German Centre for
Rail Traffic Research at the

Federal Railway Authority

List of Reports

Reports of the German Centre for Rail Traffic Research

November 2023

In the Series ***Reports of the German Centre for Rail Traffic Research*** the following reports have been published:

Report 44 (2023)
Development of Datasets for Applications of Automated Driving in Railway Operations
For the development of object recognition functions for automated train operations, extensive, high-quality and homogeneous data sets are required. For the railway sector, there are only few open data sets and hardly any references for the development of data sets so far. In the research project, the open data set "Open Sensor Data for Rail 2023" (OSDaR23) was developed, which contains 204,091 annotations from 20 different object classes as well as sensor data from color cameras, infrared cameras, lidars and a radar.
October 2023, 88 pages, ca. 10,1 MB, doi: 10.48755/dzsf.230012.01. Available: Abstract (EN).

Report 43 (2023)
Refurbishment of rolling stock
Railway vehicles are subject to constantly changing requirements and are modernized at least once in their "lifetime". In this report the boundary conditions of modernization processes are presented in a structured manner, obstacles are analyzed and concrete recommendations are developed as to how future modernizations can be carried out in a cost-effective, timely and qualitative manner.
October 2023, 84 pages, ca. 6 MB, doi: 10.48755/dzsf.230010.01. Available: Summary (EN) and Abstract (EN).

Report 42 (2023)
Near-Real-Time Identification of Treefalls on Rail Infrastructure Using High-Resolution Radar Satellites
This research report examines which data, methods and tools of satellite-based remote sensing are required to identify treefalls on the German rail infrastructure in near-real-time. The evaluation was based on radar satellite data as they provide weather-independent information on the earth's surface.
September 2023, 67 pages, ca. 15 MB, doi: 10.48755/dzsf.230011.01. Available: Summary (EN) and Abstract (EN).

Report 41 (2023)
Sensitivity analysis of vegetation along the German transport routes with regard to storm throwing hazards and embankment fires
Embankment fires and storm throw represent a major hazard to rail infrastructure and the safety of rail traffic. The hazard potential of embankment fires was determined for Germany for the present and for the near (2031-2060) and distant future (2071-2100). In addition, a risk assessment for storm throw was implemented for the federal states of North Rhine-Westphalia and Thuringia on the basis of single tree detections. The hazard indication maps are available on the GeoPortal of the EBA and the Mobilithek.
September 2023, 127 pages, 6,5 MB, doi: 10.48755/dzsf.230009.01. Available: Summary (EN) and Abstract (EN).

Report 40 (2023)
Risk acceptance criteria for automated driving for railways
The risk analysis for the grades of automation 3 and 4 complies with the requirements of the CSM regulation using all risk acceptance criteria provided by the regulation: use of Code of Practice, comparison with reference systems as well as explicit risk analysis for future automatic operation modes based on DIN VDE V 0831-103. Additionally an analysis of human reliability up to the GoA 2 was performed.
July 2023, 253 pages, 5,1 MB, doi: 10.48755/dzsf.230008.01. Available: Summary (EN) and Abstract (EN).

Report 39 (2023)
Structural Design of Shear Studs for the Load Transfer of Horizontal Forces of Bridge Bearings into Bearing Pedestals
The research report summarizes the structural behaviour of shear studs on bridge bearings which have been embedded in synthetic resin-bonded mortars. Based on the results of numerous static and fatigue tests with a vast spectra of different parameters, design rules and design equations are given for an adequate structural design of shear studs.
June 2023, 143 pages, PDP, ca. 12 MB, doi: 10.48755/dzsf.230007.01. Available: Abstract (EN) and Resumen (ES).

Report 37 (2023)
Survey: Cybersecurity and Emerging Technologies
What is the state of cybersecurity in the public transportation and rail sectors, and what emerging technologies are already in use or will become relevant in the near future? In a two-stage survey, we interviewed relevant stakeholders from the sectors. As a result, the survey shows that the sector is lagging behind when it comes to cybersecurity and that cloud technologies dominate the technological perspective.
February 2023, 88 pages, PDF, ca. 4,2 MB, doi: 10.48755/dzsf.230004.01. Available: Abstract (EN).

Report 36 (2023)

Investigation and impact of the wear behavior of new wheel-rail pairings

The research project deals with the overall wheel-rail system from the point of view of the contact geometry (wheel-rail profile pairing), from the point of view of the material (wheel-rail wear) and from the point of view of the signaling technology (track vacancy detection). In this research report, the wear behavior of the current wheel and rail profiles is analyzed based on extensive investigations. Furthermore, the influence of the wheel and rail materials on the changed wear development is shown and the interaction with infrastructure systems (e.g., track vacancy detection devices) is checked and analyzed.

February 2023, 136 pages, PDF, ca. 12,5 MB, doi: 10.48755/dzsf.230003.01. Available: Abstract (EN).

Report 35 (2023)

Systematisation of infrastructure maintenance planning and description of the application of predictive maintenance

Based on a systematisation of the individual planning steps in the overall maintenance planning process, the application possibilities for the concept of Predictive Maintenance (PM) are described. It is also been evaluated how the individual planning tasks in the different levels can benefit from the application of data-based PM methods.

January 2023, 99 pages, PDF, ca. 4,3 MB, doi: 10.48755/dzsf.230001.01.

Report 34 (2023)

Compatibility of automatic couplers for commuter railcars and trains in Germany

Local rail passenger transport (SPNV) is characterized by a large variety of vehicles. It can be seen that technical limits are imposed on the free deployment of local transport vehicles by their ability to be coupled. Difficulties are encountered both in coupling vehicles of the same series and in combining different (sub)series. The research project addresses the question of which obstacles must be overcome in order to achieve free couplability of traction units in local passenger rail transport and which (operational) potentials could be tapped if this goal were achieved.

January 2023, 103 pages, PDF, ca. 7,4 MB, doi: 10.48755/dzsf.230002.01. Available: Abstract (EN).

Report 33 (2022)

Classification of rainfall runoff on railway tracks

For the characterization of rail traffic-related emissions into the adjacent environment, a nationwide network of measuring stations was established. At five permanent measuring sites, the amount of precipitation water runoff, the pollutant load and its dispersion are determined within the framework of comprehensive environmental monitoring. The focus of the investigations is on water and soil protection, with additional scientific monitoring of chemical vegetation control at the sites.

December 2022, 153 pages, PDF, ca. 10 MB, doi: 10.48755/dzsf.220019.01. Available: Abstract (EN) and Summary (EN).

Report 32 (2022)

Reactivation of rail lines

The reactivation of rail lines can play an important role in the modal shift. In connection with these projects, the implementation of accompanying measures is necessary, which often represent decisive success factors for the reactivations. Within the framework of the research project, a guideline with effective accompanying measures was therefore developed to support reactivation projects.

(Zusammenfassung) December 2022, 17 pages, PDF, ca. 1,1 MB, doi: 10.48755/dzsf.220018.02.

Report 31 (2022)

Sensor technology as a technical prerequisite for ATO functions

ATO (automated train operation) with high grades of automation requires performant and reliable perception systems, i.e. for the recognition of obstacles and hazards. In this project, requirements for the perception system have been derived from the tasks of the human driver and a sensor system has been specified for R&D purposes.

Oktober 2022, 292 pages, PDF, ca. 9,9 MB, doi: 10.48755/dzsf.220015.01. Available: Abstract (EN).

Report 30 (2022)

Analysis of energy consumption of refrigerated containers in rail transport

To investigate the feasibility of transporting temperature-controlled goods by rail, the project examined the energy supply of reefer containers in freight trains. A test train was equipped with reefer containers and measurement equipment and a measurement campaign was carried out taking into account various operating and environmental conditions at the Open Digital Test Field of the DZSF. The results of the investigations show that transportation of temperature-sensitive goods by rail using conventional means is technically and operationally possible.

November 2022, 79 pages, PDF, ca. 6,4 MB, doi: 10.48755/dzsf.220017.01. Available: Summary (EN).

Report 29 (2022)
Analyze the framework conditions for user-friendly intermodal integrated rail passenger transport.
In order to book a journey continuously from door to door, the different providers (e.g. train, bus, sharing) must be closely interlinked. The project analyses the economic incentives and legal options to achieve this.
October 2022, 211 pages, PDF, ca. 3,7 MB, doi: 10.48755/dzsf.220014.01. Available: Abstract (EN).

Report 28 (2022)
3D printing as a component procurement
In rail traffic, vehicles and associated systems are often used over long period of time. There is sometimes a need for spare parts that can no longer be mass-produced in a cost-effective way. Using 3D printing or additive manufacturing, however, it would be possible to manufacture spare parts in small series. The aim of the study was to analyse established additive manufacturing processes, to identify differences from conventional processes and components and to propose suitable quality management instruments. Furthermore, rules and standards on obstacles to the establishment of additive manufacturing in railway industry should be identified and countered with specific recommendations for action.
September 2022, 98 pages, PDF, ca. 2,8 MB, doi: 10.48755/dzsf.220016.01. Available: Abstract (EN).

Report 27 (2022)
Investigation of methods for securing and monitoring of blocked tracks
During construction and maintenance measures of the railway infrastructure, operational actions in the interlocking are necessary to prevent the unintentional entry of a vehicle into the blocked track. However, accidents occur time and again, especially during short-term and short-duration maintenance measures. The aim of this project was to identify and investigate technical concepts that can increase the safety of people on the track without deriving additional requirements exclusively for the dispatcher.
September 2022, 62 pages, PDF, ca. 2,5 MB, doi: 10.48755/dzsf.220012.01. Available: Abstract (EN).

Report 26 (2022)
Minimum equipment of freight wagons - effective and economic condition monitoring for condition-oriented maintenance
In the present research project, the most frequent causes of failure of freight wagons were analysed. On this basis, concepts were systematically derived for the economic and efficient equipping of freight wagons with condition monitoring. In addition, a detailed legal report on the exchange of data in rail freight transport shows legal obligations and possibilities for the exchange of sensor data within the rail sector.
September 2022, 154 pages, PDF, ca. 13 MB, doi: 10.48755/dzsf.220009.01. Available: Abstract (EN).

Report 25 (2022)
Report on transparent noise barriers with high acoustic effectiveness
The project developed ideas for prototypes of transparent noise barriers with good absorption properties. The project investigated the acoustic effect of different solutions using simulations and considered the suitability for railway application. Partially transparent, highly absorbent sound barriers can be realised with periodically arranged absorbers or absorbent lamellas.
October 2022, 182 pages, PDF, ca. 14,2 MB, doi: 10.48755/dzsf.220007.01.2.

Report 24 (2022)
Evaluation of the implementation of the noise abatement programme on federal railways
The report presents the progress of the noise remediation programme from 1999 to 2018 and the noise reduction achieved. The results of psychoacoustic investigations and surveys as well as measurements of noise abatement measures are presented. Finally, recommendations for the continuation of the programme are derived.
June 2022, 244 pages, PDF, 9,3 MB, doi: 10.48755/dzsf.220010.01. Available: Abstract (EN).

Report 23 (2022)
Development of a specification sheet for programming of a web-based information system for building materials
In order to be able to better evaluate and take into account the environmental properties of building materials in future construction projects in the infrastructure sector, a specification sheet for an internal information system for public authorities and an exemplary prototype were developed within this research project. Furthermore, a thorough legal evaluation of possible conditions and obstacles for the implementation of such an information system was carried out.
May 2022, 46 pages, PDF, 1,2 MB, doi: 10.48755/dzsf.220004.01. Available: Summary (EN).

Report 22 (2022)

Pilot study for an AI-based management of planning approvals

The study describes the application of natural language processing techniques on an existing dataset originating from planning objections. This application focuses on four typical tasks occuring in the analysis of text data during this process.

March 2022, 68 pages, PDF, 1,6 MB, doi: 10.48755/dzsf.220006.01. Available: Abstract (EN).

Report 21 (2022)

Implementation of the CSM regulation (EU) 402/2013 for the operation and traffic management subsystem

This study deals with the topic “Implementation of the CSM regulation (EU) 402/2013 for the operation and traffic management subsystem”. This research report provides the risk management process for an operational and organisational change of a new railway operator in Germany according to [CSM15].

February 2022, 107 pages, PDF, 6,2 MB, doi: 10.48755/dzsf.220005.02. Available: Abstract (EN).

Report 20 (2022)

Security requirements forecast and evaluation of possible security concepts

The first work package of the „Security Requirements Forecast and Evaluation of Possible Security Concepts” project provides application probabilities for various technologies in railway operations and supporting processes. A definition of the railway system and a review of technology trends in the railway sector and similar industries lead to a set of use cases for emerging technologies. An advisory board supported the findings, ensuring the applicability of the results.

(WP 1) January 2022, 117 pages, PDF, 1,5 MB, doi: 10.48755/dzsf.220008.06. Available: Abstract (EN).

Report 19 (2022)

Analysis of further training and development opportunities in the rail sector

Suitable training programs are needed to counter the skilled workforce shortage in rail transport and to strengthen the employees given increasing digitization and automation. The study provides an overview of the existing training market in rail transport in Germany, identifies requirements and provides recommendations for action.

May 2022, 96 pages, PDF, 6 MB, doi: 10.48755/dzsf.220003.01. Available: Summary (EN).

Report 18 (2022)

Analysis of academic education in the rail transport sector

In order to meet the Paris climate targets, more highly qualified specialists in the rail transport sector are needed in the future. The study provides an analysis of the current state of higher education in the rail transport sector and offers recommendations on how to expand the provision of higher education in railway engineering.

January 2022, 88 pages, PDF, 3,5 MB, doi: 10.48755/dzsf.220002.01. Available: Summary (EN).

Report 17 (2022)

Acoustic certification of new composite brake blocks

The project developed a procedure for the acoustic certification of new composite brake blocks at component level and proposed a limit value. The procedure is based on the measurement of wheel roughness generated on a brake test bench. The project results are integrated in the revision of the TSI Noise and support to close an open point.

January 2022, 59 pages, PDF, 1,6 MB, doi: 10.48755/dzsf.220001.01.03. Available: Report (EN) and Abstract (EN).

Report 16 (2021)

mHUB-B: Requirements analysis for a web-based platform to supply, present and analyze geodata

The goal of mHUB-B was the analysis of requirements for an intermodal geodata platform. The creation of such a platform could simplify the access, processing and analysis of data. The systematically analysed requirements lay the foundation for the construction of such a platform.

December 2021, 115 pages, PDF, 2,2, MB, doi: 10.48755/dzsf.210008.01.

Report 15 (2021)

Analysis of the conditions to use the BIM method in the federal railway authority

In order to leverage the potential of the BIM method for the application, review and approval processes, the research project " Analysis of the conditions to use the BIM method in the federal railway authority " is examining the basis for introducing BIM at the Federal Railway Authority from an organizational and technical perspective. The main task was to develop an implementation plan for the introduction of BIM at EBA.

November 2021, 97 pages, PDF, 3,2 MB, doi: 10.48755/dzsf.210002.01. Available: Abstract (EN).

Report 14 (2021)

Economic significance of the German rail sector based on employment impact

The rail sector is a crucial factor for the mobility of people and goods. In addition, the sector secures more than half a million full-time equivalent jobs in Germany and thus generates purchasing power and prosperity along the value chain.

November 2021, 112 pages, PDF, 2,2 MB, doi: 10.48755/dzsf.210001.01. Available: Summary (EN).

Report 13 (2021)

Investigation of possibilities and requirements for an open digital test field for railway traffic

Through establishing of the Open Digital Test Field by the German Center for Rail Transport Research (DZSF), a new range of research opportunities was created and a gap in the existing research landscape has been closed. As the only test field in Europe, the Open Digital Test Field enables the testing of new technologies and further innovations on the existing route network under real conditions. The present study elaborates which requirements are placed on the test field, which equipment is necessary for this and which legal aspects have to be taken under account during the operation of the test field.

November 2021, 306 pages, PDF, 30 MB. doi: 10.48755/dzsf.210003.01. Available: Summary (EN).

Report 12 (2021)

Risk assessment on the risk of infection with COVID-19 in rail passenger transport and local and long-distance road passenger transport

As a result of this study, the risk of becoming infected with SARS-CoV-2 in public transport is not higher than in the domestic environment. Measures such as correct wearing of suitable protective masks, an adequate supply of fresh air, recirculating air filtering and the observance of distances can effectively reduce the risk of infection.

June 2021, 319 pages, PDF, 13 MB, doi: 10.48755/dzsf.210004.01. Available: Abstract (EN).

Report 11 (2021)

Assessment of introduction and reproduction potential of tiger mosquitos (Aedes albopictus) on German railway systems

The tiger mosquito (Aedes albopictus) is considered a potential vector for several viral diseases. Via transport routes and vehicles the species can be spread across large distances and form new populations. The project aims to assess the supply of suitable breeding places in the vicinity of railway systems.

May 2021, 130 pages, PDF, 18 MB, doi: 10.48755/dzsf.210006.01.

Report 10 (2021)

Individual tree detection and characterization along railway tracks

The DZSF research project focussed on the risk potential of vegetation for the railway infrastructure. As part of the project, a GIS tool for individual tree detection along the German railway tracks was developed and implemented.

The tool is mainly based on the freely available high-resolution topographic aerial survey data of the German federal states.

May 2021, 70 pages, PDF, 4 MB, doi: 10.48755/dzsf.210007.01. Available: Abstract (EN) and Summary (EN).

Report 9 (2021)

Determination of bird protection effectiveness of animal deflectors on railway overhead lines

Railway overhead lines may cause specific hazards to birds due to electric shocks. To protect birds and minimize the risk of short circuit events, animal deflectors on the insulators of the overhead lines has been installed. The project aims to investigate the effectiveness of different deflector types under different environmental conditions.

March 2021, 117 pages, PDF, 4 MB, doi: 10.48755/dzsf.210010.01. Available: Abstract (EN).

Report 8 (2021)

Methods for the assessment of engineering structures - module „non-destructive testing“

Infrastructure operators / construction authorities are regularly confronted with the problem that there is hardly any independent, valid information available on advanced methods for the (condition) assessment of engineering structures. A modular catalogue of such testing methods is being developed by the DZSF within the BMVI network of experts “Knowledge Ability Action”. For this report, the NDT-CE procedure descriptions from reports 6 and 7 have been merged.

January 2021, 246 pages, PDF, 7,5 MB, doi: 10.48755/dzsf.210011.01.

Report 7 (2021)

Collection, description, evaluation and linkage of NDT-CE procedures and techniques for engineering structures of road and railway (concrete and masonry)

A modular catalogue of testing methods for the assessment of infrastructure engineering structures is being developed by the DZSF within the BMVI network of experts “Knowledge Ability Action”. In this project, non-destructive testing methods for engineering structures made of concrete or masonry were collected, described and linked to relevant testing tasks.

January 2021, 186 pages, PDF, 5 MB, doi: 10.48755/dzsf.210012.01.

Report 6 (2021)

NDT methods for engineering structures made of steel and conception of an IT solution for the use and retrieval of the data (steel)

A modular catalogue of testing methods for the assessment of infrastructure engineering structures is being developed by the DZSF within the BMVI network of experts “Knowledge Ability Action”. In this project, non-destructive testing methods for engineering structures made of steel were collected, described and linked to relevant testing tasks; in addition, the concept of the future web based catalogue was designed.

January 2021, 142 pages, PDF, 5 MB, doi: 10.48755/dzsf.210011.01.

Report 5 (2020)

Modeling the import and dissemination of non-indigenous species along different transport modes

We developed the computer model “CASPAIN” to predict the spread of invasive alien species along roads, rails and waterways. The model includes several relevant migration paths, modes and vectors such as ships, cars, trucks, trains and containers. The results allows us to detect the main migration corridors for invasive species within Germany.

November 2020, 84 pages, PDF, 10,5 MB, doi: 10.48755/dzsf.210013.01. Available: Abstract (EN).

Report 4 (2020)

Quantification of the need to retrofit freight wagon fleets in Germany and member states of the European Union in light of the differing legal frameworks

At the timetable change 2020/2021, the operation of "noisy" freight wagons will be banned on the German rail network. The study determined the necessary needs for retrofitting composite brake blocks including the associated costs for the years 2018-2021 for various legal scenarios.

October 2020, 48 pages, PDF, 4,5 MB, doi: 10.48755/dzsf.210014.01.

Report 3 (2020)

Needs and stakeholder analysis for establishing an information system to assess environmental properties of building materials

In order to better consider and evaluate the environmental properties of building materials in future infrastructure projects, a needs and stakeholder analysis was carried out to establish an information system for assessing the environmental properties of building products and materials. With the help of expert interviews, an initial model structure for such a system was derived and developed.

March 2020, 117 pages, PDF, 7,5 MB, doi: 10.48755/dzsf.210015.01. Available: Summary (EN).

Report 2 (2020)

Socio-economic and environmental impacts of the closure of level crossings

The approach developed in this study attempts to assess the questions arising in the context of level crossing closures. Changes in accessibility, environmental costs and operating costs on the basis of standardised procedures and value approaches with regard to the most significant effects are taken into account. The overall quantification of socio-economic and ecological effects makes it possible to determine the total damage caused by the closure of a level crossing and, if necessary, also supports substitute (alternative) solutions.

March 2020, 188 pages, PDF, approx. 11 MB, doi: 10.48755/dzsf.210016.01.

Report 1 (2020)

Investigation of the conditions for a widespread use of eddy current brakes

The aim of these investigations is to describe the general effects of the use of a linear eddy current brake on the equipment of the control and safety technology as well as on the infrastructure. General measures and suitable specifications for infrastructure and future linear eddy current brakes should create the prerequisites for a more comprehensive use of the linear eddy current brake. An analysis of the requirements in the relevant regulations and standards completes the analysis.

January 2020, 78 pages, PDF, 2 MB, doi: 10.48755/dzsf.210017.01. Available: Abstract (EN).

In the Series **EBA-Researchreport** has been published:

(till 31.12.2019)

Report 2019-06

Konzept for dust collection while ballast cleaning

In this project, an enclosure for the machine parts that release dust is being developed and the extraction performance, pipe diameter and cleaning performance of the extraction system are being calculated. The aim is to provide the complete planning service so that a ballast cleaning machines can be made suitable for work in tunnels. Subsequently, the developed documents were published in the form of a research report.
July 2019, 59 pages, PDF, 9 MB, doi: 10.48755/dzsf.210018.01.

Report 2019-05

Assessment of the design of track drainage systems and culverts

The aim of the project was to conduct whether design and dimensioning of existing railway drainage systems and stream culverts are sufficient due to severe precipitation events. It was shown that particularly for existing track drainage systems of open railways, the drainage of increased run-off flow rates is possible, even in case of severe precipitation events. However, regular inspections and maintenance measures are essential for safe drainage of water.
Exemplary calculations were performed to show the sufficient hydraulic capacity of culverts and a possible method for an initial assessment of hydraulic capacity was developed. A nationwide evaluation of culverts is not generally possible and must be done instead on a case-by-case basis. The consideration of certain construction methods at in- and outflow-points of culverts can increase its hydraulic capacity and reduce undermining.
August 2019, 210 pages, PDF, 9 MB, doi: 10.48755/dzsf.210019.01. Available: Summary (EN).

Report 2019-04

Potential analysis for the optimisation of the safety at level crossings

Accident rates are comparatively high at level crossings in the railway system. This marks the initial situation for the work of the research project “potential analysis for the optimisation of the safety at level crossings”, which aim was to identify potential improvement measures in order to avert accidents at level crossings. The fundamental groundwork of this analysis composes several system definitions of the various railway crossing protection systems implemented at state-owned railways. In this research project, numerous reasonable and appropriate measures for the enhancement of safety at level crossings were identified. As a result of the analysis, a recommendation catalogue of optimisation measures for level crossings at state-owned railways was developed.
December 2019, 159 pages, PDF, 4,5 MB, doi: 10.48755/dzsf.210020.01. Available: Summary (EN).

Report 2019-03

Development of test cases for ERTMS

A comprehensive generic test case catalogue for ETCS in Germany, ETCS level 2 and level 1 German version (State of knowledge 12/2017), has been developed. The test case catalogue consists of more than 2.200 individual test cases. In addition to a comprehensive quality examination, a comparison between the developed test cases and the published test cases from other European countries and those provided in the subset-076 was conducted.
March 2019, 57 pages, PDF,1 MB, doi: 10.48755/dzsf.210021.01. Available: Summary (EN).

Report 2019-02

Effects of digitalisation on railway operations: Derivation of possible changes for the train driver

The current and future use of digital applications of the train driver were in the focus of this research project. The ergonomic analyses and evaluations are based on the observations made during train journeys and interviews with drivers and other operating staff, taking into account ergonomic and ergonomic findings. The recommendations derived from this include the experiences of individual industry representatives.
March 2019, 222 pages, PDF, 6 MB, doi: 10.48755/dzsf.210023.01.

Report 2019-01

Consideration of software development in the railway sector

The study describes current trends and challenges that software development in the railway sector will have to face in the coming years. It addresses future product structures, standards, methods and processes as well as training issues. Based on an analysis of the trends in the neighbouring domains automotive, avionics, telecommunication and industrial automation, proposals for the railway sector are developed.
February 2019, 63 pages, PDF, 1,2 MB, doi: 10.48755/dzsf.210022.01. Available: Abstract (EN).

Report 2018-13

Compilation of a geo-hazard map for slope instabilities and landslides along the German railway network

The aim was to create a geo-hazard map for slope instabilities and landslides along the German railway system. Firstly, the geo-hazard potential for slope instabilities and landslides was mapped for the German railway network with a knowledge-driven approach, which was based on geotechnical expertise by combining pre-defined slope classes and geotechnical rock classes. The second, data-driven approach was based on the application of self-learning artificial neural networks (ANN), which try to understand the relationship and linkage of the model input data through “training” at the locations with known slope instabilities and landslides. Due to limited availability of training data sets, the model was only trained and applied along the railway network of Saxony. The compiled maps are so-called geo-hazard maps that show potentially endangered areas, but without stating the height of the risk itself.
December 2019, 127 pages, PDF, 19 MB, doi: 10.48755/dzsf.210024.01. Available: Abstract (EN) and Summary (EN).

Report 2018-12

Quantification of the retrofitting needs of the freight wagon fleets in Germany and the member states of the European Union for different legal scenarios

At the timetable change 2020/2021, the operation of "noisy" freight wagons will be banned on the German rail network. The study determined the necessary needs for retrofitting composite brake blocks including the associated costs for the years 2018-2021 for various legal scenarios.
November 2019, 120 pages, PDF, 13 MB. Available: Abstract (EN) and Summary (EN).

Report 2018-11

Determination and risk assessment of rail-related invasive species

Numerous alien plant species occur on transport verges and preferably spread along transport routes. Some of these species can threaten biodiversity, cause high economic costs or can be a risk to human health. The objectives of the study is to investigate current and future invasive species along railroads that cause increased maintenances effort.
March 2019, 654 pages, PDF, 9 MB, doi: 10.48755/dzsf.210026.01. Available: Abstract (EN)

Report 2018-10

Effects of maintenance measures at railway tracks on sand lizard and common wall lizard populations

Rail way tracks are suitable habitats of protected lizard species. In this study, the potential threat for sand lizards by mechanical ballast cleaning has been studied. The findings give first hints to mitigation actions
September 2018, 79 pages, PDF, 21 MB, doi: 10.48755/dzsf.210027.01.

Report 2018-09

Aerodynamic effects on noise protection galleries

In this study, calculation approaches for the reliable dimensioning of noise protection galleries were to be developed, with which the train-induced aerodynamic effects can be calculated. As a result, an analytical load model for a dynamic analysis of noise protection galleries could be developed, which describes the distribution of aerodynamic pressure-suction loads on the wall and roof area of the noise protection galleries by mathematical functions. The load model was validated for the case of simple noise protection galleries by comparison between model and simulation as well as by measurements.
November 2018, 109 pages, PDF, 5,4 MB, doi: 10.48755/dzsf.210028.01.

Report 2018-08

Analysis of railway regulations with regard to the expected climate change

The aim of this project was to review the regulations, standards and policies governing railway operations today with regard to potential dangers due to climate change. The selected regulations for the different areas were systematically reviewed with regards to certain climate impacts. Relevant sections were identified, extracted, assessed and the recommended actions noted. The results are collected in standardized tables. The overall objective is to consider extreme weather events, as well as gradual changes in the climate, within the planning phases of infrastructure, energy and safety as well as vehicles.
March 2019, 259 pages, PDF, 5 MB, doi: 10.48755/dzsf.210029.01. Available: Abstract (EN).

Report 2018-07

Standardisation of frame Structures

The aim of the project was to create standardised planning documents for frame structures. These documents now exist for the spans of 80% of the bridges in the DB Netz AG network. This project extended the planning documents to include clear spans of 10 m - 16 m.
April 2023, 98 pages, PDF, 5,5 MB, doi: 10.48755/dzsf.230005.01

Free access under:

https://www.dzsf.bund.de/DZSF/DE/Forschungsergebnisse/Forschungsberichte/forschungsberichte_inhalt.html

Contact:

Deutsches Zentrum für Schienenverkehrsforschung
beim Eisenbahn-Bundesamt
August-Bebel-Straße 10
D-01219 Dresden
Fon: +49 351 47931 199
E-Mail: forschung@dzsf.bund.de
Web: www.dzsf.bund.de