A System Solution to Optimize The Maintenance Process

IRISSYS®

IRISSYS®

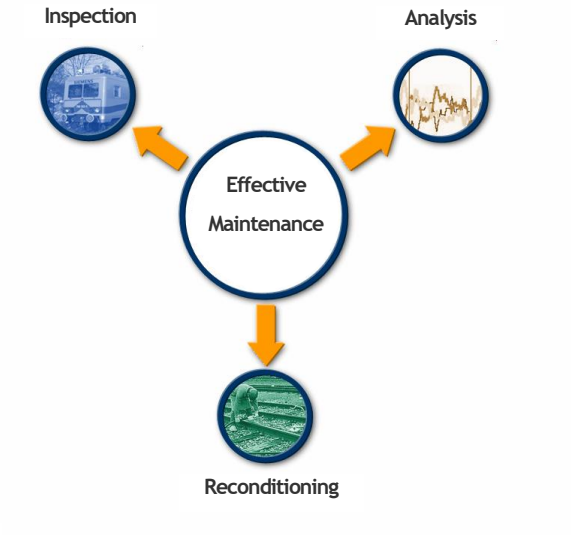
(International Railway Inspection and Services System)

IRISSYS®

1 Introduction

1.1 The Process of Maintenance

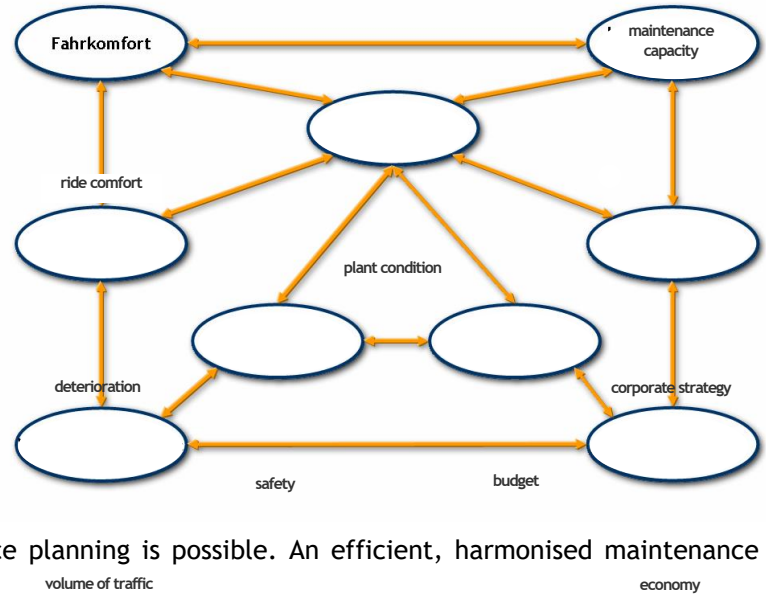
The economic maintenance of infrastructures is developing more and more into a global market. It is a key factor determining the efficient operation of the transport system, railroad. Maintenance mostly contains three main sections.



Inspection service is one of them. In this section high-tech measuring equipment is available. These instruments scan the whole infrastructure from subsoil up to catenary wires. The main focus of analysing and evaluating that data is to recognise dependencies between different impacts on infrastructure wear. This creates the basis for effective and economic maintenance.

1.2 The Task

Infrastructure could be named as basic resource of railway companies. This resource is a complex system of highly-developed elements including permanent way, substructure, catenary wires etc. The condition of this complex technical system is altered continuously and has to be maintained. A holistic approach is needed to fulfil the requirements of safety, reliability and maintainability for that complex system. There are many interdependencies between the factors shown in the drawing on the right.



A comprehensive analysis of inspection data is the basic requirement for keeping the target state of all parts of the infrastructure. This kind of approach enables infrastructure diagnostics. Out of the determined condition appropriate maintenance planning is possible. An efficient, harmonised maintenance

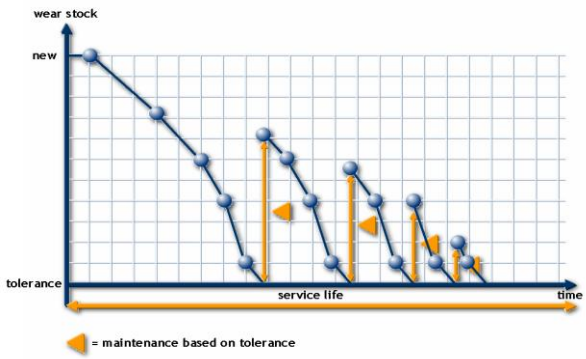
considers all interdependencies and minimises the intricacy of the whole operating process. Basically there are four strategies of maintenance.

Preventive Periodic Maintenance

The preventive periodic maintenance strategy's aim is to do foresighted workings, e.g. depending on the daily tonnage. The big disadvantage of that procedure is to do maintenance having no regard to the infrastructure's condition.

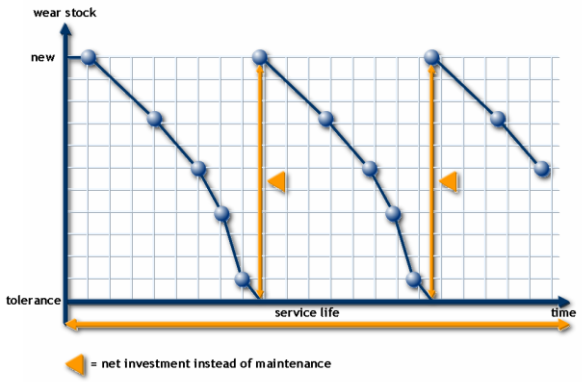
Corrective Maintenance

The threshold-oriented strategy only defines repairs, not until the infrastructure's condition is critical. These kinds of works are inefficient.



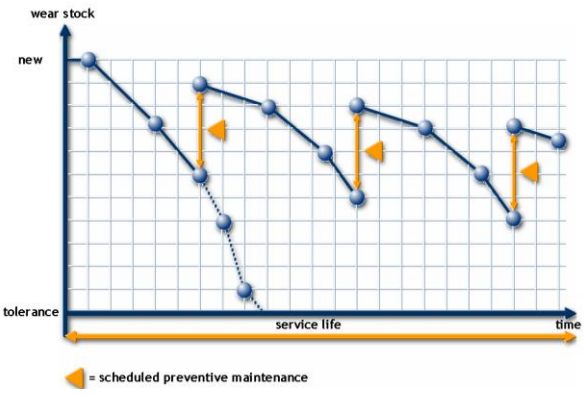
Maintenance at Breakdown

This 'strategy' means to replace infrastructure when it is out of order. This avoids all preventive or conserving measures. This is no real maintenance but destroying the funds.



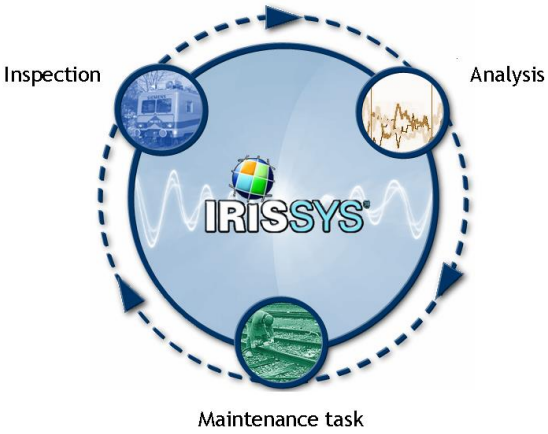
Scheduled Preventive Maintenance

The scheduled preventive maintenance aspires optimum asset condition in the long run. The executed preventive measures lead to minimum total costs and long life cycles. The job is to determine when to do what – defining dates and types of measurement tasks.



1.3 The Solution

To solve the complex problem described above, a comprehensive approach is necessary – a system that supports the whole process of maintenance. The software family **IRIS**SYS® (**I**nternational **R**ailway **I**nspection and **S**ervices System) is such a solution. It supports the mentioned process beginning with inspection running over analysis up to maintenance tasks.

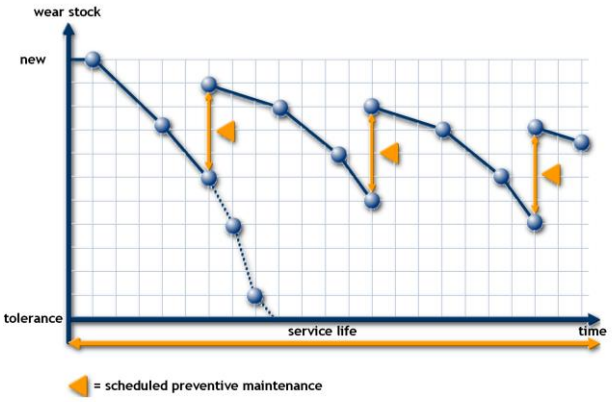


The holistic approach to the rail system in connection with all available data (measured data, asset data, pictures, tasks, etc.) within **IRIS**SYS® leads to the following results:

The interdependencies between all influencing factors for railway wear can be identified and evaluated.

IRISSYS® helps recognizing weak spots and it also shows causes for problems. **IRIS**SYS® supports for budget planning & controlling and maintenance planning & controlling. The system is able to hold all data regarding the infrastructure's condition. It works independently of the source measuring systems and infrastructures.

The idea of **IRIS**SYS® is to be flexible and appropriate for each department in the maintenance process. It is easy to configure the system for the real needs of a railway administration. At the same time it fulfils the requirements of the maintenance process running on their infrastructure. Thus **IRIS**SYS® creates a basis the scheduled preventive maintenance strategy.



1.4 Your Partner

The ERDMANN-Softwaregesellschaft mbH is an international software company. It was founded in the year 1994. Since that time the company holds contact to partners all over Europe. The main focus of the development is set to complex database solutions for infrastructure management. Several research teams are involved in infrastructure condition prognosis, maintenance optimisation and RailML. The ERDMANN-Softwaregesellschaft mbH has many years of experience in the field of software development for inspection systems, for saving and evaluating inspection data of several network-like structures.

2 Advantages at a Glance

Advantages in the Field of Inspections

- Universal import interface (Independency of measuring systems, data formats and infrastructures)
- Storage of all infrastructure data (asset data, inspection data, pictures, videos, measures, etc.)
- Illustration of infrastructure condition history
- Exact data positioning and storage
- Manual data input is possible (including user defined screen forms)

Advantages in the Field of Analysis

- Integrated condition analysis (analyses all parts of the infrastructure as a system) and flexible reporting features
- Analysis of condition histories and trends
- Ensured availability of data history via atomic transactions
- Programming and configuration environment for flexible creating and adoption of analyses and evaluation procedures (Visual Programming Interface – VPI)
- Integration of electronic maps with AutoDesk Map® and interfacing ESRI services via the integrated GIS-viewer
- All analyses are available as diagrams, maps and reports
- Utilisation of authentic procedures of the Digital Signal Processing via LabVIEW® interfaces

Advantages in the Field of Maintenance

- System-supported optimisation of the maintenance process
- Easy to handle maintenance task planning with user defined screen forms
- Generation of workflow documents out of planned maintenance tasks
- Condition prediction via Neural Networks with NeuroSolutions®
- Easy to handle trend analyses
- Automatic calculation of Key Performance Indicators and other quality numbers for network-wide maintenance control
- Administration for all maintenance tasks in one software system

Technological Advantages

- Reliable network-wide processing of mass data
- Compatible to metric and imperial scale units
- Transparent architecture with access control and reporting features for all companies working in the process of maintenance
- Easy to port to several infrastructure networks
- Ergonomic user interface with intuitive handling
- Functional segmentation to multiple **IRIS**SYS®-servers suitable for the organisational structure
- Easy to handle user rights management
- Scalable functionality powered by **IRIS**SYS®-plugins and open standard interfaces
- Integration of Crystal Reports® for all reporting features

3 IRISSYS® - Solutions

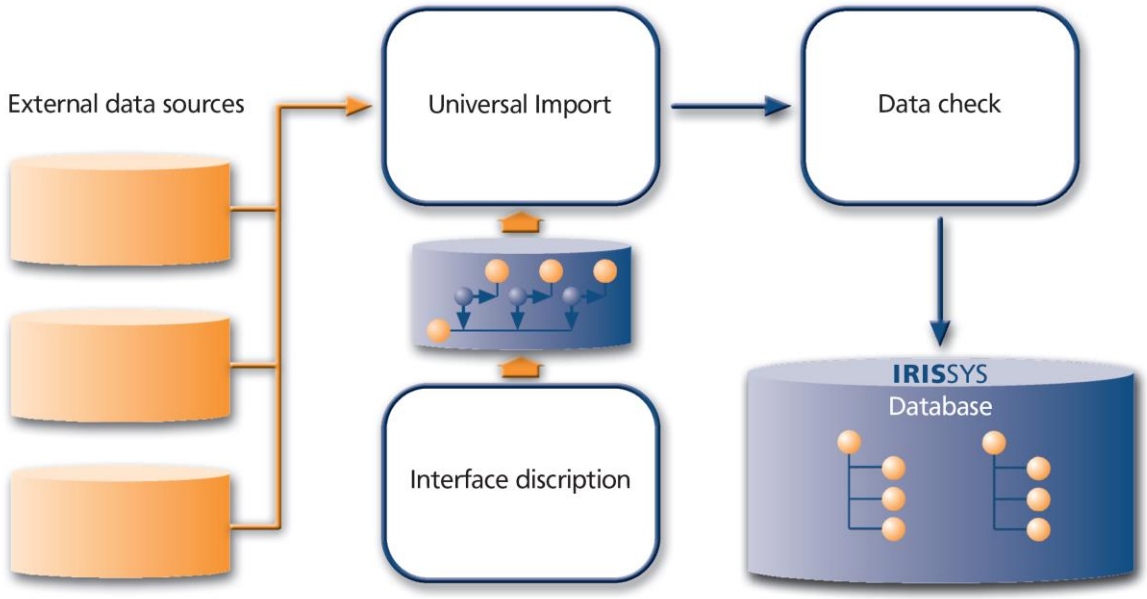
3.1 Inspection Data Management

There is a central problem in the field of inspection and processing of survey data. All data of a network have to be represented in one standardised database system. That is the only way to ensure an efficient and error-free data evaluation. This seems to be very difficult because of the multiplicity of used inspection systems and interchange data formats. In addition to measured mass data this also plays a role for all other relevant information (e.g. asset data). To avoid increasing time effort and costs for program modification, a high flexibility against updates and changes of the data structure is required.

The **IRIS**SYS® inspection management system offers well-engineered solutions for the described problems and tasks. To emphasise the meaning of the effective and flexible data management and import the most important features are described in detail below.

Data Import (Universal Interface)

The enlarging variety of manual and automatic measurements of infrastructure parameters and the big amount of asset data have to come into the **IRIS**SYS® database system. This process is supported by the adjustable **IRIS**SYS® import interface. It understands a large number of data formats e.g. ASCII-files, XML-files, relational databases and streams.



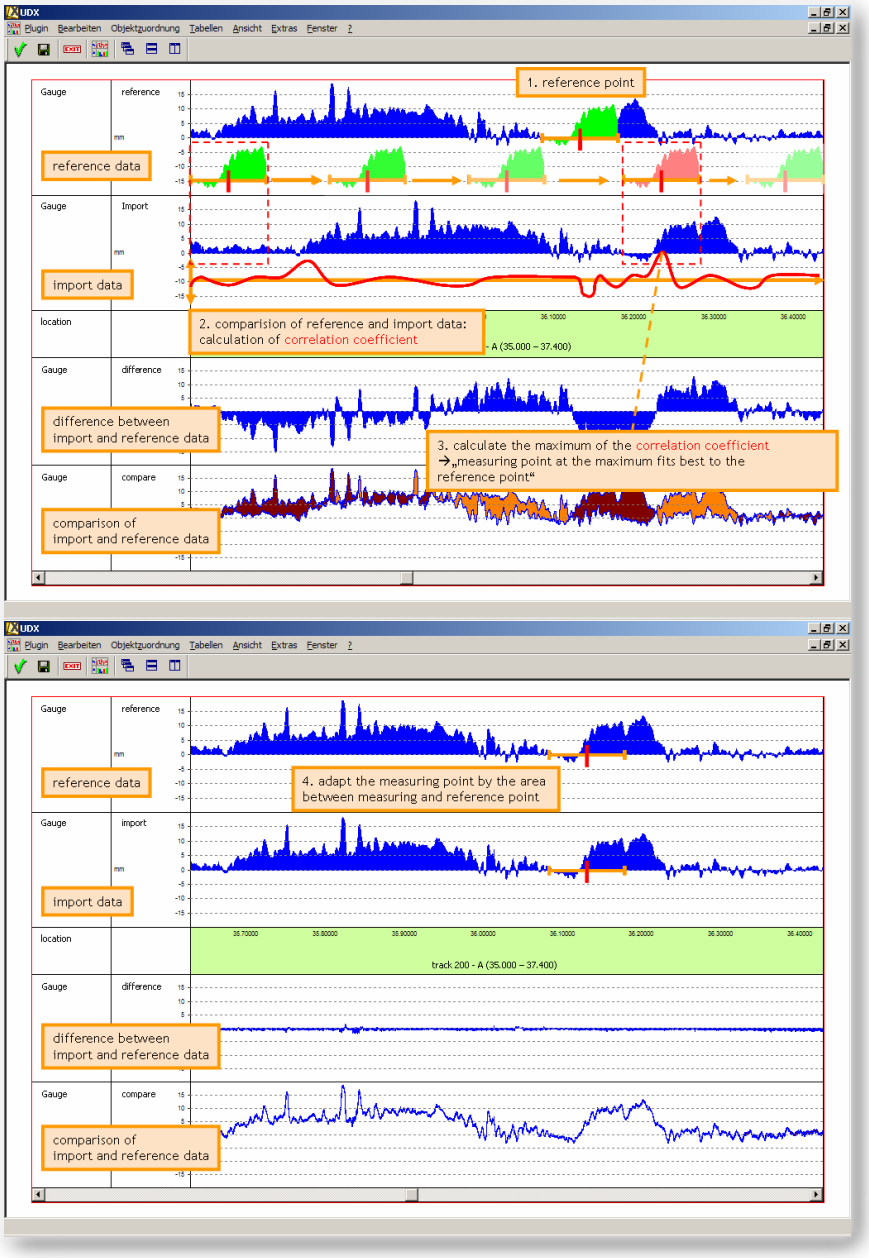
Exact Data Positioning

The most important basic requirement for correct analyses and views is the exact positioning of data in the database. This is ensured by the multi-level positioning system.

The position of infrastructure data is determined via GPS-coordinates, real names (string identifiers) and correlation with existing reference data.

In the picture on the right the principle of correlating data by a reference is shown.

The idea is to determine that part of import data that (mathematically) fits best into the reference.



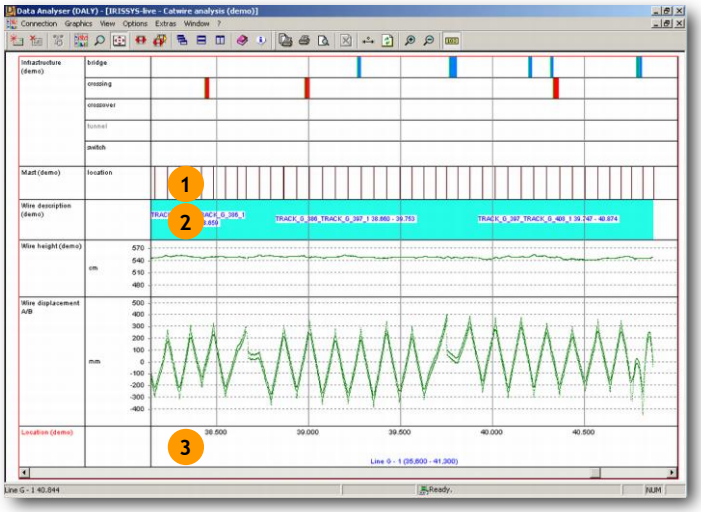
Storing Single Values

On the basic system level of **IRIS**SYS® a generic database is working. This model makes it possible to store all the different data formats. Furthermore this storage strategy ensures safe archiving of several data structures in almost any quantity. Raw data (1) like single values coming in short intervals (e.g. 0.16 m) can be stored as well as non-array values (2).

Chronological Data Storage

The chronological data storage allows the reproduction of local and chronological histories (1). All changes at the infrastructure itself are stored in their time order. The system maps all condition data to that altering infrastructure information. The system offers a history tracing for all objects.

Framework element	From	To	Event
Track E - 1 - 15,000 - 26,400 0,000% - 100,000%	[0]	[4000000000]	30.03.2001
Track E - 1 - 15,000 - 26,400 0,000% - 100,000%	[0]	[4000000000]	08.10.2001
Track E - 1 - 15,000 - 26,400 0,000% - 100,000%	[0]	[4000000000]	29.04.2002
Track E - 1 - 15,000 - 26,400 0,000% - 100,000%	[0]	[4000000000]	14.10.2002
Track E - 1 - 15,000 - 26,400 0,000% - 99,998%	[0]	[3999912281]	16.06.2003
Track E - 1 - 15,000 - 26,400 0,000% - 99,998%	[0]	[3999912281]	29.09.2003
Track E - 1 - 15,000 - 26,400 4,386% - 73,193%	[175438596]	[2927719298]	25.04.2004
Track E - 1 - 15,000 - 26,400 73,193% - 100,000%	[2927719298]	[4000000000]	25.04.2004
Track E - 1 - 15,000 - 26,400 0,000% - 28,640%	[0]	[1145614035]	04.10.2004
Track E - 1 - 15,000 - 26,400 28,640% - 28,947%	[1145614035]	[1157894737]	04.10.2004
Track E - 1 - 15,000 - 26,400 28,947% - 100,000%	[1157894737]	[4000000000]	04.10.2004



Relations Between Objects

The system stores local and chronological relations between infrastructure objects. They support the process of data import. Relations are also orientation guides for maintenance tasks. There is an example for such relations in the picture on the right. The poles (1), the catenary wire segments (2) and a part of the track (3) are related directly.

Individual Identifier

In **IRIS**SYS® infrastructure data are stored ‚international'. It is possible to govern an visualise data with different national frameworks. Objects of the permanent way can be accessed by several specific frameworks.

This is also shown in the relation picture above:

One company taking part in the maintenance process names the tracks (3) in their special manner using metric location markers. Another company could use the same object and its data by giving the object another ‚name' with miles and chains.

The issues 'identifiers' and 'object relations' are discussed in the chapter 'Fast Portability to Different Route Networks'.

3.2 Analysis

The analysis of data is an essential task for maintenance. It is the basis for a regular, preventive, asset conserving, cost optimised maintenance planning.

IRISSYS® combines demonstrative graphics for data evaluation with a high level of usability and inuitive handling. The system provides a large range of display formats, which will be exemplified below in this chapter.

The whole range of **IRIS**SYS® researches was designed such that all methods, calculations and displays can be flexibly set up and applied according to the demands.

Central as well as user defined researches can be set up.

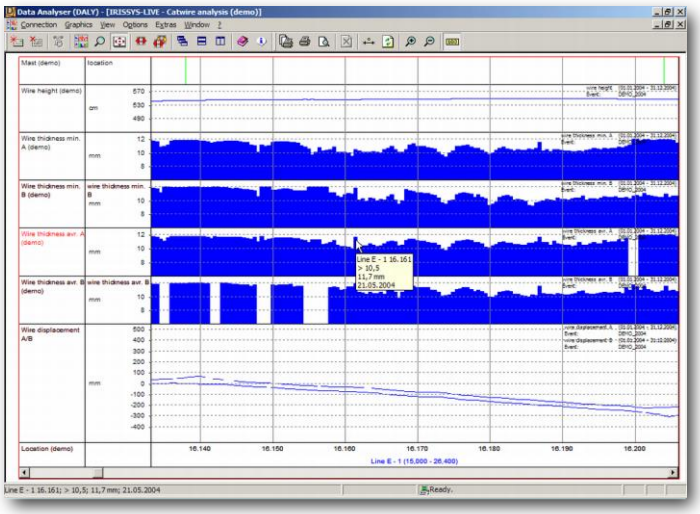
Access is controlled through the extensive **IRIS**SYS® access management. Search results can be optionally displayed in many different forms.

In addition to professional evaluation of particular state data, data of different track elements can also be viewed simultaneously. This approach is called “Integrated state analysis“. The intention of this approach is to show interrelations between particular track elements, to reveal the causes of actual wearouts.

The figure below illustrates the universal applicability of **IRIS**SYS® analysis forms. In this chapter, we will introduce the most important features regarding **IRIS**SYS® analysis. All combinations of line segments and researches are possible.

Single Value Research

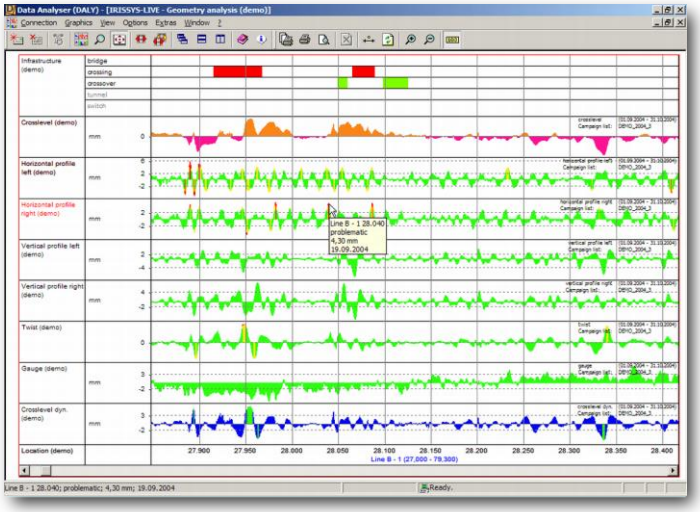
The display of single values, or punctual data next to segment data allows most detailed fault analysis. This picture shows for example single values of catenary inspection - amongst others the thickness of the contact line and its lateral position.



Flaw Analysis

By thresholds and threshold functions, data can be optimally evaluated. By rated, coloured display, faults are better recognisable.

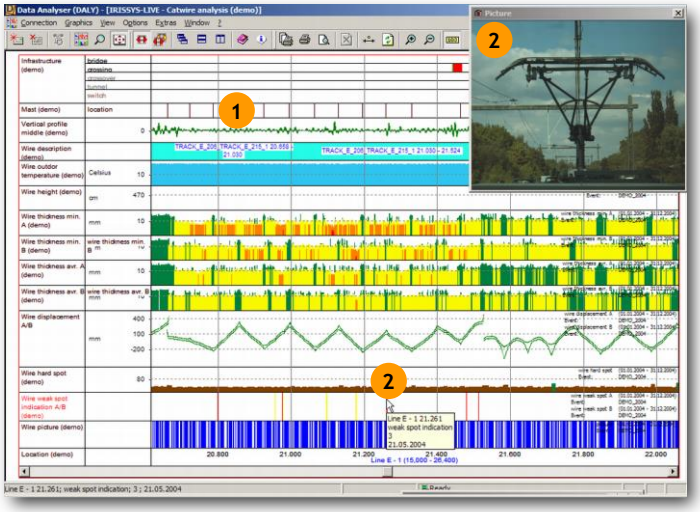
This picture shows an evaluation of geometrical track measures. Applying country-specific ratings is no problem.



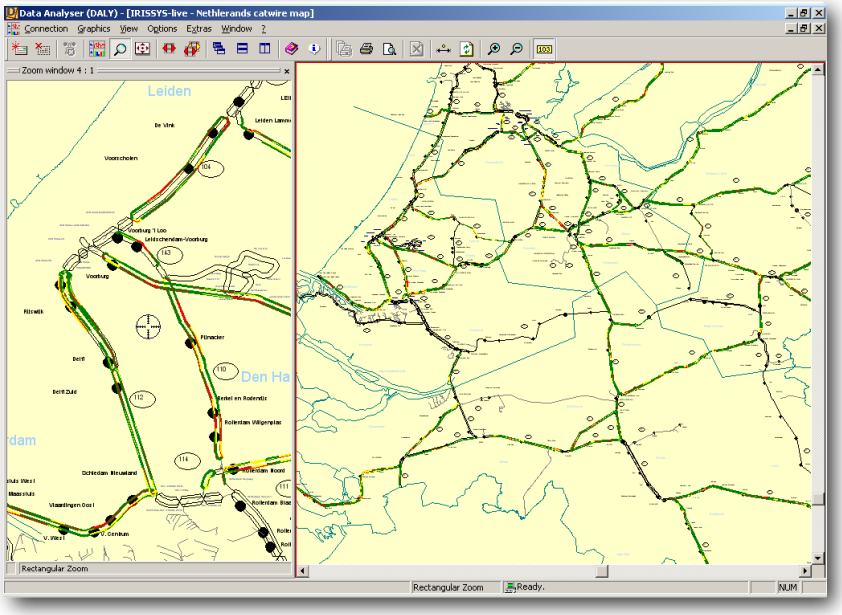
Precise Locational Display

The GPS-based data gathering allows a precise locational display of data along the line. Thus, specific and efficient fault recognition, fault analysis and clearance is possible.

In this example, the masts (1) and photos of the catenary (2) are realistically placed on a section of line by their GPS-information.



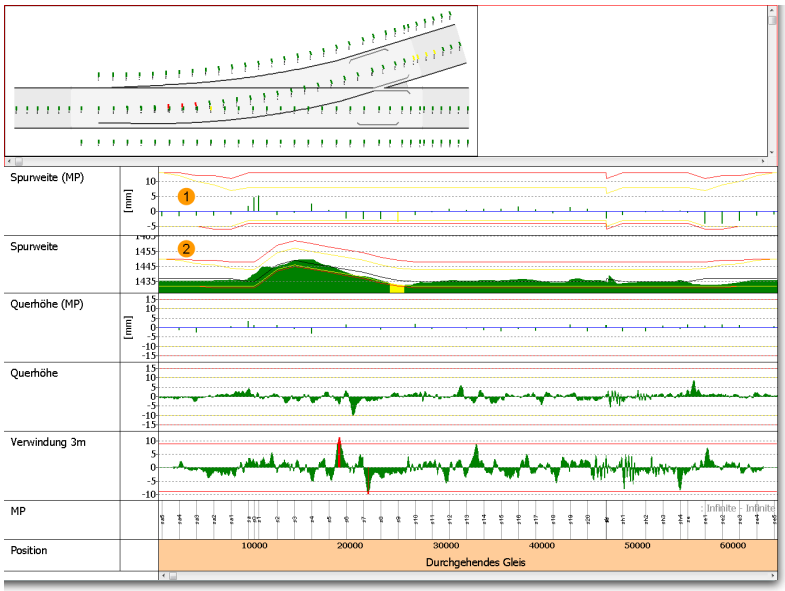
Area/Regional Analysis



Computer maps of the route network allow demonstrative area researches. Any measuring data can be displayed right beside the tracks in a range of ratings. Faults in the network strike immediately. For detailed research, maps of particular areas can be imported via Autodesk Map® into **IRIS**SYS®.

Maintenance of Switches

Compared to the normal track, switches have particular characteristics that have to be considered for maintenance. With **IRISSYS**® you can define all switch types (e.g. standard turnouts, slip switches, etc.) and map their inspection regulations. You can import and analyse measuring point related inspection data (1) as well as continuously recorded inspection data (2). The system offers also numerous tools to supervise the status (3) and inspection cycles (4).



IRISSYS 3

Switch geometry

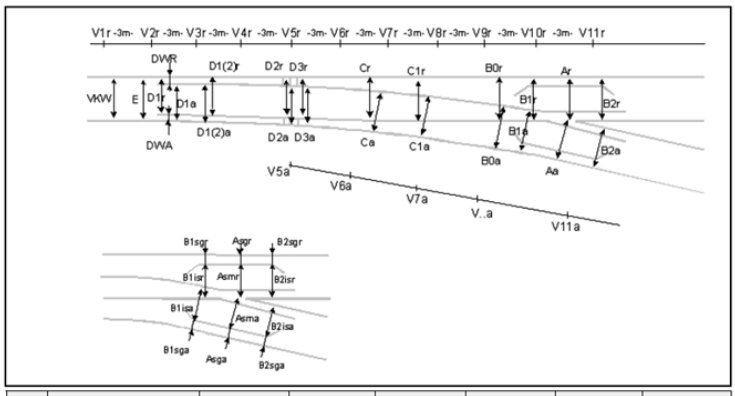
Inspection protocol

08.09.2010

Line 1023 – Switch no. 153

Date of inspection: 21.10.2009 Maintenance company: GBG

Switch type: EWL UIC54 1:9L Date of construction: 12.03.1994 Switch class: B



MP	Gauge nominal	Gauge mm	Gauge Gw	Superelevation mm	Superelevation Gw	Guard rail 1 mm	Guard rail 1 Gw	Switch rail 1 mm	Switch rail 1 Gw	Guard rail 2a mm	Guard rail 2a Gw	Guard rail 2b mm	Guard rail 2b Gw	Switch rail 2 mm	Switch rail 2 Gw
Branching line															
Tong *															
DWA															
D1a	1.436	-11	-8/14												
D1(2)	1.436	-10	-8/14	-2											
D2a	1.435	1													
D3a		0		-10											
Ca	1.435	4													
B0a		4		-16	-10/1										
B1a															
Punt *															
Aa	1.435	-9	-5/7	-26	-10/1										
B2a	1.435	-3		-20	-10/1										
Main line															
VKW		2													
E		0		-2											
Tong *															
DWR															
D1r		1													
D1(2)		1		-4											
Tong*															
Mid 1 *															
D2r		2													
D3r		1		-4											
Cr		1													
B0r															
B1r															
Punt *															

IRISSYS 4

Switch inspection dates

Survey of progress

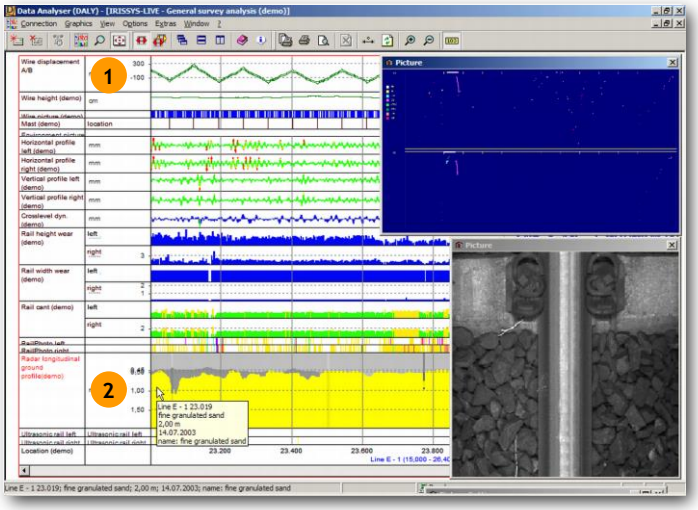
07.05.2009

Switch	Second last inspection Date	Insp.	Kl.	Deadline Progress	Last inspection Date	Insp.	Kl.	Deadline Progress	Next Inspection
1023 - 407	03.12.2007	GBG	B	-5m 18d	15.06.2008	GBG	B	-1m 8d	15.06.2009
1023 - 411	03.12.2007	GBG	B	-5m 18d	15.06.2008	GBG	B	-1m 8d	15.06.2009
1023 - 423	21.10.2007	GBG	C	-4m 6d	15.06.2008	GBG	C	-1m 8d	15.06.2009
1023 - 425	21.10.2007	GBG	B	-4m 6d	15.06.2008	GBG	B	-1m 8d	15.06.2009
1023 - 426					15.06.2008	GBG	B	-1m 8d	15.06.2009
1023 - 458	21.10.2007	GBG	B	-10m 18d	03.12.2007	GBG	B	+5m 2d	03.12.2008
1023 - 459	21.10.2007	GBG	B	-9m 28d	23.12.2007	GBG	B	+4m 12d	23.12.2008

Colour legend: Elapsed time since date of inspection; Remaining time until date of inspection; Exceeding of date of inspection; Next inspection date within the cycle; Next inspection date is overdue

Discover Active Principles

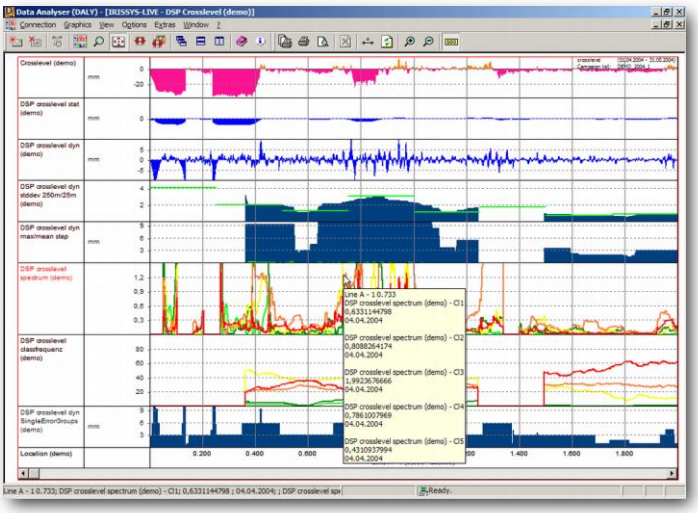
Regarding the permanent way as a system allows you to discover correlations between effects and causes of irregularities. By this strategy, various measuring data from the catenary (1) unto the subgrade (2) can be evaluated together on any point of the permanent way.



Digital Signal Processing With LabVIEW®

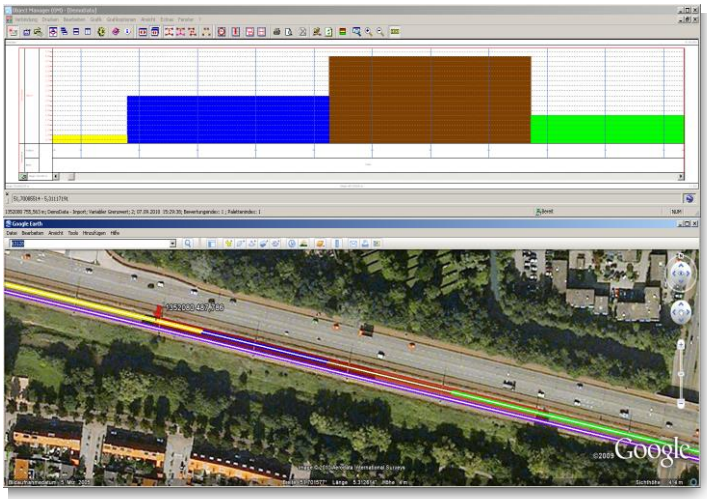
IRISSYS® integrates market leaders' systems like LabVIEW®.

This interfacing allows immense varieties of evaluation. Numerous authentic and optimised filters and extended functions can be quickly and flexibly integrated to **IRIS**SYS®. Just customise and immediately use them.

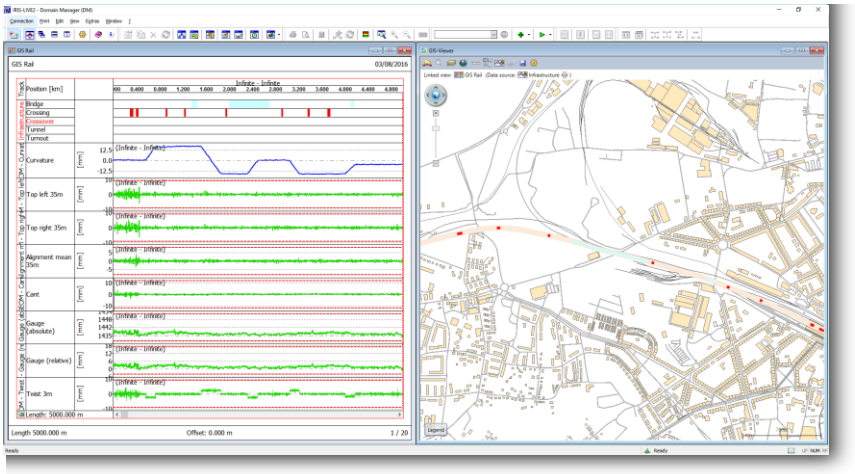


Google Earth™

When GPS information to track sections is available, you can evaluate them with Google Earth™. In addition to a simple representation of track or measurement courses, data as well are accentuated by colours. Using the synchronised display between Google Earth™ and **IRIS**SYS®, a geographical reference to the currently displayed data is possible at any time.



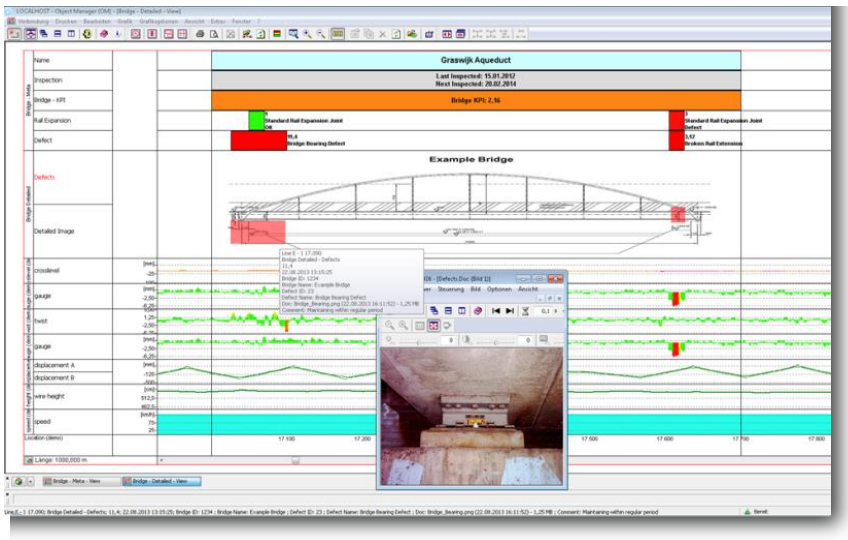
GIS - Interface



IRISSYS® provides a standard interface to GIS services from ESRI. The integrated GIS-viewer supports displaying all provided layers. All diagram-based analysis can be displayed in the GIS-viewer beside the corresponding tracks. Functions and analysis in **IRISSYS®** can be executed via the track elements in GIS-viewer as well. The GIS-functionality is supported by the **IRISSYS®**-Desktop and **IRISSYS®**-WebEdition.

Engineering Structures

Based on the generic data model in IRISSYS, all additional elements (e.g. bridges, tunnels, …) of the permanent way can be represented. All elements can be saved in relation to the track und then be used for further analysis. This enables a comprehensive approach for identifying weak- or defect spots and its removal.



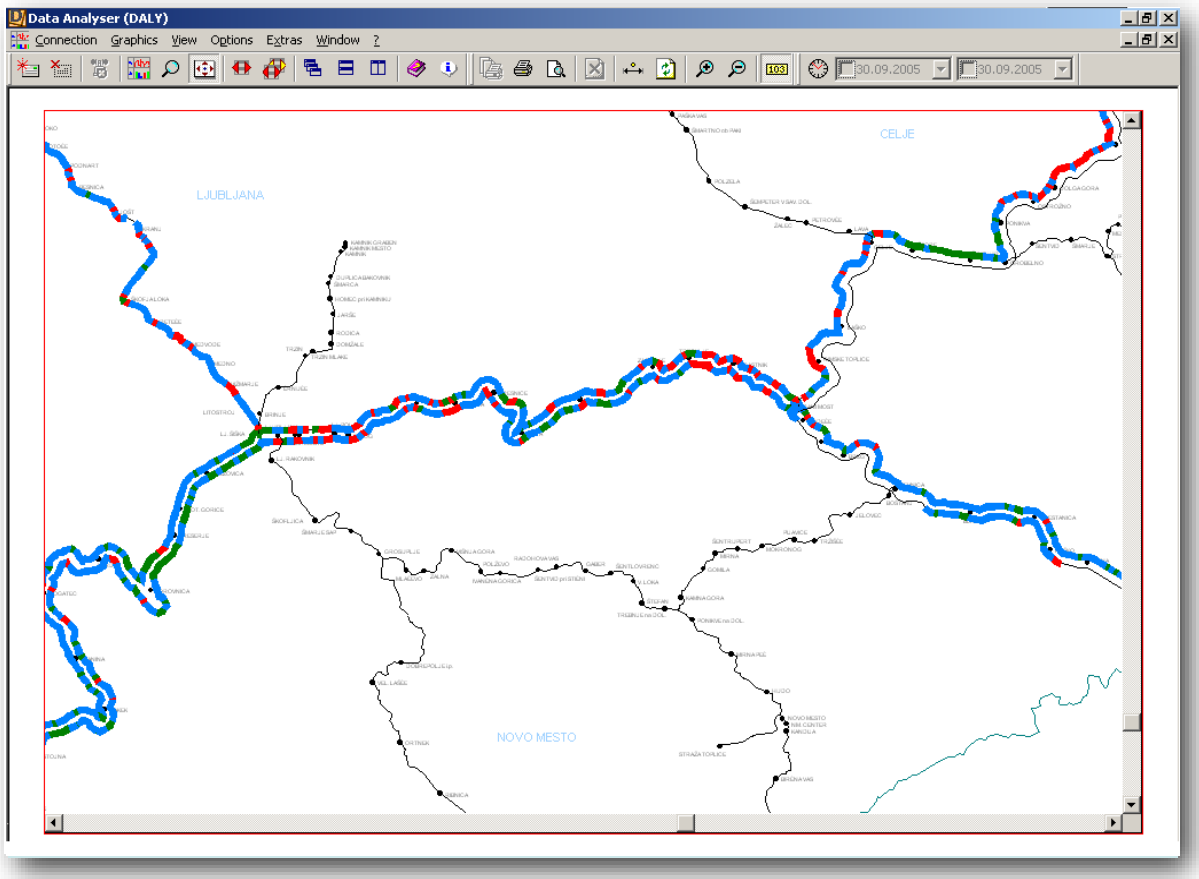
3.3 Maintenance and Repair

Surely an integrated state evaluation contributes to substantially improve the planning of repair measures. Subjective influences can be excluded or diminished in track state evaluation and in decisions about kind and time of repairs. Especially the latter, to know at which point of time which measure is due to take, is essential for an economical maintenance.

The **IRIS**SYS® - functions for the maintenance section allow a simple, system based planning of maintenance measures. They gaplessly tie in with the analysis of state data and can be used in the whole network. Aditionally, **IRIS**SYS® has got open standard interfaces which allow an integration of standard software systems for maintenance and project planning. Below, we are going to treat the maintenance-relevant features of **IRIS**SYS® more closely.

Quality Key Figures & Quality Analysis

Automatically generated quality key figures for all track segments allow network control in a very fast and easy way.

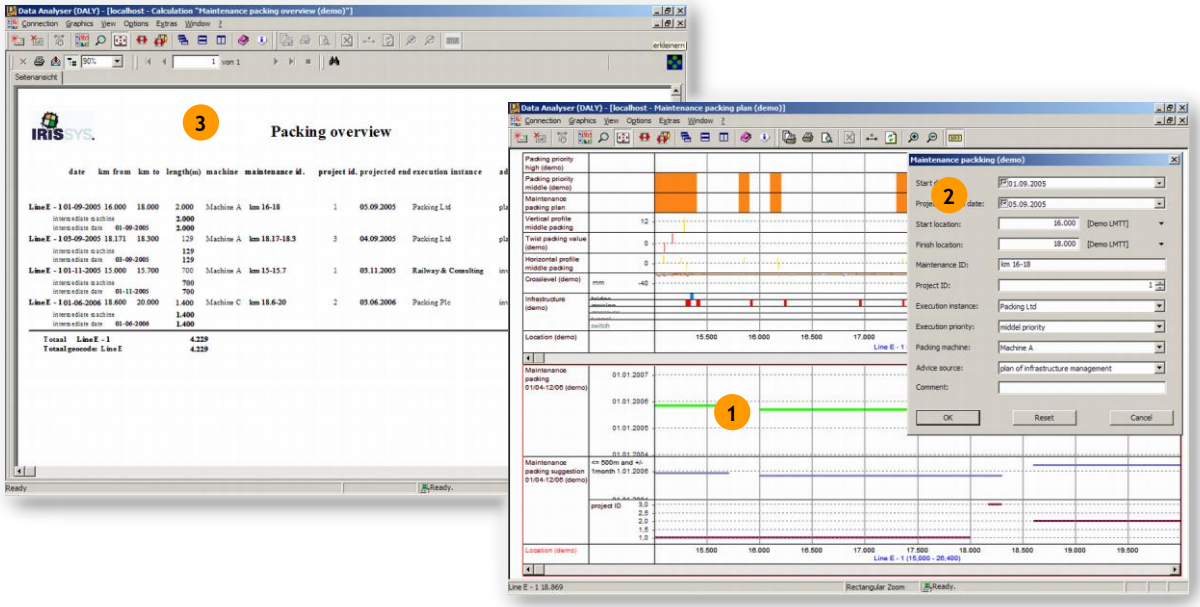


Definition of Measure Catalogue

Defining all kinds of repair and maintenance measures allows a simplified maintenance planning and is a basis for broad evaluation methods and maintenance optimisation. The registered measure catalogue is ever extendible and can thus be adapted to new developments in maintenance technology.

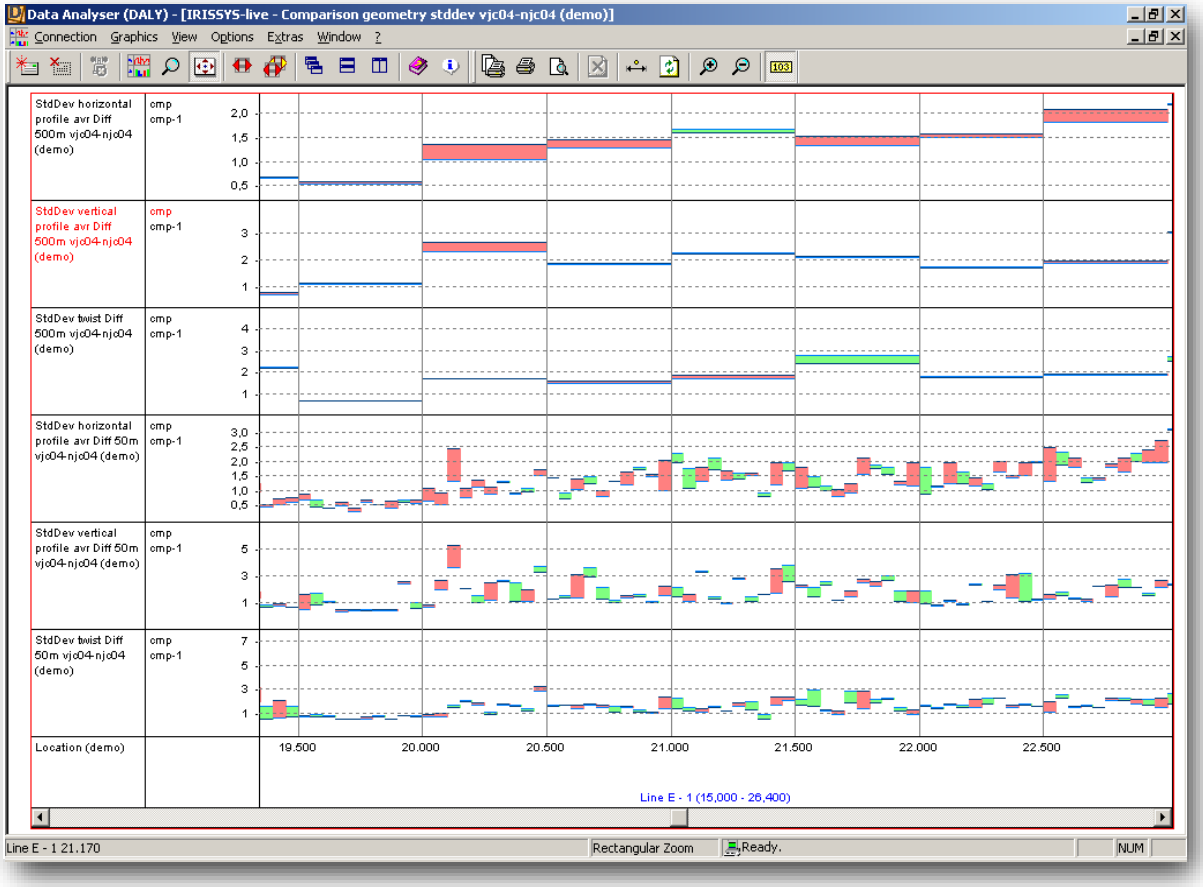
Maintenance Planning

The integrated state analysis prevents a superficial, symptom-related performance of maintenance measures. It assures real sourcing, cost efficient planning and execution of measures. Apart of deciding about particular maintenance measures and their appropriate points of time, the concerned executives can also initiate immediate measures (e.g. reducing the speed limit) and inscribe comments. The system will calculate proposals to bundle the due measures. In these figures, you see the planning of maintenance measures (1) by user defined dialogues (2) and the generation of planned maintenance overviews (3).



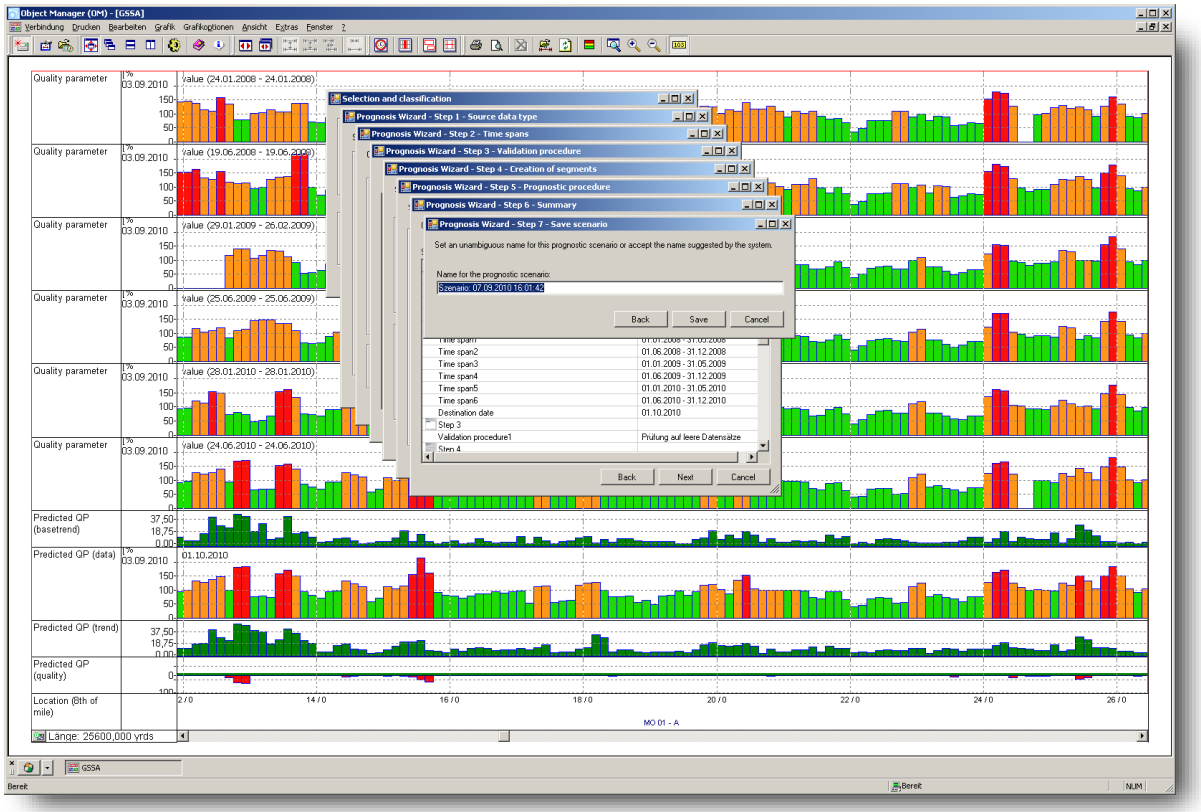
Trend Analyses

The presentation of developments allows you to compare the track status of various periods of time. Thus the execution of measures is done much closer to the optimal point. Counteractions against any misguided development are much more effective.



Status Prediction

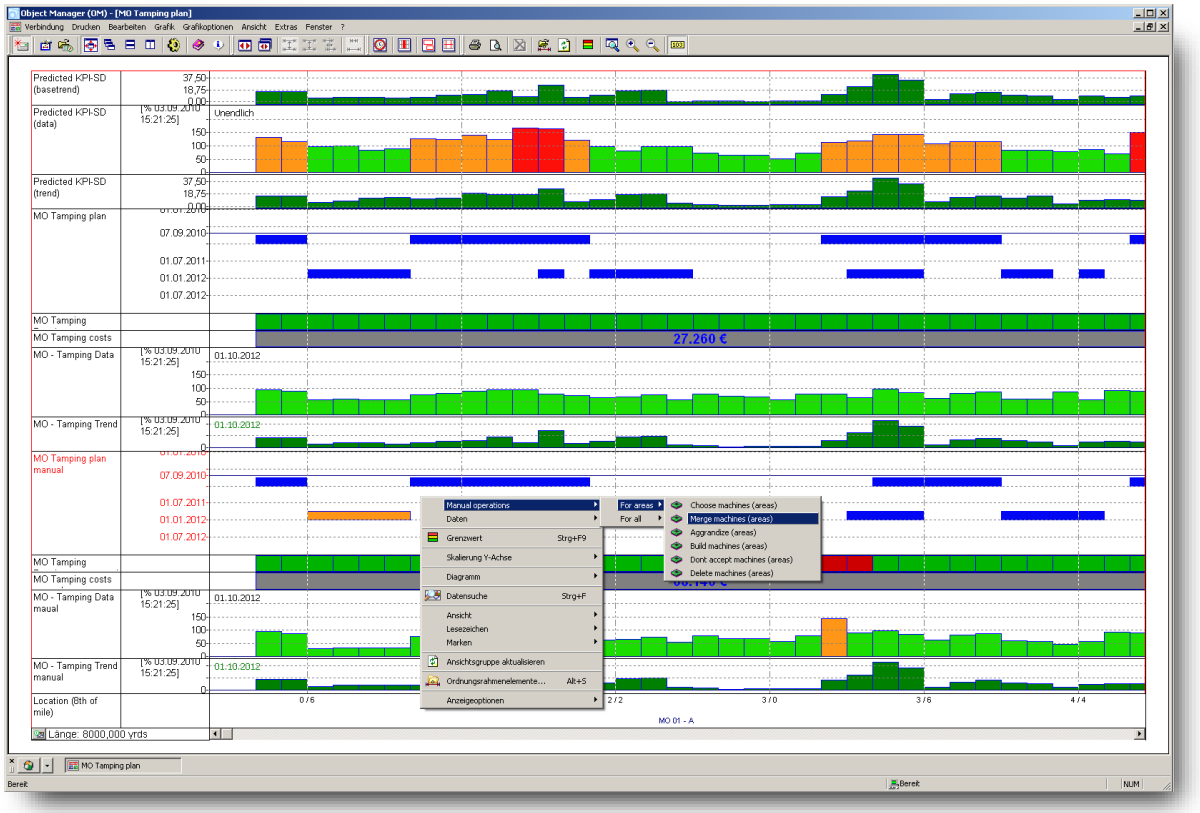
Basing on the status history that has been recorded and maintained with **IRIS**SYS®, it is possible to make parameterisable status predictions in the system. The **IRIS**SYS® prediction procedures and methods have been designed for a comprehensive operational use. You can define correct procedures and methods as well as times of execution by analysing this predicted status relating to the current status.



To simulate the future actual situation, it is possible to develop prediction scenarios with the aid of a wizard. Here you can select and parameterise source data, time spans, filters, procedures of prediction and creating segments in a sequence of dialogs easily understandable to the user. Thus it is possible to develop and to compare several prediction scenarios, in order to achieve a prediction result as optimal as possible.

Maintenance Optimisation

The correct distribution of severely limited funds is the vital maintenance problem. In reality, a maintenance strategy designed for a minimum of costs at short notice is tracked in many cases. Using the integrated status analysis that understands the track as a complex system with interactions among the system elements, you can define the correct priorities and distribute funds in an optimal manner. The resulting scheduled preventive maintenance assures an approach to the minimum of total cost as well as a long track service life.



Basing on previously developed prediction scenarios, it is possible to automatically generate maintenance proposals with the aid of the maintenance optimisation in **IRIS**SYS®. For this, you can parametrise various parameters for maintenance machines to be used, as e.g. cost, effect, and the rate of maintenance works. Further criteria, such as thresholds as well as intervals and deadlines for the optimisation, can be passed to the optimisation procedure as well. After that, you can manually rework the system proposals according to specific railway aspects. Then these two variants can be compared in the same diagram. This way individual requirements of the parties responsible are considered. Finally both variants can be compared in the same diagram in respect to their effect and cost, in which **IRIS**SYS® provides assistance with its mathematically optimised solution.

3.4 Fast Portability to Different Route Networks

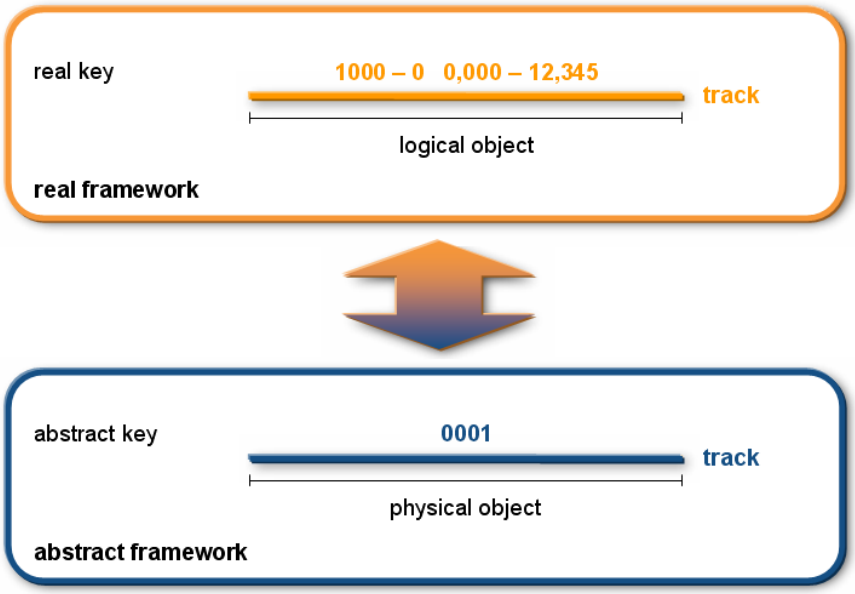
Queries on tracks' data always include determinations of position. Such determinations have to be unambiguous. For that reason, a framework is built around the route network, which uniquely describes every part of the track. Along with that, also exceptional mileages (like jumps or extensions) are considered, which may have occured due to rebuilding or re-measuring. All data to be stored have to be in line with this framework. Naturally, every country has got its own standard of track numbering and mileage. **IRIS**SYS® claims to be quickly portable to different route networks.

Data Storage

On this level, the essential data are stored. They are stored without any reference to their real framework. Instead, a system generated abstract key is used.

Identifier

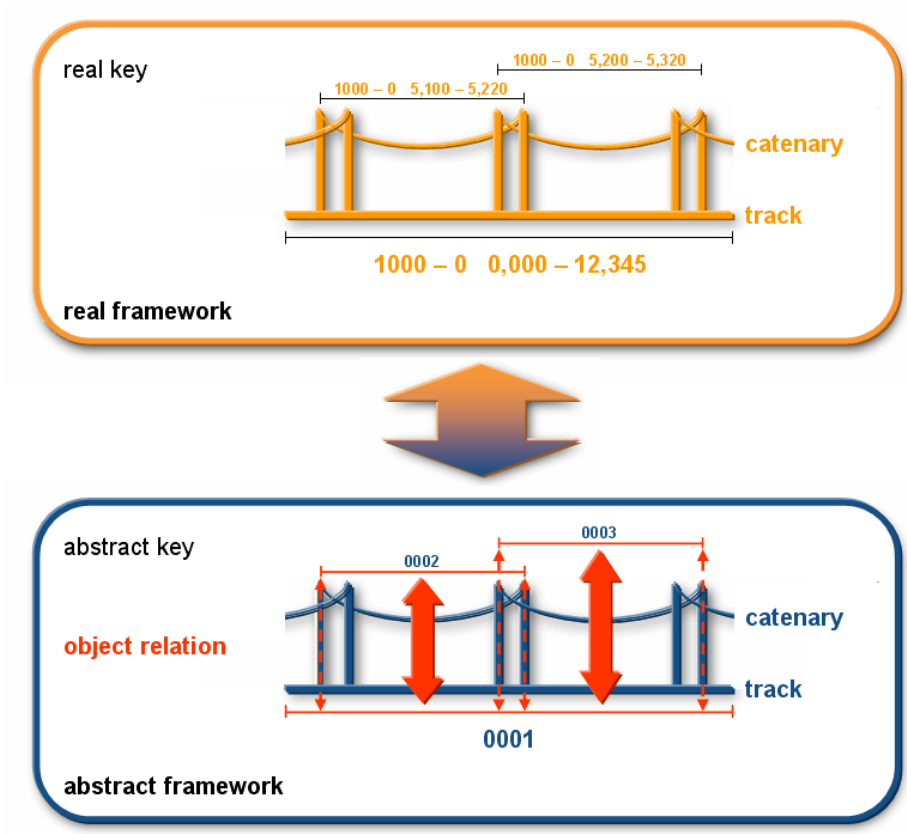
This means the framework of a route network, which is used in a particular country. There is a relationship between the real location name (e.g. route number, direction, kilometre) and the abstract object key. All evaluation methods, analysis etc. are based on abstract keys. Thus, a universally usable system has been developed. Only in the representation layer of the data, the abstract keys are replaced by terms of real language. So applying the system **IRIS**SYS® to a new route network requires nothing but implementing the according framework, and connecting it with the abstract system. In this way you can also access one same object through different frameworks.



Object Relations

In this layer, relations between objects are established. Relations may be e.g. between tracks and switches. Additionally, questions like ‘At which point of which track does this catenary mast stand?’ can be answered more easily through relations. Relations are established on the basis of a common framework. But they can also be calculated on the basis of GPS-coordinates. Such relations are especially important when the whole permanent way is due to be surveyed altogether.

In this layer, too, all objects are referred to by abstract system generated keys.



4 IRISSYS® - Software

4.1 Systems Architecture

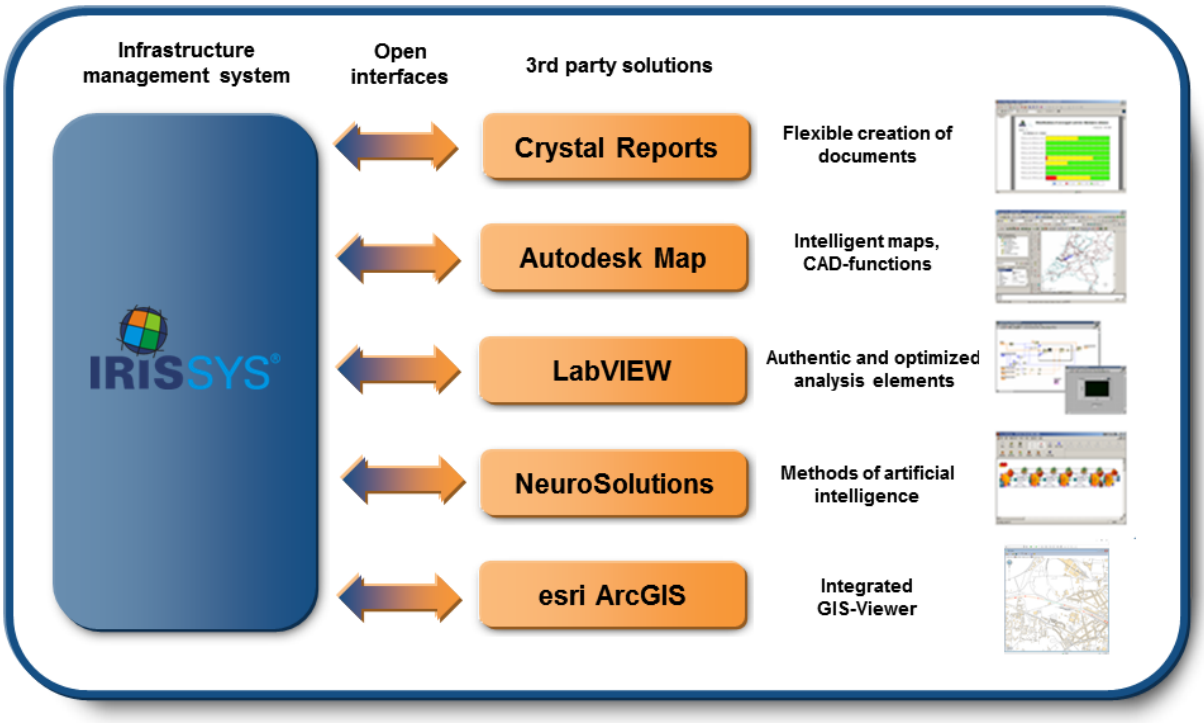
Requirements

The requirements on transparent architecture result from the following situation:
In practice there are many different maintenance concepts applied. The gamut runs from a single state-owned railway company unto a strict separation of infrastructure owner, operator and maintenance services. The latter makes the highest demands on the technical implementation of a software solution. The owner is no longer alone in charge of the track system maintenance, but he delegates it to other companies. These companies are assigned by the owner to maintain whole route networks during a fixed period of time. For that matter, operational safety and availability of the network are the essential benchmarks of quality. Consequently, there are different demands that an analysis system has to meet. While the owner exercises control functions to assess the performed services, the maintenance personnel needs the system to make their maintenance process as economical as possible.
To meet these demands, a high level of data security is required. Different companies work on one single system. It must be sure that only the owner of data can grant anyone access to that data. **IRIS**SYS® meets these requirements.

Realisation

IRISSYS® is a software system based on a flexible configurable client-server-architecture. Thus, the server can perform time consuming tasks, and via local network or internet just transfer the results to the client. Additionally it is assured that all users get to see and analyse the same up-to-date information.
On the lowest level, the data are being stored in a so-called generic database. It stores numerous different objects in many different structures. The ability to connect external data sources is another advantage of **IRIS**SYS®, to grant access to existent data sources without duplicating them.
The complex domain model of **IRIS**SYS® allows to combine different server types according to the customer's requirements.

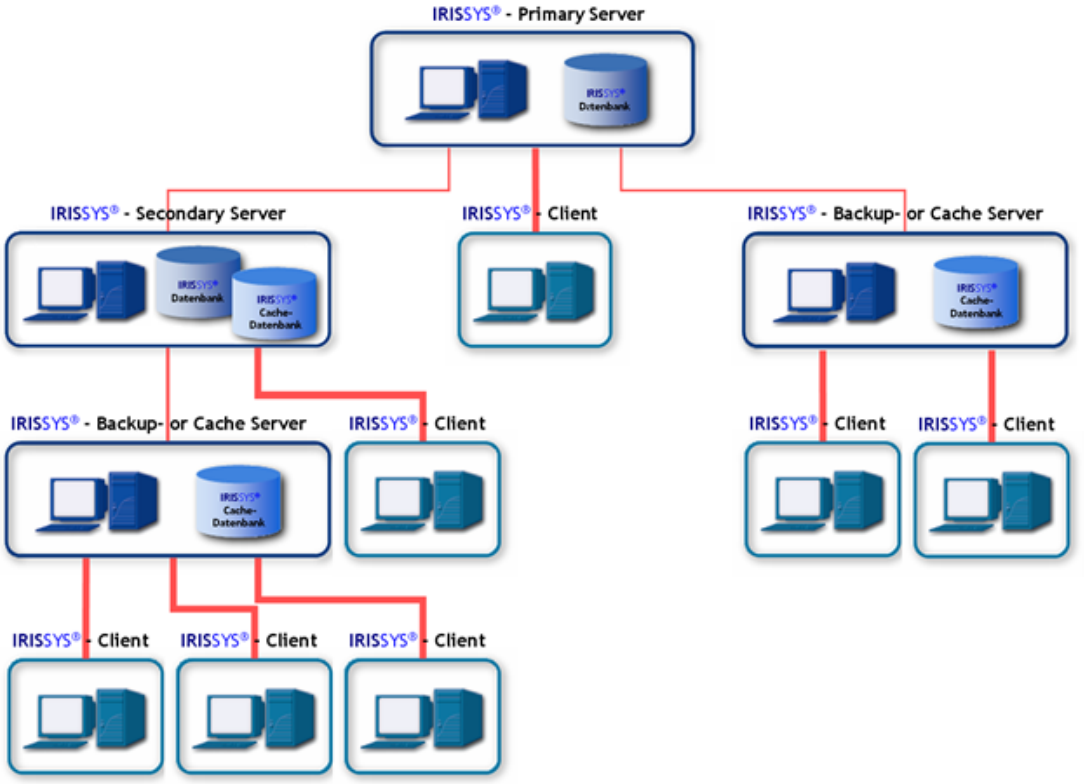
Besides the connections between **IRIS**SYS® - servers and **IRIS**SYS® - clients the system provides open interfaces for the integration of third-party software systems. The picture below shows the currently integrated industry solutions using these open interfaces.



The following server types are available:

- **IRIS**SYS® - Primary Server
- **IRIS**SYS® - Backup Server
- **IRIS**SYS® - Secondary Server
- **IRIS**SYS® - Cache Server

The main reason to differ between several types of servers is an efficient distribution of storage and calculational load.
By secondary servers, data stocks can be held regionally or organisationally separated. On the primary server, a common data stock is created. Common data is forwarded through secondary servers for distributed usage. When common data stock changes, updates between primary and secondary servers are possible. Apart from the mirrored data stock, a secondary server can also possess its own databases independently of the primary server. Only the clients of that particular secondary server have access to these databases.



A gain of mobility is accomplished by so called Backup Servers. They allow to gather data without having access to any superordinate server. By transfer, these data are later released into the main system for further analysis.

A cache server permanently connected to a superordinate server will bridge bottle necks between client and server. The data it provides is always loaded from a secondary or primary server.

The following table will point up the differences between the **IRIS**SYS® server types once more.

	IRISSYS® - Primärserver	IRISSYS® - Sekundärserver	IRISSYS® - Backupserver	IRISSYS® - Cacheserver
Connection type to superordinate server	-	Online/Offline	Online/Offline	Online
Database type	Public databases, private databases	Public databases, private databases	Public databases	Public databases
Field of application	Main server	Organisational data detachment, data distribution, distribution of calculation demands, bypass of low connection levels	data distribution, distribution of calculation demands, bypass of low connection levels	distribution of calculation demands, bypass of low connection levels

4.2 Applications Architecture

The software family **IRIS**SYS® includes the following members:

4.2.1 **IRIS**SYS®-DesktopEdition

DALY (Data Analysis)

DALY is dedicated to data evaluation and presentation. It provides a great choice of settings, selections and output options. System wide, area wide and inividual configurations, algorithms and filters can be used for evaluation of data. They can be displayed as diagrams, views, maps and reports. DALY is dedicated to manual input of data into the system, and to the development and testing of new calculation algorithms.

UDX (Universal Data Exchange)

The application UDX includes an interface designer, import modules, edit tools, and export modules. UDX is a universal interface by which data can be imported or exported in any required format without any program changes necessary.

OM (Object Manager)

The application OM is dedicated to the administration of configurational objects, e.g. data types and measurement units. New objects can be created, existing ones can be modified or deleted. Additionally, functions (analysis methods and algorithms, VPI), reports (logs, printouts) and data windows are administered here.

DM (Domain Manager)

DBM is dedicated to administer the domain and the data stock.

This program enables you to build and configure **IRIS**SYS® - database systems and connect external databases to them. By this program you also perform routine data maintenance tasks, such as copying, moving, deleting and backup of data.

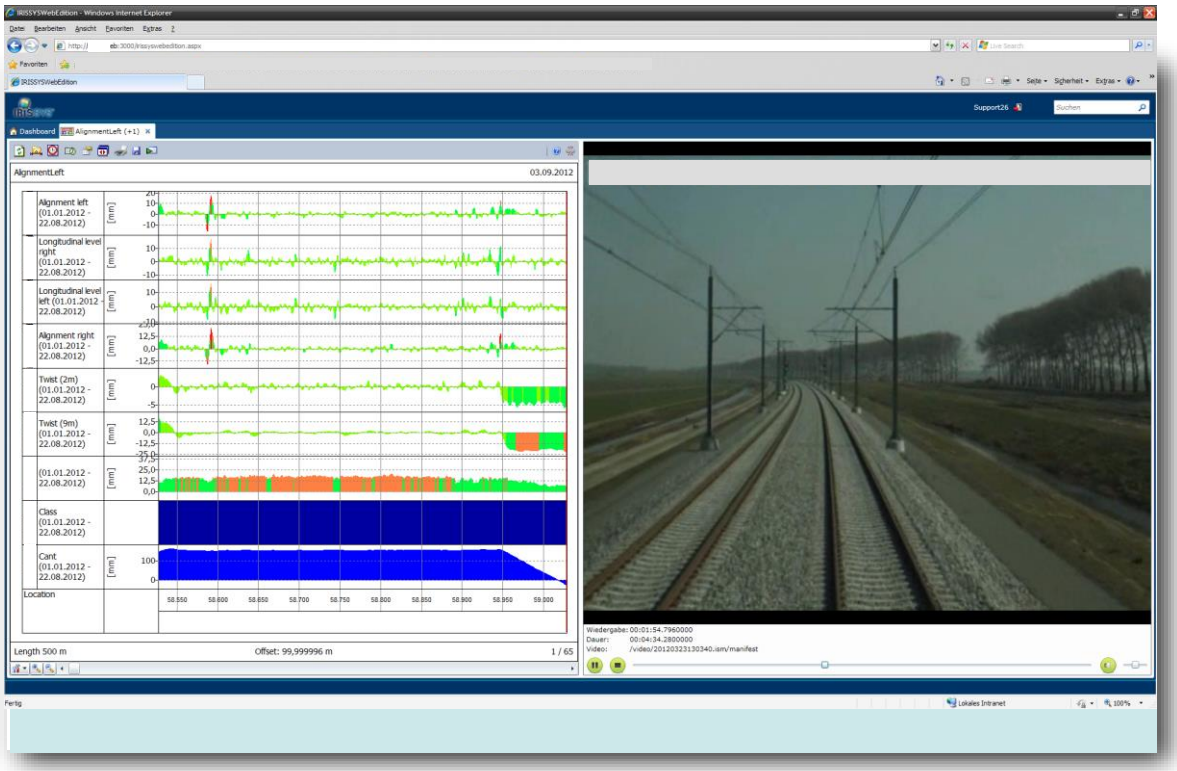
It is also possible to employ the DM to administrate application rights, IRISSYS object rights, Data (access) rights to data types, function rights, and configurations. This way you can configure user rights regarding spatial, temporal, and professional (qualification/autorisation) competence. Moreover, a monitoring, blocking, and unblocking of client applications is possible. The task scheduler allows the scheduling and temporal control of functions to be executed in **IRIS**SYS®.

4.2.2 IRISSYS®-WebEdition

The IRISSYS® WebEdition combines the functions of the Desktop Software with the benefits of a Web Application. Standard web technologies are used to achieve this. The IRISSYS® WebEdition runs directly in the web browser and offers a simplified user interface which orientates at up-to-date and widely-used Easy Access operating concepts.

The benefits include:

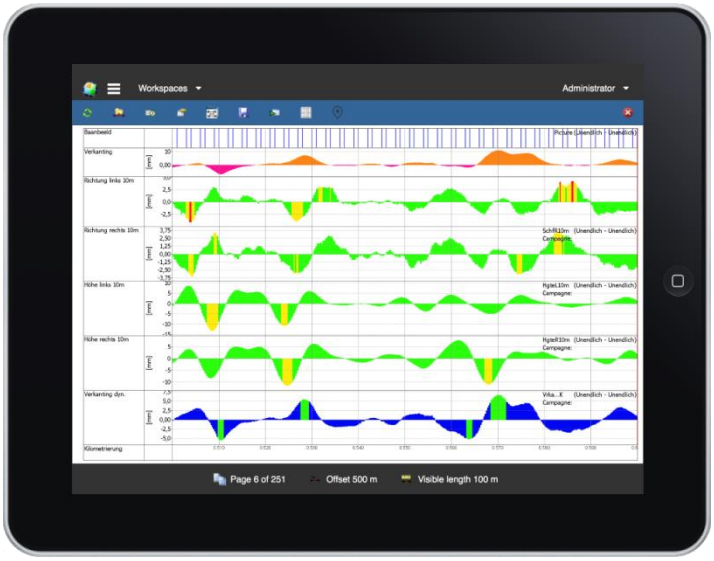
- No installation of IRISSYS® components at the client is required.
- The application is very easy to access, especially for inexperienced or occasional users.
- Easy access to analyse functionalities.
- The software can be used in regionally branched networks / stations even in case of low-speed internet connections. All calculations are carried out exclusively at the server.



The IRISSYS® WebEdition provides almost all functionalities of the DALY Desktop application (e.g.: Single Sign On, Dashboard / Desktop, …). All stored analyses of the Desktop Application can be used in the IRISSYS® WebEdition without any modifications. The general Look&Feel orientates at up-to-date web applications with standardised actions (e.g.: tabs) and can be used intuitionally.

4.2.3 IRISSYS®-MobileEdition

The IRISSYS®-MobileEdition provides customized functionality for tablet devices. This enables a comfortable use of the comprehensive analysis capabilities from IRISSYS® in the field and fast access of tailored reports and overviews for the management level.



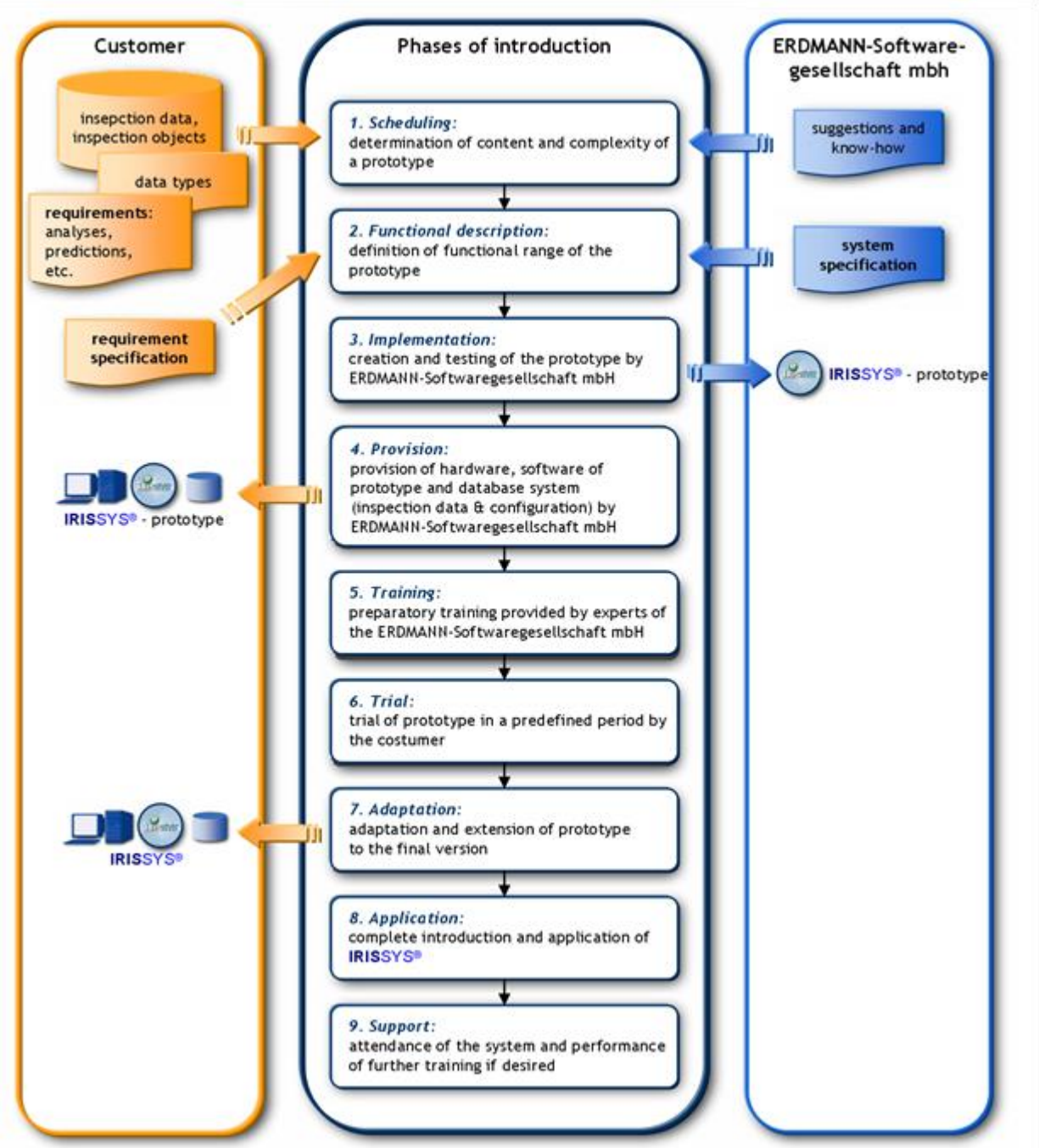
Using state-of-the-art web 2.0 techniques – like HTML5, JavaScript and CSS – the IRISSYS®-MobileEdition presents as a Thin-Client platform independent future technology for all tablet devices available (Android, iOS, Windows RT). The operating concept is consequently oriented to a touch-based user interface with gesture control and modern ergonomic standards.

The IRISSYS®-MobileEdition contains chosen functionalities from the IRISSYS®-software family (e.g.: dashboard / desktop / graphic analysis / reporting and data collection).

For the mobile usage, special applications considering the tablet environment tare implemented. For data collection the device internal GPS functions can be used for an automatic location positioning or a photo can be directly saved to a data record. Beside standardized use cases also special customer-specific input masks (e.g. switch inspection) can be configured.

Through the close connection from the IRISSYS®-MobileEdition with the software suite, all analysis, favourites and preferences are linked into one user account and can be used worldwide.

5 Introducing IRISSYS® in an Enterprise



6 Optimised Course of Business

Through **IRIS**SYS®, your course of business will be optimised in many ways:

The elaborate data management will considerably shorten the time between measurement and managerially relevant evaluation. Inconsistencies will be avoided. Transit times between departments will be shortened. The reduced consumption of paper will be an appreciated side effect.

Staff members who used to be busy with data management or data transfer before **IRIS**SYS® was installed may change into core divisions of the enterprise, e.g. data analysis, optimisation of planning, or quality assurance. Thus, your productivity and security will be increased.

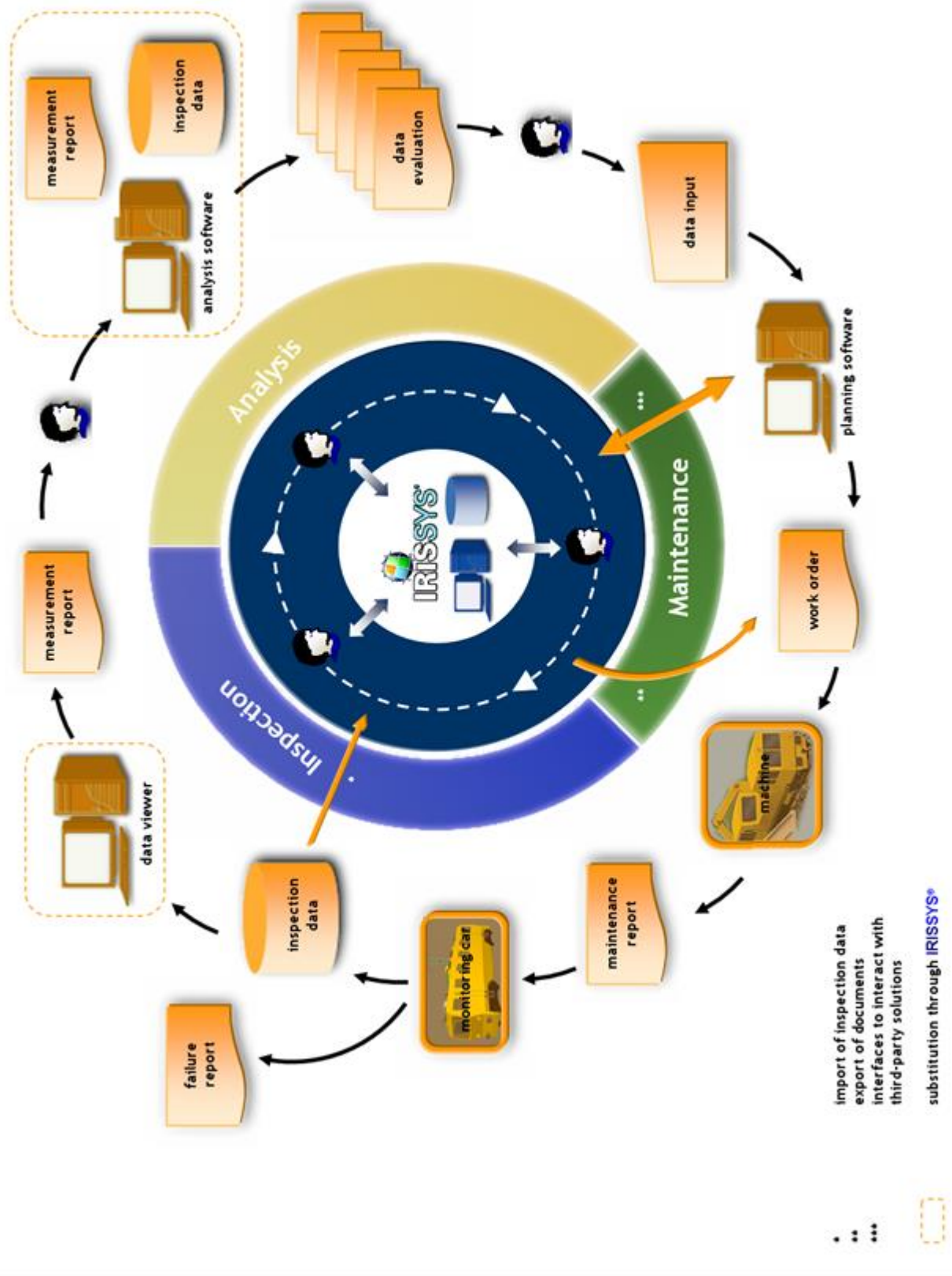
Of course, training and getting used to the software will take some time. The workflow for data import and integrated analysis has been designed as simple as possible. Thus time and effort will be in due proportion to time savings through the system.

Within the framework of European competition, the quality of all enterprises responsible for infrastructure is measured by key figures - amongst others the so called Key Performance Indicators (KPI). **IRIS**SYS® will enable you to transparently calculate such key figures by real actual state data.

Using the system **IRIS**SYS® will ‚educate' all persons involved to observe the existing rules regarding responsibilities and standardised workflows.

For example, the figure below illustrates such kind of workflow.

The initial point is the measurement of states, second stage ist the analysis, and the last step is the measure taken to conserve the infrastructure.


Analysis
Maintenance
Inspection
IRISSYS
data evaluation
data input
planning software
work order
machine
maintenance report
monitoring car
inspection data
failure report
data viewer
measurement report
analysis software
measurement report
inspection data
import of inspection data
export of documents
interfaces to interact with
third-party solutions
substitution through IRISSYS®

7 References

7.1 Application of Our Software Solutions

Country, Customer	From	To	Products, Services
Germany			
DB Netz AG	1994	-	Intelligent Inspection System (IIS) Permanent Way Monitoring Car (OMWE) Track Monitoring Multiple Unit (GMTZ)
DB Systemtechnik – TZF	2007	2011	IRISSYS®
BMVI: Federal Government of Transport and digital Infrastructure	2013	-	IRISSYS®, Hosting, Import, Consulting
Netherlands			
ProRail	2003	-	IRISSYS®, Hosting
Strukton Railinfra bv	2002	-	IRISSYS®, Hosting
BAM Rail bv	2003	-	IRISSYS®, Hosting
Eurailscout Inspection & Analysis bv	2003	-	IRISSYS®
Volker Rail Services bv	2003	-	IRISSYS®, Hosting
Infraspeed Maintenance bv	2006	-	IRISSYS®, Hosting
GVB Amstardam	2010	-	IRISSYS®, Hosting
Great Britain			
Network Rail (High Speed) Ltd	2005	-	IRISSYS®, Import
Slovenia			
Slovenske zeleznice d.d.	2003	2005	IRISSYS®
Denmark			
Banedanmark	2010	-	IRISSYS®, Hosting, Import
Norway			
Jernbaneverket	2012	-	IRISSYS®, Import
Morocco			
Office National des Chemins de Fer (ONCF)	2010	-	IRISSYS®
Israel			
Israel Railways ltd.	2014	-	IRISSYS®
Switzerland			
Swiss Federal Railways (SBB)	2016	-	IRISSYS®
SERSA maschineller Gleisbau AG	2014	-	IRISSYS®, Hosting, Import
France			
Eurailscout France SAS	2015	-	IRISSYS®

IRISSYS-Prototypes

Republic of Serbia
Zeleznice Srbjie (Serbian railway)

Finland
Ratahallintokeskus (Finnish railway)

Russia
Railway Institute VNIIZhT Moscow
RZD Railway Head Office Moscow
RZD October Railway St. Petersburg

Poland
PKP

7.2 Software Development by Detail

International Railway Inspection and Services System - IRISSYS®

Software solution for monitoring and optimised maintenance of track system

Developed in 1998 – 2003

Maintenance: 2003 – today

"Intelligent Inspection System (IIS)" Deutsche Bahn AG

System for integrated state analysis of permanent way

Developed in 1994 - 1997

Maintenance: 1997 – today

"GeoView" - standalone version monitoring the state of rails

System for integrated state analysis based on monitoring car UFM 120

Developed in 1999 – 2001

"SwitchView" - standalone version monitoring the state of switches

System for switch analysis

Developed in 1999 – 2001

Permanent Way Monitoring Car Unit (OMWE)

Evaluation software for measuring cars under real-time conditions

Developed in 1999 – 2000

In addition, several software solutions have been developed for diagnostic systems (measuring cars).

8 Contact

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