

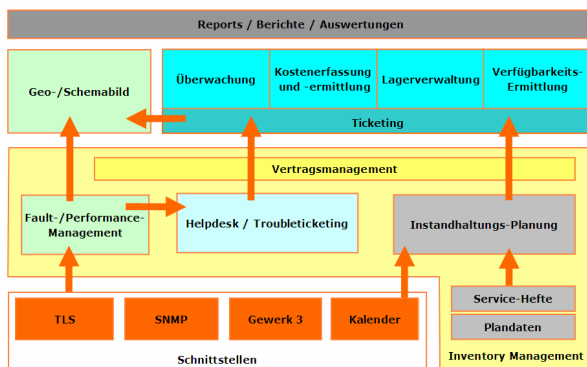
# PSItraffic- traffic's control system

Functional reliability and maintenance management for the geographically-spread transport infrastructure.

## Overview

Increasing traffic volumes in Europe require intelligent solutions in the telematics sector. Networks spread over large geographical areas require telematics systems with multiple functions and services and result in complicated challenges for management and maintenance.

The desired level of integration for process monitoring and maintenance management highlights the limits of conventional solutions and of systems present on the market, and presents the opportunity to implement a completely new holistic approach.



Picture 1: PSItraffic functions modules

## Austrian nationwide traffic telematics

The ASFINAG (Austrian Motorway Company) is the body that builds and operates in the whole of Austria all traffic telematics systems and motorways and clearways. These systems are spread in a route network that spans about 2200 kilometres across the whole country. Some 200 kilometres of network run through bridges and tunnels. In addition to the telematics systems, there are also as part of the networks many operational facilities, in particular as regards tunnels.

The array of telematics systems ranges from the simple traffic data collection thanks to detections systems for traffic management systems with video technology and environmental data, to systems to implement traffic information services.

These include a variety of data transmission systems as well as centralised and decentralised

IT systems. In particular in the field of traffic telematics, i.e. traffic data collection and traffic management and the associated services, a very complicated and divided landscape made of varied systems linked to one another emerged within a short period of time.

The facilities are based and are communicated on the basis of different protocols and interfaces (standardised and open norms as well as proprietary definitions).

For a process that is spread over the whole country, fast and reliable fault detection using personnel on the network is not economically viable.

Simple monitoring of the system's operating status for errors is also insufficient.

What is needed in fact is a comprehensive maintenance management system:

- The operational processing of maintenance, also emergency-led storage and damage recovery as well as
- Preventive maintenance, which includes not only the control of the execution of regular maintenance and inspection of the facilities, but also the support of the associated planning processes for these activities.

## 2. Requirements

The requirements analysis outlines the following priorities for the operation and maintenance of this infrastructure:

- Fast and reliable collection of operation status data, in particular of faults data in real-time
- Collection of the measured values for the connected facilities and level monitoring
- Flexible interfaces and their modular ability for supplement and extensibility
- Dispatch of the messages to the appropriate equipment for maintenance handling using ticketing
- Centralised database for
  - a. Facilities inventory,
  - b. Contract data,
  - c. Organisations,
  - d. Operational maintenance measures as well as planning data for preventive maintenance
- Consistent service, graphic and textual representations
- System operation by different users at geographically-spread locations
- Availability of the system (if required) well above 99%

The current diversity in requirements cannot be covered with the „Standard MMS components“ (Maintenance Management System) to the extent that is required.

In the transport sector, but also in other sectors dealing with shared infrastructures, there are no solutions available for these requirements.

For the task at hand, there is a need for a system which meets the technical, economic and organisational objectives and offers the basis of existing software that has already been proven successful in the project management of large networks/process critical to companies.

**PSItraffic**, the process control and management system of the PSI group, meets the proposed objectives.

It provides both process interfacing with the corresponding visualisation and the complete execution of the maintenance in a form-based system on the basis of an intersystem centralised data storage.

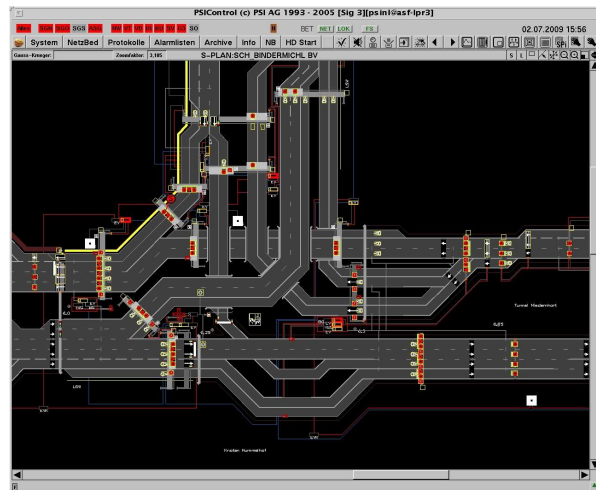
### 3. Implementation

When designing **PSItraffic**, in addition to the usual requirements for operational guidance, operating safety, redundancy and availability above 99%, there is particular emphasis on the seamless integration of all functions areas.

The operational control of nationwide traffic telematics facilities includes the complete TLS<sup>1</sup>-hierarchy, from the communication computer interface (KRI) through the control module (SM) up to the individual data terminal equipment (DE).

With the modelling of the TLS objects with the aid of physical, hierarchical and geographical relation points, a localisation of the individual DEs becomes possible in geography (coordinates or deployment) as well as in diagrams (picture 2, roads infrastructure).

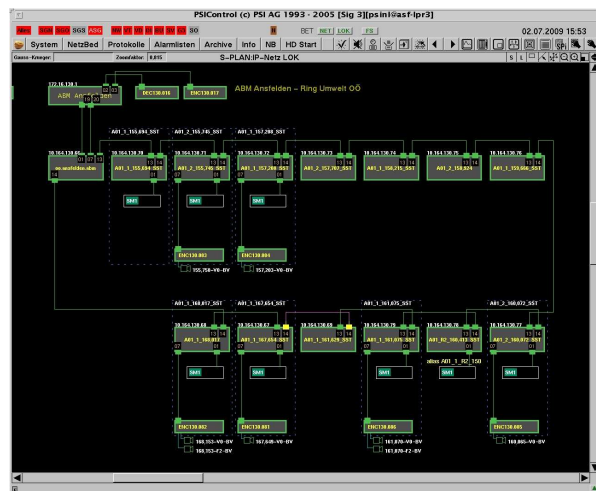
<sup>1</sup> Technical delivery conditions for the road stations 2002 (Federal Research Highway Institute, Bergisch-Gladbach 2002) – standard for control and communication in the field of traffic telematics



**Picture 2: Roads infrastructure**

The diagrams are developed from the automated conversion of detailed design documentation of the construction projects.

This does not only lead during project implementation to substantial time saving (no drawings „by hand“) but also helps optimise the operational phase with the enlargement and maintenance of routes.



**Picture 3: Schematic IT network**

Besides the strict telematics infrastructure, the video cameras for traffic monitoring will also monitor the server for the traffic control central and the nationwide IP network that ensures the smooth transfer of telematics data.

The modelling based on the typical and geographical relation points of the IT network is again the basis for a nationwide localisation of IP-based devices (picture 3).

Taking into the consideration the totality of transmissions from individual DE using SM, KRI, and then through router, switches, SDH network

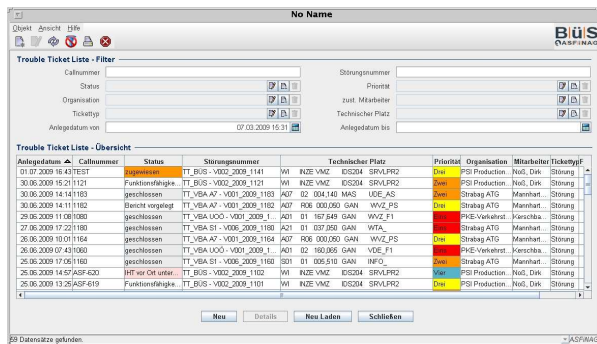
components up to the server and control stations, error or failure is not something that might occur only once.

In fact, the impact of a device failure will be completely identified and any errors resulting from it be presented as an after-effect. **PSItraffic** offers an effective discharge of operators from analytical duties thus allowing the personnel to concentrate on their actual job, namely the process control of interference suppression of the object in question.

With this cross-technological approach, one of the gaps previously encountered in the monitoring and maintenance of geographically dispersed and heterogeneous infrastructure is closed.

Through the complete integration of all functions in **PSItraffic**, a ticket for interference suppression can be automatically or manually created and applied from the alarm of the infrastructure monitoring.

In the opposite direction, the presence of a maintenance engineer on the site of the interference will be fed back from the interference component in the monitoring component. Actions by the technician on-site, which would result in an alarm, can be masked from the system and thus be differentiated from the „right“ alarms. This constitutes a substantial contribution to the discharge of the operation personnel.



Picture 4: Ticketing system

Thanks to the exact identification of the devices which are to be deamed or which are to be serviced, the relevant organisations, in this instance external contractors mainly, will be contacted and informed on the basis of contracts concluded on the object in question and of the incident that has occurred. (Picture 4, List of tickets)

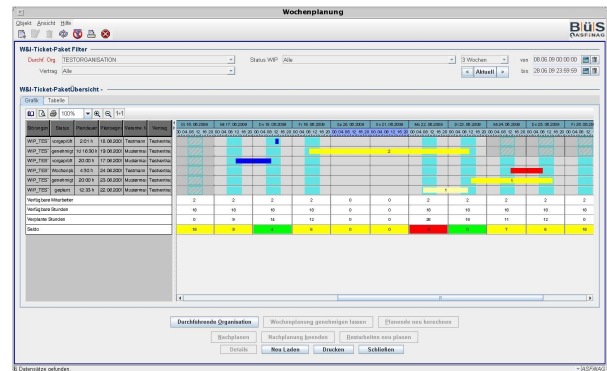
The periods agreed in the contract such as acceptance, start of operation and recovery time

will not only be automatically recorded but also checked by the system for compliance, documented and evaluated.

The planning for preventive maintenance will be done using a predetermined work plan, in which all service activities will be included together with their cycle time.

A yearly plan proposal will be automatically created by the system for each contractor and will then be submitted to a detailed planning by the contractor. From the approved year plan, a weekly plan takes shape with the allocation of resources (employee, equipment, storage equipment) (picture 5).

This must be approved by the ASFINAG for operational reasons before implementation. These processes can also be time-monitored by **PSItraffic** so as to neglect no maintenance interval.



Picture 5: Weekly plan

An essential element of the operational monitoring system is the powerful reporting component. These are on the one hand to meet the requirements for regular monthly/quarterly reports, and to offer also on the hand the flexibility required to create short-term customised reports for specific tasks.

Because the reporting will not only be used for accounts purposes, but also forms the basis for settlements with the contractors, the PDF format has been designed as the output format.

#### 4. Prospects and potential

The proposed system has growth potential in the following directions:

- Quantity and content, i.e. connection to other telematics devices and network components, as well as telematics services. In addition, there are also the traffic telematics devices that are used to influence the traffic for environmental reasons.
- Additional areas of responsibility, i.e. expansion to other infrastructures (tunnels, toll systems, city centre facilities for energy distribution, ventilation, air monitoring, emergency facilities).
- Function expansion, for example acquisition of operation management tasks, controlling modifications in the process. The documented controls that were associated with the technical facilities would not be replaced, on the contrary **PSIticontrol** is able to perform cross-system monitoring functions.
- Workflow management and documentation duties as well as aspects of quality management.

Already today there are reserves for this. Thanks to the structured modular design of the system, it can be extended at any time.

A special feature of the design lies with the fact that the system's expansion can be done, in principle, with no interruption to the current operation, no matter whether it concerns the functional expansion of **PSIttraffic** or additional workplaces.

#### 5. Conclusion

With the concept of a maintenance management system integrated with an operational monitoring system, it was to enter a brand new territory. A similar concept was not previously assigned in the field of traffic telematics. The advantage is the clear separation of the operational management (traffic control) from the safety function required for the equipment and therefore of the related processes of emergency-based and planned maintenance acts.

PSI Production GmbH was able to meet the requirements of specified functions and processes with the integrated system approach which consists in facilities monitoring in real-time and workforce management for the maintenance. In addition the system design offers a high level of flexibility in terms of expansion of the system as regards enlargement of the quantity structure, acquisition of other task areas and addition of other functions.



Picture 6: **PSIticontrol**'s workplace

**PSIttraffic** has been successfully in operation with the ASFINAG since autumn 2008, completed with functions for preventive maintenance in the first quarter of 2009. In the first half of 2009, all the commissioned work, including associated tests and inspections, were completed in time.