

BASt topics

Information from the Federal Highway Research Institute

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New BASt President

Univ. Prof. Dr.-Ing. habil. Markus Oeser is the new president of the Federal Highway Research Institute. Starting his work in November 2021, he succeeded the previous president Stefan Strick, who died unexpectedly in February 2021.

Markus Oeser has a long-standing research cooperation with the BASt. He was already involved in BASt projects as a research assistant at the TU Dresden, and his appointment as professor at the RWTH Aachen University enabled him to deepen this cooperation.

Prof. Dr. Markus Oeser (born 1974) studied civil engineering with a focus on structural engineering at the Technical University of Dresden.

After his doctorate (2004) and habilitation (2010), he was appointed to the RWTH in 2011, where he headed the Chair of Road Engineering and was appointed as Director of the Institute of Road Engineering, followed by his appointment as Dean of the Faculty of Civil Engineering in 2016.



Photo: Daniel Carreño, hat&cap

Interview with Prof. Dr. Oeser

Professor Oeser – what do you appreciate about your job?

It is the combination of science and science management that I enjoy very much. In my work as chairman of the Faculty Council for Civil Engineering, Geodesy and Environmental Engineering (FTBGU), I worked very closely with associations, industry and politics. This task is both challenging and interesting at the same time.

What connects you with the BASt?

I have a long-standing research cooperation with BASt. I was already involved in BASt projects when I was a research assistant at the TU Dresden. Since my appointment to RWTH Aachen in 2011, I have been able to intensify this cooperation.

What appeals to you about the position of BASt President?

The BASt "... has the task of promoting the development of road engineering and, for this purpose, to provide the Ministry with scientifically sound decision-making aids for upcoming transport policy and technical issues in the field of road engineering". This is what the website says. It makes BASt a link between research, development and politics. However, BASt also fulfils other functions. It promotes innovations in the road sector, supports the transfer of technology between research and industry, is active in setting regulations and, together with its partners, develops solutions for important social issues such as the mobility of the future. It is very exciting for me to lead such an organisation.

What will be the first thing you will do as president?

The first thing will be to get a good grasp of BASt's processes and to learn to know the employees at the various levels. The aim is to create a solid basis of trust. After that, the technical work will start.

What would you like to achieve as BASt President?

I would like to work out solution options for sustainable mobility of the future in the team which politicians can take up and implement. For me, "sustainable" means practicable, economically sensible, ecologically compatible and socially balanced. I am thinking here in the direction of a "blue engineering" concept for the road sector.

Young Researcher Seminar

The young researcher seminar (YRS) is a biennial event that is intended to bring together young scientists from a broad transport research community and to give them the opportunity to improve scientific writing and oral presentation skills. Besides qualified exchange and discussions, main emphasis of the seminar is given to extend professional networking.

This year's YRS was held on September 15-17 in Portoroz, Slovenia and was hosted by the Faculty of Maritime Studies and Transport of the University of Ljubljana. The participants of the three-day seminar mainly belong to institutions of the 3 transport associations FEHRL, ECTRI and FERSI, as well as from transport research organisations from the USA. The young scientists are preferably graduates or PhD students, however, postdoctorals with a few years of working experience are likewise allowed to attend. The mentoring is done by senior researchers, who themselves act in transport related working fields.

The seminar addresses several transport related research domains with a special focus on current transport challenges such as, among others, digitization & connectivity, autonomous & unmanned transport systems, sustainability and environment and different infra-



From left: Mehdi Kalantari, Conrad Piasecki, Anne-Farina Lohrengel, Mahdi Rahimi Nahoujy and Leon Straßgütli

structure and engineering concerning topics. A total of 38 papers were submitted and presented by authors coming from 16 countries and 17 institutions – these were supervised by 19 tutors. Due to the pandemic situation, this year's seminar took place as a hybrid event allowing participants to attend physically or via remote screen.

6 authors and one tutor (Conrad Piasecki) from BAST participated in the seminar. For his contribution

“Effectiveness of Advanced Emergency Braking Systems in trucks: an Analysis of rear-end Collisions on Motorways in Germany”, Leon Straßgütli was awarded with the 2nd prize for special achievements in his paper and an outstanding presentation performance.

The articles on pages 2 to 5 make it possible get to know the contributions of BAST's young scientists.

Conrad Piasecki

Effectiveness of Advanced Emergency Braking Systems in trucks

Advanced emergency braking systems (AEBS) are designed to help prevent or mitigate rear-end collisions. With EU-Regulation No. 347/2012, these systems became mandatory for heavy good vehicles and buses. The Regulation came into effect in two approval levels each first for new types of vehicles and 2 years later for new vehicles.

The study analysed the effect associated with the Regulation on the crash level in Germany. This was

examined for the first approval level for new vehicles which came into effect in November 2015. 2 research questions were addressed: How did the number of rear-end collisions of heavy good vehicles and buses develop after the Regulation was implemented? Did the severity of rear-end crashes change after the Regulation became effective?

The analysis used individual police records and additional technical vehicle information by the German

Federal Motor Transport Authority (KBA). At first, relevant vehicles and crashes were identified in the data. Subsequently, treatment and control groups were defined that were compared before and after the Regulation came into effect. The analysis was limited to crashes on motorways because crash situations on motorways are less complex. Due to missing technical vehicle information on foreign vehicles, the analysis was further limited to vehicles registered in Germany.

In the analysis, the number of crashes of vehicles that had to be equipped with AEBS was compared to the number of crashes of those vehicles not affected by the Regulation. Heavy good vehicles and buses for which AEBS was mandatory were significantly less involved in rear-end crashes than vehicles to which the Regulation did not apply. The overall effect of the measure was estimated as -37 percent. Additionally, the results suggest that the severity of crashes declined disproportionately for vehicles affected by the Regulation.



Leon Straßgütel

Photo: Frank Roeder/Westend61/Getty Images

The climate impact on German's transport system

Climate change and the associated increase in extreme weather events confront the road infrastructure with various challenges. Natural hazards such as storms, floods, gravitational mass movements and heat periods can cause damage to infrastructure and result in traffic restrictions and at worst, accidents can occur.

The Federal Highway Research Institute is dealing with the effects of climate change on the road transport infrastructure since 2011. The aim of the so-called AdSVIS research program was to identify relevant effects of climate change, to assess the vulnerability of individual objects of road transport infrastructure and to develop adaptation measures. In 2016 the Federal Ministry of Transport and Digital Infrastructure formed the BMVI Network of Experts bringing together expertise of 7 departmental research facilities and executive agencies.

The goal of topic 1 in this network is to develop the basics for increasing the resilience of the federal transport system to climate change and extreme weather events. Based on the analysis of climate impacts, adaptation measures are developed and assessed to minimize the negative impacts of climate change on the transport system.

In an effort to create a common structure and to generate comparable results on the effects of climate change on the different modes of the transport road, railway and waterway, a methodological framework was developed which is divided into 3 sub-steps.

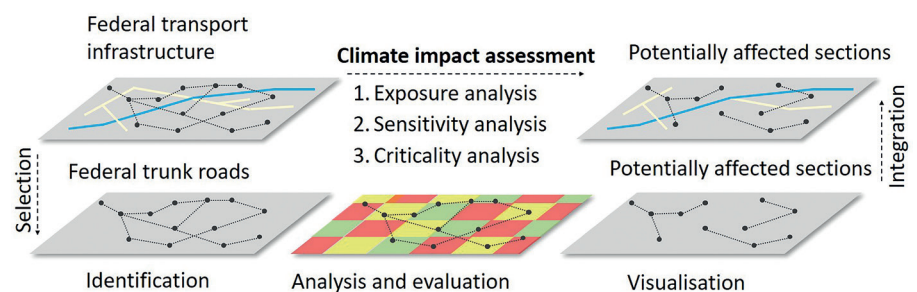
During 1) the exposure analysis, areas of the federal trunk road network are localized which could potentially be exposed to the mentioned natural hazards. Subsequently, in 2) the sensitivity analysis, those sections of the network are identified which are particularly sensitive to the natural hazards due to their properties or equipment. Finally, 3) the criticality analysis helps to assess the relevance of the affected trunk road

sections based on traffic, economic and ecological factors.

Anne-Farina Lohrengel, Lennart Meine

* Hänsel, S., Herrmann, C., Jochumsen, K., Klose, M., Nilson, E., Norpoth, M., Patzwahl, R., & Seiffert, R. (2020). Verkehr und Infrastruktur an Klimawandel und extreme Wetterereignisse anpassen: Ergebnisbericht des Themenfeldes 1 im BMVI-Expertenetzwerk für die Forschungsphase 2016 – 2019. Berlin: Bundesministerium für Verkehr und digitale Infrastruktur (BMVI)

Methodological framework



Source: adapted from Hänsel et al., 2020*

Dynamic measurement systems – use of fast driving measuring vehicles for the network-wide recording of night visibility of road markings in dry conditions

Because of their guiding function, road markings make a significant contribution to traffic safety. To guarantee their function, requirements like skid resistance and day and night visibility have been defined in European standard (EN 1436) and in further national regulations. Especially considering the fact that road markings are worn products, it can be seen that regular network-wide condition monitoring is required – also in connection with Connected and Automated Driving (CAD). The use of dynamic measuring devices to detect the condition of road markings offers significant potential in terms of road safety. Furthermore, measurement data from dynamic measurement systems can contribute to the systematic maintenance management and cost savings.



The research project shows that measurement systems with a diverse range of technology are available on the market which are specially used to measure the night visibility of road markings. It was shown

that the prerequisite for developing potential is that, on the one hand, the night visibility of road markings can be reliably recorded by verified measuring devices, and on the other hand, the measurement data as a basis of road marking condition assessment can be correctly located and uniformly processed.

On the basis of the knowledge acquired in the practical investigations, recommendations for the use of dynamic measuring devices are to be developed in the further process of research, which, in addition to defined

requirements for the recording, such as the length of aggregated individual value measurements (measurement blocks), also contain information about suitable measurement periods and measurement intervals. A desirable goal for the future is also the dynamic detection of other traffic-related properties of road markings, such as skid resistance, for which there are no adequate technical solutions yet.

Christian Mathea

Characteristics / properties		
Mounting position	On side of measuring vehicle	Frontal on measuring vehicle
Maximum speed	150 km/h	120 km/h
Distance measuring field/vehicle	6 m	12 m
Dimensions measurement field	1 m x 0,5 m (l x w)	3 m x 5 m (l x w)
Illumination	Halogen lamp	(green) LED
Sensor technology	16 photodiodes	2 cameras with narrow-band filters

Examples for different dynamic measurement systems

The approach of k-means clustering as a tool to analyze the multifunctional assessment tool for the structural evaluation and the design of pavements (MESAS) data

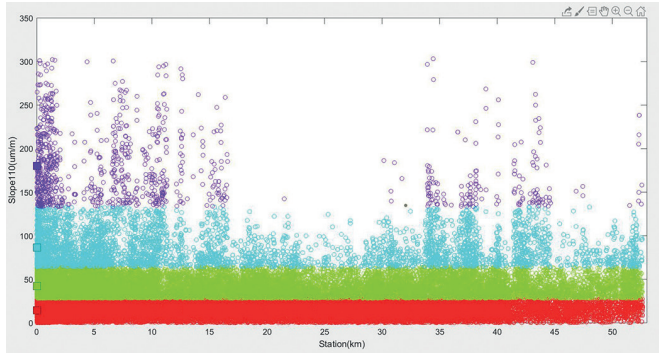


Since 2018, the German Federal Highway Research Institute has been using a Multifunctional assessment tool for the structural evaluation and

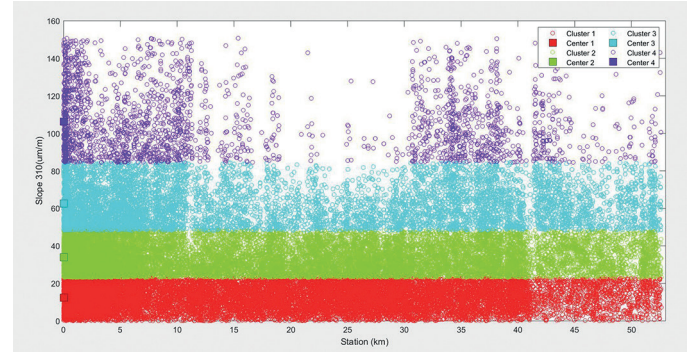
the design of pavements (MESAS) to assess the structural condition of asphalt pavements on network level. MESAS can measure 1,500 km per week with a measuring point each 10 m, where more than 60 values such as bearing capacity, layer thickness, surface picture etc. are collected. This amounts to approximately one terabyte of raw data per week and can thus be called "Big Data". This results in the following problem: The data has to be evaluated and quality controlled, but there is no established methodology yet for the analysis, especially for these huge amounts of data.

The objective of this study is to develop a new methodological approach for the analysis of the big data collected by MESAS and thus, to generate knowledge from it. Data mining is a set of methods applicable to large and complex databases to discover hidden and noticeable (obvious) patterns in the data that were previously unknown.

In this study, K-means clustering is used to model the slope data collected by a Traffic Speed Deflectometer (TSD), which is a basic function of MESAS. This method



Cluster diagram for slope 110 values



Cluster diagram for slope 310 values

is one of the popular machine learning methods, where there is no label (index) for the dataset given. With the help of clustering, the data can be divided into different

categories, for example “Excellent”, “Good”, “Sufficient” and “Failure” or according to other indicators relevant in the assessment of the structural condition of pavements, providing

a basis for further analysis and data usage.

Mahdi Rahimi Nahoujy

Assessing the performance of a cold recycled pavement with foamed bitumen under accelerated pavement testing (APT) with mobile load simulator (MLS30)

In recent years by increasing the demand on more sustainability, different solutions have been defined and applied for pavements. Among different methods, cold recycling has the potential of using higher rates of recycled material with lower production temperature.

During the last decade, different researches were performed on this technology in Germany. Positive international experiences reported on bitumen stabilized materials (BSM), especially with foamed bitumen, gained interest in Germany in recent years. In 2018 a research project on topic cold recycling with foamed

bitumen was defined in BAST in cooperation with the Wirtgen GmbH. The main goal of the project was to gather more information on the behavior of cold recycled material with foamed bitumen by monitoring its response and performance under accelerated loading. A 100-meter test section was built at duraBAST with 2 pavement types: one conventional (as reference) with hot mixes as the wearing and base layers and one with the same wearing coarse but a cold recycled base layer. They were constructed in September 2019 and loaded from February 2020 with the mobile load simulator MLS30. The paper for JRS 2021 aimed to present

this project, its different phases from planning to execution, monitoring, analysis methods and a part of the results.

Based on the monitoring results, the cold recycled pavement satisfied the design life and showed that it is possible to design and construct pavements types with cold recycled base layers and have the same or even better performance and durability than the conventional pavements with HMA (hot mix asphalt).

Mehdi Kalantari



Reports from other research areas

SOPRANOISE – in-situ inspection procedure for airborne sound insulation properties of existing noise barriers

SOPRANOISE is a European research funded by the CEDR (Conference of European Directors of Roads) about simplified methods to characterize the acoustic performance of noise barriers. As part of the consortium, BAST was responsible for the development of an in-situ inspection procedure, which exploits the possibilities of visual examinations to obtain first indications about the effect of degradations on the sound insulation of existing noise barriers.

The results have successfully been presented on the EURONOISE 2021 congress, which took place from 25th to 27th of October as an e-congress. EURONOISE is organized every 3 years on behalf of the European Acoustical Association (EAA) and covers a broad spectrum of acoustic topics, ranging from technical acoustics, room acoustics and bioacoustics to all facets of noise and noise protection. In more than 50

general and structured sessions, the most recent scientific findings of the field were presented and discussed among highly acknowledged international experts.

In the frame of the SOPRANOISE project, BAST established a simplified theoretical framework and designed an acoustic inspection protocol, which allows a quick assessment of possible effects of leaks on the airborne sound insulation of noise barriers. The protocol yields a quick and direct estimation of the consequences of detected leaks. Depending on the properties and position of the leak, a critical radius of influence is calculated and an acoustic rating is indicated. From this quick assessment it is possible to evaluate the

need for further testing, either by using a quick measurement method (being also developed within SOPRANOISE) or by carrying out measurements according to the standards EN 1793-5 and -6. With the acoustic inspection protocol, a first important step is made to facilitate the follow-up monitoring and maintenance of noise barriers in the future. More detailed information and all progress reports can be found on the project website:

www.enbf.org/sopranoise

Fabio Strigari



BAST contributes research results at Euroasphalt & Eurobitume Congress 2021



The E&E Congress 2021 was dedicated to the overall theme „Asphalt 4.0 for future mobility“. New research results and new developments play an important role to ensure that asphalt roads will be ready to meet the challenges of future mobility. The E&E Congress 2021 provided a platform to demonstrate and learn from innovations and new technologies that have been developed over recent years. It offered a unique opportunity for all stakeholders to engage, to exchange ideas and to stimulate discussions in order to encourage positive actions in future.

2 BAST researchers presented their projects at this congress. Franz Bommert presented the project „Performance of asphalt determined by the tensile creep test on binder and asphalt mortar“. His speech presented the tensile retardation test, a modern variant of a creep test. Both binders and asphalt mortar can be addressed with the tensile retardation test. The effects of binder modifications and also the stiffening effect of fillers were demonstrated. From the mortar properties, conclusions were drawn about the competing properties resistance against cracking and resistance against deformation of the asphalt mixture. This project was initiated and funded by BAST itself.

Gudrun Golkowski informed the participants of the conference about the ongoing research project on „Tempered road test sections on duraBAST“. In comparison to the standard temperation systems by pipe registers, an innovative system of porous bound interlayers will be tested at duraBAST. The tempering of the pavement with the innovative system is controlled by the flow-through of the interlayer itself. The functionality and efficiency of the different tempering systems will be evaluated. The BAST-funded project is executed by a research consortium of Durth Roos Consult, Eurovia GmbH and ISAC GmbH.

Franz Bommert, Gudrun Golkowski



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www.bast.de

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