab for Urban Transport 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.

After a very successful year in 2022, with some projects completed and many new ones initiated, we look forward to our fifth anniversary of research and progress in March 2023. We would be delighted if our many project partners and associates would join us on March 24 at the Frankfurt University of Applied Sciences to celebrate this milestone and our achievements.

Another highlight in 2023 will be the Urban Transport Conference which will take place on March 27 and 28. We would be pleased to receive numerous registrations for this event. A Call for Speakers is currently open and will remain open until January 31, 2023. For more information and to apply, visit https://utc-frankfurt.com/.

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 Schaefer   Kai-Oliver Schocke   Tobias Hagen

Wissen durch Praxis stärkt

PuR2Scale: Continuing park+ride research

The PuR2Scale project is a multi-dimensional forecast scaling of park+ride utilization without the need of structural changes to parking areas by the use of Floating Car Data and individual characteristic of P+R-Sides. It is a follow-up project of „R+R Aktuell" which began in December 2020 and ended at the end of November 2021.

Park+ride systems play an important role in the intermodal linking of motorized private and public transport. Park+ride systems lead to the reduction of traffic and environmental pollution, as well as increased use of public transportation systems. Furthermore, the volume of traffic in inner-city areas can be reduced through the use of park+ride systems, especially in the outskirts of the city.

An important factor for users when deciding to combine motorized individual transport and public transport is the probability of free parking space. If there is too much uncertainty about the occupancy, an intermodal use of public transport becomes less attractive and using a private motorized vehicle for the entire journey increases.
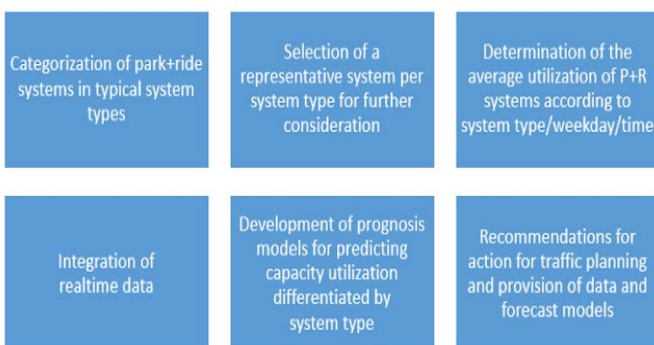
Unfortunately, currently recording and tracking parking space usage is only available for a few park+ride systems. Even forecasts are currently rarely possible. At present, a park+ride model type with a high forecast quality that can be transferred to different systems does not exist. A reliable and comprehensive forecast of available parking at various park+ride systems could enable a balanced utilization of the parking areas. Having more commuters use a park+ride system is a way to achieve relief in the areas of emissions, traffic volume, and travel time, and increase in travel comfort.
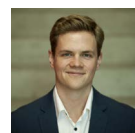
This research project, therefore, will enable a novel contribution to the use of floating car data and random surveys for forecasts at park+ride systems to increase the attractiveness of public transport. The main goal is to subdivide park+ride systems into typical system categories and to create a forecast model for each system type which can be transferred to all facilities of the same category. In this way, forecasts can be made without great effort and low economic costs.

The overall goals of the project, as outlined in Figure 1, are defined as SMART goals (Specific, Measureable, Achievable, Reasonable, Time-bound) within the framework of the project. They are monitored through continuous project management and pro-active risk management.
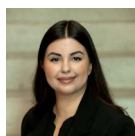
The research project „PuR2Scale" is a collaboration with the partners of [ui!] Urban Mobility Innovations (B2M Software GmbH) and the Society for Integrated Traffic and Mobility Management (Gesellschaft für Integriertes Verkehrs- und Mobilitätsmanagement (Gesellschaft für Integriertes Verkehrs- und Mobilitätsmanagement – ivm GmbH) while ReLUT owned the role as a scientific partner. The project will run from September 2022 until August 2025.

| Categorization of park+ride systems in typical system types | Selection of a representative system per system type for further consideration | Determination of the average utilization of P+R systems according to system type/weekday/time |
| Integration of realtime data | Development of prognosis models for predicting capacity utilization differentiated by system type | Recommendations for action for traffic planning and provision of data and forecast models |

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Jonas Hamann
Research Assistant

M. Eng.
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Research Assistant

Faculties 1 & 3
ReLUT

Making urban intersections safer for all modes of transportation

In the past decades, intersections were primarily developed with the goal of a car-oriented city and motor vehicle traffic. With an increase in pedestrian and bike traffic in recent years, it is now essential to reevaluate the safety of intersections for all forms of transportation. Especially in urban areas which are characterized by a high volume of private vehicles and traffic congestion as well as high CO2 emissions, the importance of and demand for sustainable mobility is resulting in an increase in pedestrian and bicycle traffic. The needs of vulnerable road users are often not sufficiently considered at many intersections which results in accidents and near misses. Our new project titled „RisiSens", which has been running since summer 2022, aims to investigate the type and quantity of frequently-occurring accidents between pedestrian, bicycle, and motor vehicle traffic at individual types of intersections, such as four-arm signalized intersections or traffic circles.

The aim of the project is to develop a survey concept that can be used in the future to quickly identify risks to pedestrian and bicycle traffic at the various types of intersections studied. For this purpose, a survey method is being developed that can be used to record traffic conflicts. The emerging concept is being tested in Frankfurt, Germany. With the help of traffic observations from cameras and live surveyors, we plan to record and categorize traffic behavior that causes near misses. In a workshop planned for early 2023, we will discuss with municipalities and traffic planners how they have assessed the current traffic safety of intersections and what requirements they have for the survey concept so that it can later be used in practice. After we have finalized the survey concept, we will observe traffic conflicts between pedestrian, bicycle and motor vehicle traffic at six intersections in Stuttgart in spring 2023. After the survey results have been evaluated, the traffic conflicts will be analyzed.

For the analysis of near misses, further insights into the frequency and types of conflicts will be analyzed with

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the help of automobile sensor data, e.g., from emergency braking assistance systems. In addition, a methodology that will enable traffic planners and municipalities to carry out risk management for intersections in the future will be developed. With the results of the conflict analysis, which includes a root cause analysis, recommendations for traffic planning and policy will be derived and made available in the form of a guideline for action. This will assist in improving traffic safety and promoting local mobility.

M. Eng.
Elisabeth Lerch
Research Assistant

5 Years of ReLUT!

Save the Date!
March 24th, 2023

The Research Lab for Urban Transport (Re-LUT) celebrates 5 years of progress in 2023!

To mark this occasion, on May 24 at 15:00 at Frankfurt UAS we are hosting a reception. All institutions who have worked with us in the past 5 years are warmly invited to celebrate this milestone with us.

Please join us and RSVP here.

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Wissen durch Praxis stärkt

DroLEx: Rural local supply with drone and cargo bike

In the „DroLEx" project funded by the Federal Ministry of Digital Affairs and Transport (BMDV), the overarching goal is to realise fast and reliable delivery of demand-driven goods in rural areas through a combination of drone and cargo bike transport and to evaluate it from a social, economic, and ecological perspective.

Drones from the project partner Wingcopter are used to transport products from a central mobile delivery point in a medium-sized centre to surrounding villages over a distance of up to 55 km. In the destination region, the goods are picked up by project staff and delivered to the end customers by cargo bike. Alternatively, customers can also pick up the goods at the landing site.
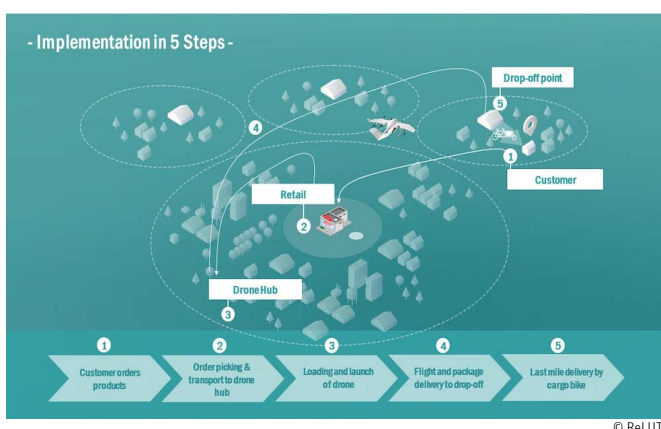
Initially, products from local retailers are delivered. The maximum load per flight is 5 kg. The project will be implemented as a concrete use case under real conditions in the public environment. The use of drones for transporting consumer goods will be tested and the multimodal networking of drones with other means of transport, such as the cargo bike, for last-mile delivery will be investigated. The Research Lab for Urban Transport (ReLUT) at the Frankfurt University of Applied Sciences is providing scientific support.

Combined transport enables fast and reliable delivery under environmentally friendly conditions. By implementing the project, the logistical connection of rural areas can be improved. The use of a drone to deliver to rural areas in combination with last-mile delivery by cargo bike enables retailers to offer their customers a delivery service even in sparsely populated areas. Fast delivery by drone can significantly expand the catchment area of potential customers. Likewise, the bundling of different providers in a mobile shop can bring further economic advantages compared to autonomous shops or delivery services of each trader on his or her own responsibility. The principle of demand-driven delivery also ensures high transport efficiency. The location flexibility of the transhipment point ensures the possibility of reacting optimally to developments in demand. Involving the population in the pilot district can also strengthen public acceptance of drones and initiate a social dialogue.

The project creates a basis for the scalability and transferability of the business model to other areas of application. Through the evaluation of the use case, an implementation in a permanently operated business model is economically calculable, as well as potentially resulting in ecological advantages. The application is neither limited to a specific region nor to a specific industry, which opens up a broad field of new possibilities.

The added social value consists primarily in the improvement of the standard of living in rural areas through an improved local supply in the form of a delivery service that is accessible to all population groups. This can increase the attractiveness of rural areas compared to the city. In particular, people with limited mobility are offered an attractive supply service that enables them to have everyday goods delivered to their door. Time-critical goods, such as non-prescription medications, can also be

- Implementation in 5 Steps -

1	2	3	4	5
Customer orders products	Order picking & transport to drone hub	Loading and launch of drone	Flight and package delivery to drop-off	Last mile delivery by cargo bike

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reliably delivered to rural areas with the help of drones. In addition, private car use can also be reduced. This effect can be further strengthened by a future expansion of the offer, as soon as several retailers offer their products centrally via the drone delivery service. In this way, a reduction in emissions can also be achieved, because especially in rural areas, longer distances are often covered when doing smaller purchases. In addition, delivery by cargo bike is completely emission-free over the last mile.

Data protection, noise, and the protection of people's privacy are key issues that have already been partially regulated in the course of the new EU drone regulation. However, full clarification is all the more urgent due to the expected socio-economic benefits of a combined drone and cargo bike delivery service in rural areas.

M. Sc.
Steffen Henniger
Research

Urban Transport Conference 2023

March 27th - 28th

House of Logistics and Mobility

Bessie-Coleman-Straße 7, 60549 Frankfurt/Main, Germany

Call for Speakers:
2023 Urban Transport Conference

The Urban Transport Conference (UTC) is a key event jointly organized every year by the Research Lab for Urban Transport and the House of Logistics and Mobility GmbH. In 2023, the UTC will take place from March 27th - 28th (from lunch to lunch) in Frankfurt/Main, Germany.

The theme of this year's conference is: *Shaping the future of urban mobility and logistics in times of high energy prices.* The conference attracts national and international speakers & participants from many different sectors: research, private companies, public administration, and politics. Up to 200 participants are expected.

A **Call for Speakers** is open from now until January 31, 2023. After the selection by the scientific committee, applicants will get final feedback by 15th February 2023. All interested presenters should send an application as a PDF by e-mail to orga@utc-frankfurt.com. With your application, please include the topic of the presentation, the content of the presentation (min. 2,000 characters, max. 4,000 characters incl. spaces), the benefit for the audience (max. 500 characters incl. spaces), and details about the speaker (full name, professional position, institution, e-mail, phone). For more details, please visit www.utc-frankfurt.com.

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Wissen durch Praxis stärkt

ClusterMobil: Understanding Trip Purposes

Understanding trip purposes is a key component in traffic planning. Nowadays, traffic planning is mostly based on surveys or simulations, which are both costly and time inefficient. Within our project "ClusterMobil," we want to understand trip purposes and the spatio-temporal differences of trips. The goal is to answer questions like 'When, with what purpose, and to what extent do "groups" of motorized vehicles travel in specific areas of cities.' In order to reveal trip purposes two things are mandatory: a detailed analysation of what the destination is and additional data for GPS trajectories.

To get analyzation, a data-driven city segmentation is used. The destination area is tessellated into different tiles e.g. hexagons. These tiles are then enriched with additional data, like number and types of Points of Interest. This is done using a python package called TessPy. The tiles are clustered and interpreted and then made fully automated. Therefore, a combination of statistical metrics and SHAP values are used. As a result, one ends up with a data-driven city segmentation with interpretable clusters. These clusters represent typical residential areas, shopping zones, or central business districts. (See Figure 1.)

Secondly, additional data to the GPS trajectories is added. Trajectories can be enriched with data that can be calculated directly from the GPS data, such as mean speed or travel distance. These kinds of data are called segmented features. Besides segmented features, additional data that helps understanding the trip purpose can be added. Trajectories enriched with such data are called semantic trajectories. Within this project, we use data such as the number and types of roads, weather data at the start time, and an urbanity index. The urbanity index indicates whether a trip is more urban, i.e. has many curves, or suburban, which means that a trip is straighter. Lastly, the detailed information for the destination area, for example the area type where the journey ends, is added.

To reveal trip purposes, a clustering algorithm that divides all the enriched trajectories into different groups is used. These groups can be interpreted as import/export traffic, commuters who live and work in a particular city, commuters who work in a particular city, and live somewhere else or passing through traffic (See Figure 2).
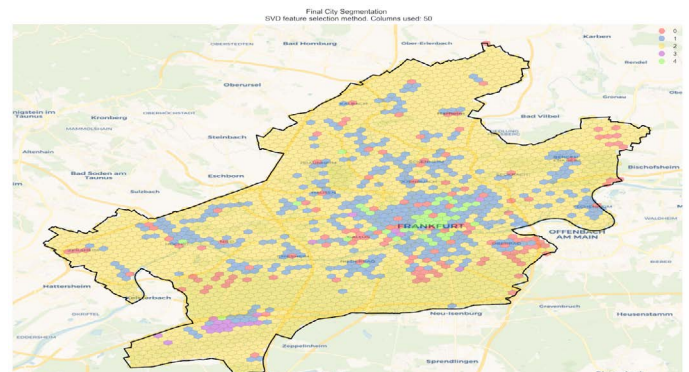

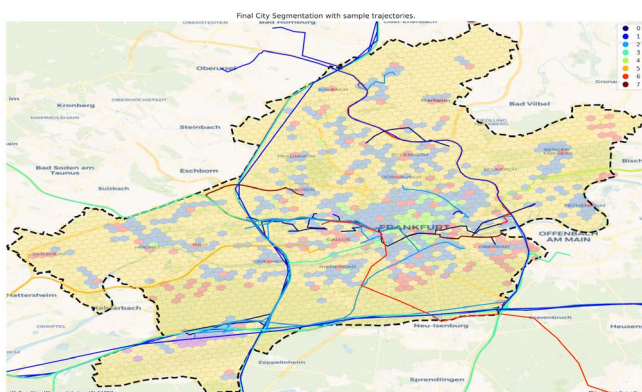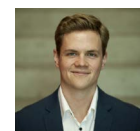Figure 2: Excerpt from clustered trajectories.
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Figure 1: Data-driven city segmentation.
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Wissen durch Praxis stärkt

Digital interface platform to push climate-friendly mobility concepts in freight transport

Delivery with cargo bikes is being piloted in many large cities, especially in the area of courier, express, and parcel service providers, as a climate-neutral and sustainable mobility concept. Micro hubs are often used to implement cargo bike delivery in urban areas. However, there are challenges when planning and implementing micro hubs. One of the challenges is communication difficulties between various stakeholders. Both sides, municipalities and companies, describe a gap in the creation of suitable contacts that can only be solved by a „neutral contact initiator." This gap requires a practical solution that enables potential partners to be identified. This is exactly where this research project comes in. The DiMoG research project investigates the feasibility of a communication platform between Hessian municipalities and private companies to facilitate the implementation of micro depot and cycle logistics concepts.

Different methods have been used to collect information for the digital platform so far. Good practice examples and practice partners for ongoing micro hub concepts are included in the research. Logistics associations were included in the surveys and various municipalities and companies who already experienced micro hub projects were interviewed. We are looking to answer how to get the basic knowledge for the platform and what features and tools the platform needs to be attractively designed.

So far, municipalities and companies are fundamentally interested in a communication platform. The decisive factor will be the features and possibilities that the digital platform will offer. A preliminary example of what the platform might look like can be seen in Figure 1. Available areas for the

Figure 1: Example of platform surface showing availability for micro hubs.
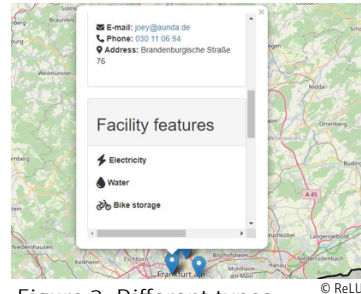© ReLUT

Figure 2: Different types of features, that can be used to describe a facility.
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use of micro hubs can be easily shown. Based on this, important features and selection options are then displayed (see Figure 2). Here, relevant local and private information is considered. Additional examples could be potential areas for micro-depots, location descriptions and pictures, logistical parameters, and infrastructural aspects. Another key point is keeping the database which is used on the platform up-to-date, maintained, clear and uniform. Keeping the data updated plays a major role here, especially when considering who will take on this important task.

All in all, an easy-to-use and interface-free digital surface is important. The usefulness of the platform can only increase if all participants have access to the features and data and if the access is uncomplicated and free of cost. In the best case, all German municipalities and companies would be represented nationwide.

The platform will not only be helpful for establishing contacts and communication, it will also contain various informative aspects relating to micro hubs. A guideline for the planning and implementation of a micro hub should be included. The entire process can be mapped from planning, finding space and the right contact information, all the way through to the conclusion of the contract, implementation, and maintenance of the micro hub. An additional benefit is that the various good practices of micro hubs in Germany can serve as an example of proper use of micro hubs in general.

M. Sc.
Lukas Fassnacht
Research Assistant
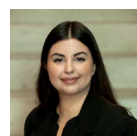
M. Eng.
Seray Künbet
Research Assistant

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eCARe – Interim Report

Currently, the majority of passenger vehicles are still manufactured with combustion engines. Accordingly, logistics chains and distribution processes are still designed for this type of engine. Nevertheless, registrations of e-vehicles are increasing at an ever-faster pace, especially in recent years. From 2015 to 2021 alone, the share of new registrations of e-vehicles increased from 0.4% to 22%.

eCARe is investigating this transition in the automotive market from combustion engines to electric engines. The aim of the project is to redefine the processes in distribution and fleet operators of e-vehicles. In this project, we analyzed vehicle statistics from the Federal Motor Transport Authority with figures from logistics service providers and their processes, as well as various developments in electromobility in Germany.

This diverse data was then used to develop a scenario model that estimates the various developments in electromobility. The model was used to develop a simulation tool with which automotive logistics service providers can use in combination with their fleet size and the various scenarios to estimate how many charging processes and how much electricity consumption will be necessary for certain proportions of electric vehicles in a given scenario. At the same time, a charging infrastructure was set up at the plant of the participating partner, Frankenbach, in order to test the new processes being created.

Overall, a good, basic overview of electrification in Germany in the coming years and the volumes of passenger cars to be charged by automotive logistics service providers can be obtained from the project as well as the accompanying data base and the scenarios. When the recording and processing of data on alternative drives, in this case BEVs and PHEVs, is continued, an even more precise overview of the future course of e-mobility can be obtained.

Processes of automotive service providers are not currently adapted to e-mobility and need restructuring.

This primarily concerns the size and equipment of parking areas, processes from vehicle entry to exit, and employee-specific responsibilities and competencies. In particular, checking charge status or the plugging in and unplugging of e-cars are new processes that must be gradually incorporated into current workflows.
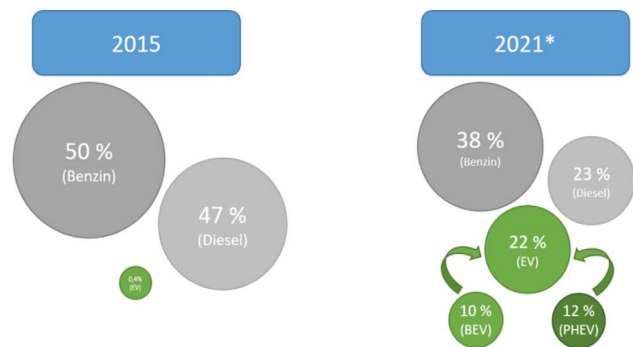
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If the developed charging concepts and processes are considered, it can be generally stated that each logistics service provider must find out the best suited process for itself. Each logistics site has its own specifications which must be responded to accordingly. Thus, it is not possible to specify a standard process solution for the charging infrastructure. This also applies to the deployment of employees on site. However, if the knowledge gained is combined with the individual requirements and adapted to them, the construction of an ideal charging infrastructure for the site can be realized.

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Lukas Fassnacht
Research Assistant

Wissen durch Praxis stärkt

start2park-App - Cruising for Parking

Gefördert durch:

You are probably familiar with this situation: You are on the road with your car and when you arrive at your destination, you first have to look for a parking space. Sometimes it takes no time, but sometimes it takes some searching to find a suitable parking space. Your navigation system does not indicate the time you will need to spend looking for a parking space. If you had known how much time you would have to spend looking for a parking space, you might have used a different mode of transportation. In the research project start2park, we analyze parking search traffic and will be able to predict expected parking search times. This could be added to the expected travel time in navigation systems. To do this, however, we need data on many different parking search processes. This is where you come in! Please help use by using the start2park-app! You can support us in our research if you record and share your parking search traffic via the start2park app. When you use the start2park app, you are helping researchers in the field of sustainable mobility. On the other hand, you also learn a lot about your own parking behavior. If you use the app frequently, you can also expect small gifts. The start2park-app is available

Dennis Knese joins the National Advisory Council for Cycling

Prof. Dr.-Ing. Dennis Knese was appointed by the Federal Transport Minister, Volker Wissing, to the new Advisory Council for Cycling. Together with 19 other cycling experts from politics, administration, science, and associations, he will advise the German Federal Ministry of Transport and Digital Infrastructure in the next few years on the implementation of the National Cycling Plan 3.0. Press information about this appointment can be found here.

Dennis Knese receives the certificate of Transport Minister Volker Wissing (Source: BMDV)

Conference on Sustainable Urban Mobility

Dennis Knese and Lukas Fassnacht represented the ReLUT at the Conference on Sustainable Urban Mobility (CSUM) in Skiathos, Greece. For the 6th time, the conference brought together mobility experts from around the globe to discuss the current challenges and promising solutions in the transport sector. The session on cargo bikes for sustainable mobility and logistics was moderated by Dennis Knese together with Dr. Tom Assmann from the University of Magdeburg. Within this session, Dennis and Lukas presented their new paper which deals with the diversification of the bicycle market and its consequences for urban infrastructure. It will be published soon via the Springer Verlag.

More information about the conference can be found here.

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Wissen durch Praxis stärkt

ReLUT attends EUROBIKE Show 2022 with a big team and several presentations

Between July 13-17, 2022, the EUROBIKE Show took place for the first time in Frankfurt. The bicycle industry presented its innovations and the ReLUT was represented at the stands of the State of Hesse and the German Federal Ministry of Transport and Digital Infrastructure. The team offered education on cycling professorships and presented the diverse research projects around the topic of cycling. In addition, the ReLUT was represented by Prof. Dr.-Ing. Dennis Knese and Prof. Dr. Kai-Oliver Schocke in various panel discussions on the future of sustainable mobility, last mile delivery solutions, and corporate mobility management. Also, Lola Freyer, Dana Stolte, Nicole Reinfeld, Elisabeth Lerch and Lukas Fassnacht presented their research and PhD projects at the Young Researchers Forum. Next year, the EUROBIKE Show will take place in combination with the National Cycling Congress in Frankfurt from June 20–25, 2023. For more information about the Eurobike Show click here.

Participants for the Eurobike Young Researchers Forum (Source: Uni Kassel)

Dennis Knese at the introduction panel of the Eurobike Convention (Quelle: B.)

ReLUT at the European Transport Conference 2022

September 2022   Milan, Italy

Prof. Dr. Tobias Hagen was chair of a session on „Open Data Analysis" in which Jonas Hamann presented his research on „Discretization of urban areas using POI-based tessellations."

In addition, Nicole Reinfeld presented a paper titled „Modeling of parking violations using zero-inflated negative binomial regression - a case study for Berlin," and Siavash Saki presented a paper on „Analyzing the determinants of cruising for parking: when does the parking search begin?"

The European Transport Conference (ETC) is the annual conference of the Association for European Transport attended by transport policy makers, practitioners and researchers from across Europe and beyond.

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