

Innovation Programme for Roads

Framework Programme



bast

Federal Highway Research Institute



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1 Introduction

Mobility and therefore the demands made on the traffic infrastructure will continue to increase in future. Even now, the roads bear the brunt of goods and passenger traffic. Increasing traffic flows in a converging Europe will place an even greater strain on the road infrastructure in future, necessitating an adjustment to the new demands. It is precisely in the light of this knowledge that the restricted resources for the construction and maintenance of the road infrastructure must be put to the very best use, also taking account of the requirements of an ageing society and the consequences of globalisation. Adjustment measures and avoidance strategies for the consequences of climate change must also be developed under consideration of the transition to a post-fossil society.

The realisation of these objectives is based on the “Roads in the 21st Century – Innovative Road Construction in Germany” research programme, which is intended to provide the necessary innovative thrust for the road system. In addition to the known challenges, roads in the 21st century also face new challenges which must similarly be given wholehearted consideration if the road system is to remain viable into the future. These challenges include demographic change, climate change, technological change and globalisation with its risks and sustainability in a post-fossil society.

The objectives formulated in the “Roads in the 21st Century” research programme are to be realised with the following three cornerstones:

- Internal research by the Federal Highway Research Institute (BAST)
- Contract research conducted by BAST
- Research funding by BAST

The framework programme “Innovation Programme for Roads” describes tasks and goals which are intended to contribute to achieving the objectives of “Roads in the 21st Century” using the tool of research funding.

Innovative concepts, materials, technologies as well as methods and procedures must be developed and investigated to make the road system efficient and viable for the future. Innovation and its implementation in road and bridge construction must be stepped up here. In view of the expected increase in traffic, one point of

focus must be placed on the durability and availability of the road infrastructure. Innovative ideas must be supported in order to shape the construction of new roads efficiently and reliably whilst reducing the level of maintenance work required. However, roads of the future must also be more intelligent, more economical, safer and more environmentally compatible, with fewer follow-on costs for users and operators alike.

2 Incorporation in research funding

Areas of focus and objectives are formulated in the innovation fields of the framework programme. The “Innovation Programme for Roads” is intended to run for a period of 10 years. The financial resources are earmarked in the federal budget every year and are subject to approval by parliament. Amendments to the budget or financial planning may entail changes in technical implementation. The “Guidelines on the Funding of Research and Development Projects” within the “Innovation Programme for Roads” of the Federal Ministry of Transport and Digital Infrastructure (BMVI) regulate the conditions of funding, the application procedure, the funding rates and other general funding arrangements.



The respective subject areas are stipulated in “funding announcements” which are based on this framework programme.

The funding guidelines and the calls for proposal are available at www.bast.de.

3 Programme objectives and time horizon

The main objective of the “Innovation Programme for Roads” is to obtain information by funding research which contributes to making the road system efficient and future-proof. Depending on the respective research topic, the concepts, materials, technologies, methods and processes are essentially to be geared to the properties of

- safe and reliable
- intelligent and
- sustainable.

Guided by the principle of results-based research, the funding projects should amongst other things make an important contribution to enhancing traffic safety, improving traffic flows, increasing the serviceable life of roads, improving energy efficiency and production quality in the construction and operation of roads.

Based on the “Roads in the 21st Century” programme, a time horizon up to 2030 is assumed for the implementation of the research results.

4 Innovation fields of the framework programme

In the current framework programme, funding is aimed at research measures in the following innovation fields:

- Safe and reliable roads
- Intelligent roads
- Sustainable roads

The following descriptions of the innovation fields take the current state of the art into consideration. This may alter during the course of the programme so that it may be necessary to make readjustments.

4.1 Safe and reliable roads

A central objective is to ensure the safe, efficient and reliably planned transportation of people and goods over short and long distances, following the guiding principle that safe roads also significantly increase their reliability.

In order to guarantee that the demands made on traffic safety and efficiency are satisfied, road surfaces must offer good grip, be level, quiet and above all durable. Methods to record the condition of road surfaces are therefore an important element of road safety and efficiency of the road infrastructure. For this reason, innovative methods of measuring the condition of road surfaces must be developed and researched.

The need for maintenance is high in view of the age structure of the road network. Innovative, efficient and economical maintenance management must be developed here. Durable, high-quality and therefore reliable and efficient roads are founded on process reliability and an optimised production chain. In order to reliably secure the availability and efficiency of the road infrastructure in the long term, the durability of road structures must be increased whilst reducing the time required for any building measures which become necessary.

To reduce the consequences of weather-related disturbances caused by climate change, vulnerabilities in the road traffic infrastructure must be explored and innovative adjustment strategies developed.

The need for expansion and maintenance will also entail the setting-up of numerous road works with the concomitant impact on traffic flow and therefore traffic safety. Innovative approaches must be developed and researched here to optimise planning, coordination and handling of road works as part of road works management. This also includes the development and evaluation of innovative traffic-related measures for safe and efficient road works traffic management.

4.2 Intelligent roads

The aim of the intelligent roads concept is to create better conditions for operative and strategic decisions on traffic management, road construction and maintenance using intelligent approaches and technologies.

In order to safeguard the efficiency of the traffic system in future, it is important to address the use of innovative technologies and materials and to build intelligent roads which satisfy a large number of requirements over a long or defined period of use.

When assessing the structural condition of roads it is important to measure the processes and distribution of forces within road constructions over the course of time. The aim is therefore to develop a measurement and information system with sensors implemented in the pavement using which the remaining useful life may be determined. An instrument of this type would be highly beneficial, permitting road constructions to meet the growing demands presented by traffic and weather conditions.

A further research approach is to develop standardised road information memories to record and secure construction, building material and equipment data. A module of this type, in the form of an information database for example, provides the foundation for subsequent research activities (optimisation of construction methods, traffic flows, construction processes etc.). The integration of building information modelling into road construction creates a new standard which has already been further developed in other areas of construction and is intended to support macro-economic maintenance planning with the aim of mapping the entire life cycle.



In a maintenance management system of this kind it must be possible to estimate the (remaining) useful lives of the individual courses of the road structure. Tools which model the material behaviour and provide a forecast of when damage will occur would appear to be suitable here.

The networking of vehicles and road infrastructure is to be systematically researched by using all suitable information and communication techniques from a technological and economic point of view. This is to result in the support of new possibilities of comprehensive mobility management also across the different means of transport. The framework conditions for this networking are to be defined and adapted continuously to technical developments.

4.3 Sustainable roads

Sustainable development concerns all economic branches and also sets major and complex challenges for road construction. The finite availability of individual building materials, the expense involved in extraction, treatment and processing, as well as the energy requirements must be taken into consideration. Sustainable roads must be characterised by a sparing use of energy in every respect. The quality and value of the road infrastructure will be increasingly measured with respect to life cycle costs, low user and environmental costs as well as the safety of building materials in terms of human health.



One possible approach to reducing energy consumption and improving the durability of pavements and therefore extending the life cycle is to develop and test innovative methods of production and building materials.

This goes hand in hand with the consideration of further life cycle aspects in planning, realising and operating road infrastructures, including the development and testing of methods of sustainability assessment, the determination of requirements placed on building materials, structures and their realisation as well as the development of holistic, life-cycle-related infrastructure management.

Sustainability, economic viability and energy efficiency are important construction policy and social goals of the Federal Government. Within this subject area, innovative concepts of environmentally compatible recycling of materials which have not so far been recycled and the creation of alternative solutions for fossil fuels are to be elaborated for the realisation of the objectives. Focus is placed on investigations into the suitability and use of recycled building materials.

The compatibility of roads and traffic with the requirements of emission control is already an important element for the acceptance of motorised road traffic. The aim of the Road Innovation Programme is to harmonise this compatibility with the growing demands of emission control.

For this purpose, the real traffic noise is to be reduced from the outset by innovative methods of pavement construction. Low noise road surfaces are to be developed and tested using innovative methods to determine acoustic characteristics. Suitable pollutant control and retention techniques are also to be developed to minimise traffic-related emissions and integrated in standard construction methods. Effective measures to keep the air along roads clean are also to be determined and implemented across the board and in line with requirements.

5 Necessity to provide funding

The development and research of innovations in road construction is time and cost intensive and therefore pursued to only a restricted extent. The prevailing decentralised testing strategy inhibits systematic investigations, thereby preventing the adequate development of the requisite holistic strategy in road construction research and extending innovation cycles. In view of this market

failure, incentives must be created for industry, science and administration to focus on these subjects and realise innovations which are suitable to meet the great challenges of the future.

Practical research intensifies networking within industry as well as between industry, science and administration with the aim of making today's road system viable for the future through innovations in road construction and road traffic technology under consideration of the declared challenges.

6 Evaluation

A main task in programme realisation is to monitor the achievement of goals as well as the impact and economic efficiency of the resources used. Against this backdrop, the framework programme of "Innovation Programme for Roads" will be flanked by a process of evaluation. Alongside the accompanying evaluation in the form of a continuous monitoring and improvement process, this also includes the final ex-post evaluation.

6.1 Programming

Based on an extensive requirements analysis, important framework conditions for this framework programme have been stipulated. In close cooperation between the Road Construction Department of the BMVI and the Federal Highway Research Institute, this policy was set out with the support of the scientific advisory board.

6.2 Project-related monitoring

The framework programme will be accompanied by continuous monitoring throughout the term. Focus is placed on the systematic recording and monitoring of progress and of the successes achieved in the funded research projects in particular and the review of the objectives and orientation of the policy in terms of content in general.

Several assessment steps or evaluation methods are available to review the project success, which are geared to the higher ranking objectives at the level of the framework programme using suitable indicators.

Funding recipients are obliged to report continuously on the main project progress by way of concomitant monitoring. On completion of the project, the progress

made is to be presented extensively in final and success monitoring reports. This form of monitoring at the same time serves to indicate possible gaps in research and therefore to obtain selective indications for future programme design in good time.

6.3 Ex-post evaluation

On the basis of the measures presented in 6.2, an ex-post evaluation will be conducted following completion of the programme.

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