BASt special

Information from the Federal Highway Research Institute Edition duraBASt

duraBASt

Demonstration, testing and reference area of the Federal Highway Research Institute

Interview with BASt President Stefan Strick

Are you satisfied that the planning and construction time of the duraBASt is over now?

For a scientific research facility, the planning and construction of this area was a completely new challenge with unique requirements. Without our colleagues from the Landesbetrieb Straßenbau and the support from the BMVI Department of Road Construction, we could hardly have mastered these tasks.

Unfortunately, the process took longer than planned, but we were already able to launch four national or European research projects during the construction phase. From October 2017, we will finally tackle the long list of projects that are waiting for us with full force.

Why is the duraBASt so important for BASt?

The duraBASt is a flagship in European road construction research. In order not to rely solely on laboratory tests, research under virtually real conditions is indispensable. This is the only way to fulfill our task of developing road construction and road building materials which meet the expectations of the users and withstand the challenges of the future.

What is the value of the duraBASt for the "Road in the 21st Century"?

The framework research program of BMVI and BASt for a viable road can only be implemented if both science and industry have the opportunity to test innovative ideas. This prerequisite is created by the duraBASt. Furthermore, there is the opportunity to calibrate and evaluate measuring systems on reference road segments.

Which development perspectives do you see for the duraBASt?

Within the framework of a mobility strategy for the future, the road of the future can adopt the role of an innovation motor. The new demonstration, investigation and reference areas at duraBASt offer research and industry the potential to meet this demand even under changing conditions (www.bast.de).

Road research on a new scale

An experimental facility, such as the duraBASt, is an important investment for the Federal Highway Research Institute and a significant commitment to the future of road construction research. The essential questions, which must be answered as soon as possible, require instruments which can be used to provide timely and practical results and progress. The duraBASt is thus a very important component, which will provide us with important contributions in the development process of new products. Every new building material composition, every construction type and almost every other innovation that we want to contribute to road construction is based on theoretical considerations, which we then verify by means of series of tests in the laboratory whether the hypotheses drawn up could be confirmed in practice. The duraBASt gives us the possibility to implement large-scale developments that are positively evaluated in the laboratory, using the machines and processes required in the construction of roads, without having to interfere with traffic. Thus, we are able to integrate sensors into the structures and to carry out measurements at virtually every point of the examination.

We therefore expect a simplification and a shortening of the necessary process for the introduction of innovations in road construction.

Professor Dr Ulf Zander
Head of the department
"Highway Construction Technology"

Construction of the duraBASt

The long pursued wish of BASt to create new and extensive test grounds assumed concrete form during the course of 2013: together with the Federal Transport Ministry and the state agency for road construction in North Rhine-Westphalia 'Landesbetrieb Straßenbau Nordrhein-Westfalen' (Straßen.NRW), a decision was made to set up an area on which a reference section for road monitoring and assessment (ZEB) and different test areas to investigate new ideas in road construction were to be realised. A so-far unused area at the Köln-Ost motorway junction (A3/A4) proved to be a suitable location.

Realisation commenced in July 2015. In view of other concepts for using the selected area, which have since been discarded, extended explorations had to be conducted, structures and conduits adjusted to the new requirements and the terrain remodelled using embankments and support walls before work on building the actual test facilities could be started. These facilities themselves made very high demands on the construction companies and the work to be delivered.

For example, transverse and longitudinal slopes had to be realised which presented challenges to the machine technology and the imagination of staff and repeated 3D laser measurements used for acceptance. The areas set up in the central part totalling 4,300 square metres for demonstrators and test installations were equipped with different types of sensor technology whose data can be requested from work stations in the centrally located operating building via extensive cable ducts.

Ancillary spaces were created between all test facilities for parking, accelerating and deaccelerating before and after measurement trips on the different sections as well as steel and concrete road restraint systems to protect persons working there. Finally, the site was connected to the public electricity, water and telecommunications network and enclosed.

Investigations and projects

HEALROAD: Induction heating asphalt mixes to increase road durability and reduce maintenance costs and disruptions

The HEALROAD project is designed to contribute to extending the lifetime of asphalt wearing course by means of selected measures. This makes it possible to reduce the necessary maintenance work on the wearing course, and thus traffic disruptions. The repair measures are carried out in a way that causes the least impairment to traffic routes.

As well as the conventional components of asphalt – filler, aggregates and bitumen – the special composition contains small magnetic components. Using induction energy, these magnetic elements are rapidly heated, and the viscosity of the surrounding bitumen reduced. The purpose of this is to seal microcracks in the bitumen film between the aggregates and to prevent damage to the grain structure, which supports the self-healing effect of asphalt. Following extensive laboratory tests, the self-healing effect is being trialled under operational conditions on the duraBASt, using a full-scale test track built with conventional paving technology. Using the BASt's MLS30, a realistic load is applied to the track, thereby permitting a prompt evaluation of the wearing course.

Smart Bridge: Implementation of sub-aspects of the Smart Bridge in existing structures

The Smart Bridge is a system consisting of adjustable modules to record and holistically assess relevant information on changes in impact and resistance in real time. At the duraBASt-bridge innovative sensors required to measure load-bearing capacity and durability (corrosion, humidity and temperature) are integrated in the area of the bridge deck and the edge beams. The investigations at the duraBASt facility supplement research projects conducted by the Federal Highway Research Institute (BASt) to capture data using sensor systems (sensors integrated into components and wireless sensor technology), data analysis and assessment of the bridge condition. As part of thorough repair

of the duraBASt bridge with renewal of the road surface, the edge beams and expansion joints, innovative sensors to record load-bearing and durability parameters were directly built into the relevant components. Data will be transferred to BASt online and it is intended to provide a graphic representation of the measurement and analysis results. The structure can be accessed without restricting traffic. This means that the bridge can also be fitted with further instruments at a later date. The instrumented bridge is intended to collect experience in the implementation of the Smart Bridge concepts. A further important aspect is the assessment of durability and long-term stability of the installed measurement equipment under real conditions. The project is therefore an important step in realising the research framework programme "Roads in the 21st Century".

HESTER: Hybrid strengthening system for road maintenance

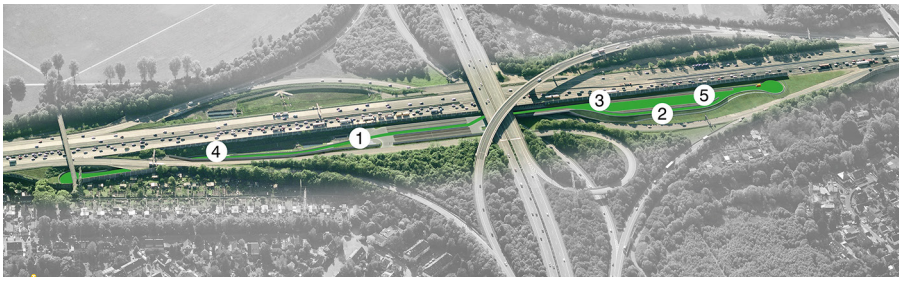
New materials help to carry out building work in an energy and resource efficient manner with the objective of producing a durable, resistant construction, thus supporting sustainable mobility. Retrofitting and repair systems requiring short building times and with high durability are needed to guarantee the availability of roads. In the HESTER project, precast concrete parts for repairing urban road surface structures are modelled and developed, for example for bus stops, junctions and roundabouts.
The shear force transmission of different coupling systems will in particular be examined using the precast part demonstrator constructed on the duraBASt. Plans include using the BASt MLS30 to simulate axle loads and apply a defined mechanical load in the joint area, and conducting a metrological calculation of the structural strength. In addition to evaluating the practical feasibility for urban areas that are subject to high stress, the demonstrator is used in particular to analyse and test innovative coupling systems.

Use of solar energy and controlling the temperature of roads

The efficiency of a road is greatly influenced by climatic effects. Black ice and hard-packed snow in winter months influence road safety, while the lifetime of a pavement can be reduced by the impact of cold in the winter and heat in the summer. Controlling the temperature of the pavement is one way of counteracting these influences, and also enables the pavement to be used as a source of energy, particularly in the summer.
The SEDa project concerned with "Examining multifunctional road building materials and composites for the use of solar energy and to improve durability" is researching the potential to generate electricity from the thermal energy produced by solar radiation stored in the road. The objective is to provide novel types of collectors to supplement those used previously with simple pipes. The energy extracted is primarily to be made available in the form of electricity.
A temperature-controlled road will also be constructed as a demonstrator, and used to identify the mode of operation of different systems by means of pipes and a flow through intermediate layers.

Reference sections

Germany has one of the densest road infrastructure networks in Europe: approximately 13,000 km of national motorways and some 38,000 km of federal highways.
To maintain permanent road safety and efficiency, road surfaces must be skid resistant, even, quiet and durable. Every four years, fast-moving measurement vehicles record the condition of road surfaces on the federal trunk road network as part of road monitoring and assessment (ZEB) – a key foundation for national maintenance planning. Reference sections with defined and permanent features on the duraBASt are used for the quality assurance and development of these measuring systems. Scientific research into new parameters for describing the condition of the surface can also be conducted here.
In addition to a longitudinal evenness section, the site also has a rolling section for transverse evenness, a skid resistance section, a section with substance features (surface) and a textured section.



Reference sections: 1 longitudinal evenness, 2 transverse evenness, 3 skid resistance, 4 substance characteristics (surface), 5 texture

duraBASt in an international context

Research projects usually follow a fixed course: from the idea through to testing under laboratory conditions, prototypes are developed and then tested on a large scale so as to minimise implementation risks. If the results are positive, functionality is then demonstrated under real traffic conditions. A number of European and international institutions (European Commission (EC), Conference of European Directors of Roads CEDR, Forum of European National Highway Laboratories (FEHRL), et al) have found that delays in the large-scale testing of research results to assess suitability for practical use are frequently the reason for failure to implement quickly.

duraBASt can contribute to increasing the Technology Readiness Levels (TRL) of innovations that are worthy of pursuing. Within the new CEDR Implementation Framework, its utilisation is planned for the first time in the 2017 Call "New Materials and Techniques". duraBASt is also available for the "FEHRL self-funded projects" financed by FEHRL members themselves. With the existing capacities, demonstration and testing areas can also continue to be used for bilateral collaborations with European neighbouring countries and for projects funded by the EC.

Ulla Blume, Advisor for international road construction research tasks

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Federal Highway Research Institute
Bundesanstalt für Straßenwesen (BASt)
Research Controlling and
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Post office box 10 01 50
D-51401 Bergisch Gladbach
Telephone +49 2204 43-0
E-Mail info@bast.de
Internet: *www.bast.de*

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October 2017

Opening of the duraBASt on 18th October 2017

The duraBASt was opened by BASt President Stefan Strick, the State Secretary at the Ministry of Transport for the State of NRW Dr. Hendrik Schulte, the Head of the Directorate for Road Building Policy, Road Planning and Road Legislation at the BMVI Christian Weibrecht and by the Director of the Landesbetrieb Straßen. NRW Elfriede Sauerwein-Braksiek (from left to right)

The duraBASt was officially opened in a ceremony on 18th October 2017 in front of 130 national and international guests from the areas of research, politics, administration, academia and industry.

"The objective of the duraBASt is to enable innovations to be put into building practice much faster than has been the case in the past, thereby enabling us to sustainably adapt the road infrastructure to future challenges, while also making a substantial contribution to ensuring the quality of road construction. We are providing around 13 million euros for this innovative test site", explained Rainer Bomba, the State Secretary at the Federal Ministry of Transport and Digital Infrastructure, on the occasion of the opening of the duraBASt.

"The challenges in road construction have been growing for years: more traffic, increased demands of environmental protection and air pollution control as well as greater expectations regarding the quality of routes", stated Dr. Hendrik Schulte, the State Secretary at the Ministry of Transport North Rhine-Westphalia. "This makes it all the more important to face these challenges with the help of research and innovations. NRW fully supports BASt in this. Precisely against this background it is particularly pleasing that the new test site is practically on our doorstep and can therefore be of mutual benefit."

The duraBASt has been jointly implemented with the North Rhine-Westphalian roads agency (Landesbetrieb Straßen.NRW) as part of the "Roads in the 21st century" research project. The site took around two years to build.

A technical exhibition presenting and demonstrating duraBASt projects that have already begun or are at the planning stage accompanied the opening.

Facts

Start of construction: June 2015
Construction period: approx. two years
Cost: approx. 13 million euros
Service life: approx. 30 years
Length: approx. one kilometre
Area: approx. 25,000 square metres
Demonstrators and test areas: 16
Reference sections: longitudinal evenness, transverse evenness, substance characteristics (surface) and texture