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The masculine form chosen in the text always refers equally to female persons.
A duplicate term was dispensed with to enhance readability.

asfinag.at

ASFINAG

insight outlook

Research, development and innovation at ASFINAG

ASFINAG

Fit for the future through innovation

Research, development and innovation make an important contribution to the ongoing improvement of our core tasks in operations, construction of roads and tolling and help us to continuously optimize our interaction with society and the environment. Against the backdrop of global trends such as digitization, automation and sustainability, new solutions are being developed through various projects and cooperation. In this context, ASFINAG introduces specific questions into the community and contributes its specialist technical know-how. As far as possible, ASFINAG supports test operations to examine innovative products for their suitability for practical use directly in the route network.

The aim is to bring innovations that deliver improvements quickly on route for the benefit of our customers and also to constantly improve the workflows of our employees. Together we make ASFINAG fit for the future!

Contents

4 trend fields indicate the direction for research, development and innovation.

The aim is to achieve the most efficient and strategic orientation of ASFINAG's activities in all ten areas of innovation. To ensure this, each individual measure is identified through a filter of four larger trend fields. After all, these are decisive for making ASFINAG fit for the future.

Trend field Automation

The process function, in particular the control and regulation tasks, are increasingly being transferred from humans to artificial systems. At ASFINAG, we also try to automate processes at the right places to be able to best adjust current operations to the challenges of the future. The use of sensors and quality assurance algorithms, automated image processing and robotics are just a few examples.

But the automation of road traffic is also of primary importance for us as infrastructure operators. How will this development change the Austrian transport system? What are the requirements for the future (digital) infrastructure and how will the reliability and security of the new systems and technologies be ensured?

All these questions will influence our activities in the coming years. Only by coming up with the right answers will we be able to offer our customers the best long-term service and perform as a reliable partner in the overall transport system.

Trend field Digitalization

Networking, speech recognition, the use of drones – digitalization! in road traffic and infrastructure management encompasses many topics, because of the huge potential offered by digitalization. We have already been surrounded by a wave of digitalization from the implementation of the digital vignette, the simplification of planning and construction through digital platforms to data acquisition via various sensor systems in operation and numerous technologies in the field of traffic information.

It is important to ensure effective data fusion and integration and that the opportunities offered by digitization are carefully scrutinized from the perspective of benefits. Data graveyards, data silos and security gaps regarding business-relevant data must be avoided to ensure the sensible and future-proof conversion of systems with sustainable benefits.

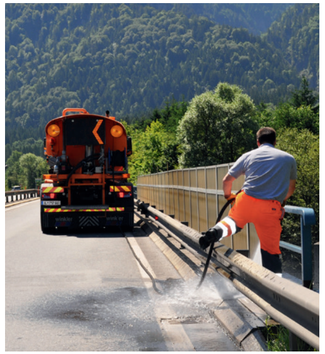
Trend field Sustainability

The steadily increasing importance of sustainability and climate protection means that ASFINAG has meanwhile developed into a trend field of innovation. Firstly, in the long term we are preparing to abandon fossil fuels. In addition to the conversion to alternative drive systems in the ASFINAG vehicle fleet, this also means the provision of the essential infrastructure along our network, such as electric filling stations and fast charging stations, and also the installation of electrical connections for the refrigeration units of refrigerated HGVs at rest areas.

However, the issue of sustainability cannot be reduced to decarbonisation. We at ASFINAG also try to make our contribution as a road operator in the areas of noise protection, minimization of air pollutants, waste management, energy efficiency, etc., to ensure the harmonious coexistence of traffic and the environment, and to develop our activities in this respect.

Trend field Efficiency

To be a successful motorway operator in the long term, attention must of course be paid to efficiency in each individual activity. In the fields of research, development and innovation, there is therefore a clear objective to contribute to the cost effectiveness and efficiency of ASFINAG and to promote further development in the individual thematic areas. In addition to targeted project initiations, for example to improve the life cycle costs of individual maintenance groups, we also apply this approach through increased cooperation with other organizations and international networking and cooperation.



Targets for Research, Development & Innovation

The use of new digital technologies in planning and construction enhances project quality and efficiency in construction and aids the subsequent operation. New materials and construction methods are being deployed to build robust structures in new buildings and renovations with short construction times. This is performed under the premise of low environmental impact and optimized life cycle costs.

Topic responsibility:
Michael Steiner

Trends:
» Efficiency
» Digitalization
» Sustainability

Construction

insight

Life cycle in the foreground

Challenge:
Civil engineering structures (bridges, tunnels) and road surfaces as well as wayside equipment are exposed to high traffic and environmental loads. This results in high construction and maintenance costs as well as often a limited service life.

Solution:
New technologies for quality assurance, new materials and construction methods as well as optimized dimensioning improve the life cycle costs of our structures and contribute to increasing road safety and availability. Construction and maintenance processes are examined from the point of view of resource conservation to minimize the environmental impact of road construction and operation.

today

- *Measures to improve the surface properties of road surfacing with a focus on permanent noise reduction*
- *Use of resource-optimized concretes in engineered structures*
- *Optimized tunnel equipment*
- *Integral bridges as a recognized method of construction in new and upgrading existing bridges*

yesterday

- *Resource-conserving superstructures (increase in the portion of recycling material in the case of asphalt)*
- *First findings with regard to integral bridges*
- *Fire protection in tunnels*

outlook

tomorrow

- *Comprehensive analysis of tunnel equipment and structure design with regard to optimized road safety (brightness, etc.)*
- *Development of durable and low-wear components and equipment*
- *New economic improvement measures for prolonging the service life of bridges*
- *Increased use of semi-finished parts and rapid repair procedures to increase availability*
- *Consideration of the effects of climatic changes on buildings and materials*

Life cycle in the foreground

- The ASFINAG network is characterized by robust, low-maintenance and resource-optimized structures.
- The dimensioning of structures and road surfaces is based on the serviceability and actual load.
- The use of materials and construction methods is in line with our understanding of sustainability and efficiency and is optimized in terms of life cycle costs, environmental impact, road safety and availability.
- ASFINAG is involved in relevant organizations to be able to transfer the knowledge gained into future rules and regulations.

Asset Management

Targets for Research, Development & Innovation

The recording and evaluation of the condition of various assets (road, bridge, tunnel, etc.) are developed and optimized.
Optimized forecasting models and management systems ensure that the asset is maintained in best condition in the medium and long term, and optimize maintenance requirements at network level.

Topic responsibility:
Christoph Antony

Trends:
- » Efficiency
- » Digitalization
- » Sustainability
- » Automation

insight

Asset management of the future: Optimization of condition monitoring and management systems

Challenge:
Forecasting models and management systems in Asset Management are essential for clear and efficient medium and long-term planning. At present, individual systems exist for the respective maintenance groups (bridge, road, and tunnel), or systems are not yet established for some facilities and no forecasting models are available.

New technologies (e.g. sensors, drones) are constantly being offered on the market to support condition monitoring. Efficient use must be evaluated in this respect.

Solution:
Existing inspection methods are redefined or optimized on the basis of innovations coming onto the market to ensure the required level of detail in facility evaluation and to combine them into essential control parameters for management via databases and forecast models.

today

- *Tests for the use of new technologies (e.g. drones, laser scans, fiber optic sensors)*
- *Focus on condition development and assessment of structural engineering*
- *Continuous enhancement and further development of database systems*
- *Implementation of (improved) forecasting models*

yesterday

- *Focus on condition development and assessment of road surfaces*
- *First pilot projects to further develop the conservation strategy*

tomorrow

- *New, efficient technologies to support condition monitoring*
- *Use of reliable forecasting models*
- *Use of reliable forecasting models and representation of network condition development using suitable KPIs*
- *Cross-thematic cross-asset management*

outlook

Asset management of the future: Optimization of condition monitoring and management systems

- Open questions regarding material and object behavior are described in detail and flow into the assessment of the facility condition.
- Database systems and forecasting models form the basis for integrated cross-asset management.
- Optimized control parameters (KPIs) make it easier for management to make decisions as part of the medium and long term planning.

Targets for Research, Development & Innovation

The aim is to develop / optimize products and processes required for operation to create the best possible conditions for employee, customer and environmentally friendly winter and summer service – with particular attention to cost-effectiveness.

Topic responsibility:
Heimo Berghold

Trends:
» Efficiency
» Digitalization
» Sustainability
» Automation

Operation

insight

Focus on availability and further increasing efficiency

Challenge:
Problem definition: The operation deals with a large number of separate topics. In addition to the core tasks of the route service in winter and summer, this area of responsibility also includes a number of maintenance tasks and the fulfillment of environmental regulations, etc.

Solution:
Procedures, processes and facilities are to be reviewed and further developed step by step or on a case-by-case basis taking into account planned changes in legislation with a view to increasing efficiency and optimizing handling (safety of employees, digital tools, etc.).

yesterday

- *Optimization of winter services (spreading guide) and tunnel cleaning*
- *Development of black ice models*

today

- *Automatic salt reserves measurement*
- *Slow-growth planting and alternative weed control*

tomorrow

- *Support of operational processes using automation (automated salt logistics, tunnel lamp washing vehicles, mowing robots etc.)*
- *Use of mobile devices (tablets) to increase efficiency in maintenance work and route service*
- *Answers for dealing with neophytes*

outlook

Focus on availability and further increasing efficiency

- Maintenance tasks are supported as far as possible by automated processes.
- Tablets enable the retrieval of relevant information for route services outside the motorway maintenance depot.
- The activities to be performed are in line with our environmental responsibility and the safety of our employees on the route.

Targets for Research, Development & Innovation

The safety, availability, efficiency and sustainability of our electromechanical facilities are being improved by the development and use of new technologies.

Topic responsibility:
Klaus Schinagl

Trends:
» Efficiency
» Digitalization
» Sustainability

Electromechanical Facilities & Maintenance

insight

High quality & energy efficient facilities and applications and use of renewable energy sources

Challenge:
The focus is increasingly on electromechanical facilities, particularly with regard to energy consumption and quality control. In many cases, technological developments are so rapid that it is difficult to compare the products available on the market, especially in terms of life cycle costs.

There is a need for research and further development in the field of LED technology and the development of suitable measurement methods for reflection properties.

Solution:
Energy efficiency shall be increased using optimized systems (focus on tunnel lighting), on-site measuring devices are to be developed for quality assurance and optimization of energy consumption of installed products, and alternative energy sources are to be developed to cover increased own requirements.

today

- *First pilot projects for generating energy from ongoing operations*
- *Optimization of tunnel passage lighting by verification light variables*

yesterday

- *Higher energy demand through continuous improvement, in particular regarding tunnel equipment*
- *Use of LED tunnel lighting as standard*
- *First tests for energy self-sufficient operation of facilities e.g.: Traffic control systems (VBA)*

tomorrow

- *Technical innovation in terms of integrating energy efficiency*
- *Support eMobility (charging infrastructure, charge while driving, etc.)*

outlook

High quality & energy efficient facilities and applications and use of renewable energy sources

- Energy efficiency is being established in all areas and technological developments are being pursued in this direction.
- Quality assurance and comparability of the products with regard to efficient life cycle management are achieved through targeted measurement procedures.
- Self-sufficient energy facilities are transferred from pilot projects to standard.
- The additional energy requirement due to eMobility will present us with new challenges.

Targets for Research, Development & Innovation

Operational agendas are supported by reliable, high quality and economical sensors (tools) as well as automated and easy to understand evaluation. Traffic incidents such as traffic jams, drivers travelling in the wrong direction, stationary vehicles and slow-moving vehicles are reliably detected.

Topic responsibility:
Bernhard Schalko

Trends:
» Digitalization
» Automation
» Efficiency

Sensors & Incident Detection

insight

High-quality sensors and innovative traffic detection

Challenge:
There are many different types of sensors, including more than 8,000 video cameras. A pre-selection of the alarm messages relevant for the operator and the motorway supervisor is to be made. Defective or incorrectly measuring sensors will be proactively detected and the interference suppression process initiated.

To provide the best support to the operation, the incident detection rate must be as high as possible and false alarm frequency kept as low as possible.

Solution:
Optimization of the systems after trial run and handover to the operation is absolutely necessary. In some cases, a sensor fusion as well as the exchange of information between the systems (e.g.: light switching in the tunnel is signaled to the video detection system) would be useful.

A tool for the operational monitoring of data availability and data quality of the sensors and cameras will also be created to keep the availability and quality of the systems high.

yesterday

- *No integrated systems*
- *Individual sensors on the route for environmental and traffic detection*
- *Video cameras as support for traffic monitoring*

today

- *Detection of incidents directly by the camera (smartcam)*
- *Test field for comparison and measurement of the environmental data sensors available on the market*
- *Combination of video alarms with audio (acoustic tunnel monitoring)*
- *First trials to detect traffic using ground based radar*

tomorrow

- *Provision of traffic and environmental data for automatic driving*
- *Automatic detection of unclear image, artifacts, aging of the cameras*
- *Creating a possibility for operators to evaluate quality and therefore create a control loop for optimization of the detection process*
- *Sensor fusion*
- *Use of mobile sensors of the ASFINAG road fleet*

outlook

High quality sensors and innovative traffic detection

- Sensor fusion for increased reliability of automated incident messages supports operation.
- Provision of traffic and environmental data for automated driving.
- Data collected through the infrastructure is compared and blended with vehicle data.

Targets for Research, Development & Innovation

The use of innovative measures is intended to increase the flow of traffic while paying particular attention to economic efficiency, resource conservation and high customer satisfaction.

Topic responsibility:
Christoph Wruß

Trends:
» Digitalization
» Efficiency

Traffic Management

insight

Increased availability without structural capacity expansion measures

Challenge:
Technical, organizational and innovative measures must be in line with acceptance, economic benefits and structural and legal framework conditions.

Solution:
The development of easily implementable, system-compatible applications with demonstrable benefits as well as long-term system changes that are understandable for customers.

today

- Traffic Manager Vienna and Linz
- Traffic control by providing traffic information
- Free flow weight measurement (WIM) and width measurement for special transports

yesterday

- Emergency corridor
- Trucks > 7.5t banned from driving as from the third lane upwards
- Pilot project inflow control (intelligent traffic lights) on the A7 motorway near Linz Franzosenhausweg

outlook

tomorrow

- Intelligent mobile information system (IMIS)
- Hard shoulder running
- Lane splitting

Increased availability without structural capacity expansion measures

- Intelligent mobile information system (IMIS):
  The existing traffic telematics infrastructure will be supplemented by mobile information systems, which can be set up and operated in a fast and targeted manner precisely for traffic control.
- Hard shoulder running: The effects of measures such as releasing the hard shoulder for driving will be investigated.
- Lane splitting: Traffic lanes in metropolitan areas are flexibly added or removed in accordance with the heaviest traffic flow direction (morning or evening rush hour) by shifting the structural center separation.

Targets for Research, Development & Innovation

ASFINAG is a recognized and leading provider of content for traffic and travel information (in Austria).

Topic responsibility:
Martin Müllner

Trends:
» Digitalization
» Automation

Traffic Information

insight

Personalized across the entire road network

Challenge:
Different data sources are available to obtain travel time information. Heterogeneous data structure and availability, different methods of information generation (sensor technology, floating car data...) and data protection regulations make it difficult to achieve a uniform quality standard for traffic information throughout the country.

Solutions:
- An "incentive service" is being developed to encourage end customers to use and collect data (user generated content).
- Project activities are performed jointly with numerous relevant stakeholders (states, ITS organizations, ÖAMTC, BMI etc.).
- Increased knowledge of the required data penetration rates to achieve reliable traffic information content.

today

- *Established traffic information Austria*
- *Deriving travel times from FC data*
- *First trials with cloud services*
- *Data generation via ASFINAG App (Kompagnon)*

yesterday

- *ASFINAG traffic situation*
- *Initial determination of travel time forecasts*
- *Pilot projects for the use of floating car data (FCD)*

tomorrow

- *Austria-wide provision of traffic situation information and travel times on the overall network*
- *Austria-wide incident reports (construction sites) and traffic reports on the overall network*
- *Improvement of travel time forecasts through linking with the lower-ranking network*
- *Personalization of traffic information*
- *Optimal integration of user generated content (FCD, Car2X, Cloud Services)*

outlook

Personalized across the entire road network

- User generated content is integrated in the creation and validation of traffic information (use of vehicles as sensors, use of the driver as a source of messages, networked vehicles, etc.) in a standardized way.
- Austria-wide traffic situation and travel times for the entire transit network including incident messages are available.
- There is a reliable travel time forecast on the A+S network.
- Traffic information can be personalized for different user groups.

Targets for Research, Development & Innovation

Road traffic automation must be accompanied by active cooperation between road operators and vehicle manufacturers and suppliers, to coordinate the different needs of all stakeholders from the outset to deliver the expected positive effects for the overall road traffic system.
The direct exchange of information between vehicles and road operators is a basic prerequisite for achieving the objectives set out above.

Topic responsibility:
Jacqueline Erhart & Marko Jandrisits

Trends:
» Automation
» Digitalization
» Efficiency

Cooperative, Connected & Automated Driving

insight

Networking with the vehicle to exchange information and support for the introduction of automated driving functions

Challenge:
New technologies (e.g. ETSI ITS-G5 and, from 2020 onwards, 5G mobile networks) will open up new possibilities for data exchange between vehicles and infrastructure, giving access to new applications that are grouped together under the term cooperative systems. Applicability and harmonization must be ensured across the various vehicle brands and national borders.

Testing automated driving functions is time-consuming and costly. Efficiency can be enhanced by supporting such tests with infrastructure-based information (e.g. overall traffic overview).

Solution:
The development of technology expertise at ASFINAG and participation in corresponding projects and activities should contribute to closing the development gaps in vehicle / infrastructure communication. A corresponding test track is to be implemented for the simulation of mixed traffic (automated / non-automated) and for testing various traffic scenarios in real traffic.

Active participation in the committees at EU level as well as national and international test fields in the environment of cooperative, connected and automated driving is aimed at.

yesterday

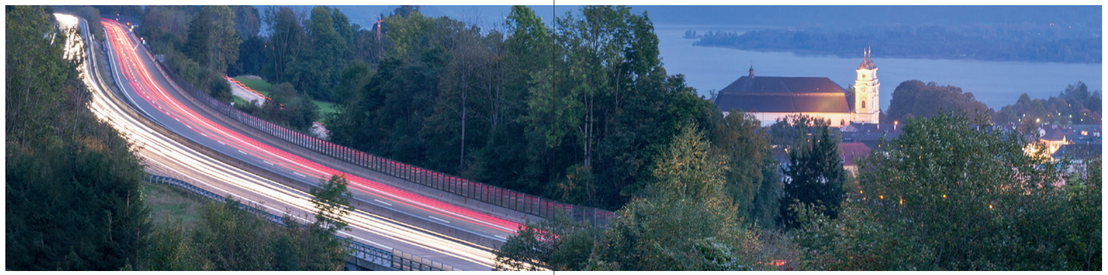
- *Traffic information etc. on the route available for all in the same quality*
- *First steps in the field of communication between road and vehicle*
- *Use of unique technologies for information transfer*

today

- *Standards for direct communication road/driver/vehicle*
- *Different systems make use of different transmission technologies*
- *Numerous organizations deal with open issues on a national and international level*

tomorrow

- *Supplementation of the systems in the vehicle and on the road through hybrid technologies*
- *Road qualification for automated driving functions*
- *Updating of HD maps – incl. inputs from infrastructure viewpoint (e.g. construction site layout)*



outlook

Networking with the vehicle to exchange information as support for the introduction of automated driving functions

- The experiences from different test fields are combined to a consistent overall result.
- The exchange of information between vehicle and infrastructure is mutually established.
- ASFINAG is consistently fulfilling its role as a road operator with regard to the introduction of automated driving.
- The different technologies are used in an optimized overall technology mix.

Toll

Targets for Research, Development & Innovation

The focus is on supporting the modernization of the GO toll systems and creating a generally user-friendly tolling system.

Topic responsibility:
Franz Hlava

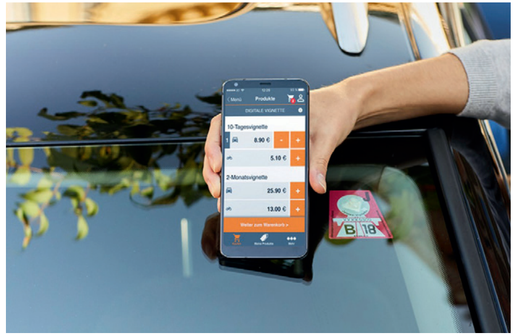
Trends:
» Digitalization
» Sustainability

insight

Automated video enforcement and license plate based tolling as a support during modernization of the GO toll system

Challenge:
For the modernization of the GO tolling system (GO-Maut 2.0), the basic priciple of the obligatory onboard unit and the existing enforcement concept are retained.

Solution:
For a user-friendly tolling, an innovative, convenient and modern alternative to the toll sticker is introduced on the basis of license-plate based tolling with the digital vignette.



yesterday

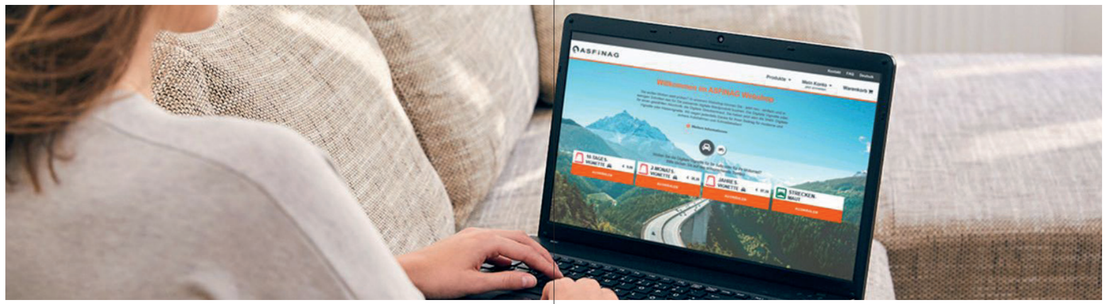
- *Vibration reduction in overhead constructions*
- *Design of information signs at main toll stations*

today

Introduction of the digital vignette, based on the concept of license plate tolling

tomorrow

Continuous monitoring of technological development



outlook

Automated video enforcement and licence plate based tolling as a support during modernization of the GO toll system

- Ongoing technology monitoring of existing and new enforcement concepts and license plate recognition software is being introduced.
- Infrastructure and services are optimized (through toll and ITS).
- A greater number and more individual combination products in the toll area.

Targets for Research, Development & Innovation

A "Safe System Approach" is known and practiced in all areas of ASFINAG, with the focus on reducing the risk of accidents and injuries.

Topic responsibility:
Bernhard Lautner

Trends:
» Sustainability
» Digitalization

Road Safety & Road System

insight

Safe system & behavioral science

Challenge:
The limits of human performance and load are confronted with technical and legal requirements.

Solutions:
- The "Safe System" will be developed at all levels.
- The findings from human factors and traffic psychology are taken into account in studies and guidelines.
- There are guidelines with comprehensible evaluation backgrounds and decision bases.
- The technical developments are used for design and assessment (e.g. visualization, simulation).
- User groups and their properties are described as the basis for communication and policy work.

today

- *Differentiation of user and behavioral groups*
- *Networking of topics and new technologies*
- *Development of automated and more resource-saving enforcement equipment for various offenses*

yesterday

- *Individual topics such as fatigue, drivers in the fast lane, drivers traveling in the wrong direction, etc.*
- *Basic studies on elements of road equipment, accident analysis and safety management*

outlook

Safe system & behavioral science

- The interaction analysis of all topics and measures is given.
- There is acceptance for extensive and automated enforcement.
- Direct communication options for driving behavior.
- There is a conscious system delimitation, also for users and vehicles.
- The road-vehicle-human system should be put into practice in all areas without significant contradiction.

tomorrow

- *Direct communication with users regarding behavior*
- *Guidelines and standards as a link to the system participants*
- *Development of regulatory mechanisms for an effective and accepted traffic control*