IT system requirements for asset management on the railways

The influence of ergonomic requirements, general standards and regulations, and requirements for IT-based asset management solutions on the railways
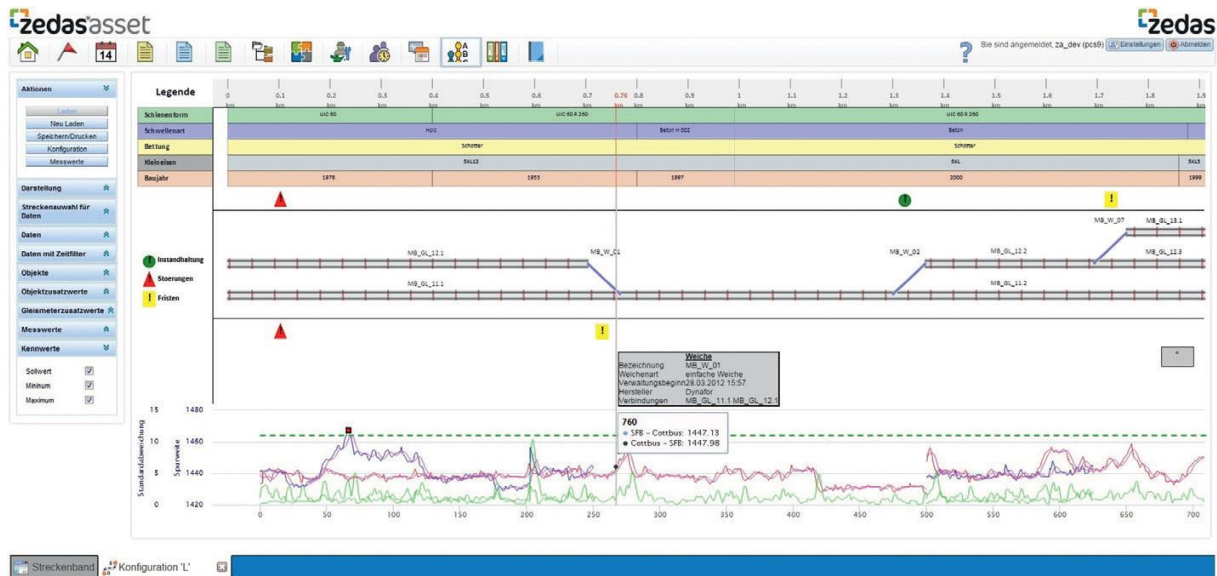
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Fig. 1: Object, location and condition information in an asset management system for ensuring security, availability, efficiency and sustainability.

A survey of the GFMAM (Global Forum on Maintenance & Asset Management) determined that the importance of asset management for companies has increased significantly. This goes hand in hand with the fact that IT support in this field is likewise continually growing. This supporting software must always be able to observe and comply with the applicable standards in the respective field of application.
ZEDAS GmbH, as a provider of asset management software, is therefore continuously working on making the zedas®asset product available to the user in compliance with the standards and regulations according to current validity. In order to ensure the management of linear assets on the railways, the use of geographical information systems (GIS), the use of mobile IT devices owing to topological distribution, high security and availability requirements and the resulting precise measure planning, and extensive standards and regulations, among other things, form the basis for any IT-based solution.

The three main requirements for IT systems for asset management on the railways therefore result from:
- General ergonomic requirements of the IT systems
- Requirements from the standards and regulations in the individual fields of management
- Special requirements from the standards and regulations on the railways.

In the following paragraphs, therefore, the standards and regulations which ZEDAS GmbH uses as guidelines for the fulfilment of these three main functions are considered in more detail.

General ergonomic requirements of the IT systems

The user wants to be clearly guided in the menu, symbols and fields should be self-explanatory, a warning is expected if incorrect entries are made, and all terms and facts should be chosen in accordance with the standards.

The general ergonomic requirements for IT systems for precisely this are contained in DIN EN ISO 9241 "Ergonomic requirements for office activities with visual display units". In particular, the requirements for usability (sheet 11), the presentation of information (sheet 12), user guidance (sheet 13), dialogue design (sheet 110) and dialogue management using screen forms (sheet 17) are set out in detail.

The following table illustrates the requirements for IT systems and shows them in relation to DIN EN ISO 9241.

Basic requirements	Requirements for evaluation of the software (according to Prümer & Anft)	Key requirements according to EN ISO 9241, sheet ...
Clarity/comprehensibility	Suitability for the task	12 Design
Self-explanatory	Self-descriptiveness	2 Dialogue
	Controllability	
	Conformity to expectations	
Resistance to incorrect entries	Error tolerance	
Conformity with regulations		110 (formerly 10) Ergonomic principles
		11 Usability
		13 User guidance
		14 Menu navigation
		17 Forms
	Customisability	
	Promotion of learning	

Tab. 1: Comparison of the requirements for software ergonomics

Requirements from the standards and regulations in the individual fields of management

ISO 55000 demonstrates an approach to asset management which presents the activities according to the management level. Strategic, tactical and operative management functions which show information aggregation from below, specification itemisation from above and information requirements in different views result from the implementation of objectives.

The individual management areas and their applicable standards are discussed in more detail below.

Asset management comprises an orderly whole of systematic and coordinated activities and approaches through which an organisation manages its physical capital goods (assets) and the associated benefits, risks and expenses throughout their entire service life optimally and sustainably in order to implement the organisation's strategic plan.

Risk management covers all measures for the systematic detection, analysis, assessment, monitoring and control of risks, these are set out in DIN EN ISO 31000. Risk assessment is an iterative process in accordance with DIN EN ISO 12100.

<u>Security management</u> is a process which is focused on the formal processes and structures for security in organisations. The requirements for an occupational health and safety management system are set out in OHSAS 18001 (Occupational Health and Safety Assessment Series). IEC 61508 and the DIN EN series 50126, 50128 and 50129 were developed for functional safety on the railways.

Both risk and security management affect the prioritization, load classification and categorisation of train paths, from transcontinental (and also pan-European here) to secondary lines in accordance with IDM^{VU} as well as utilisation categories, asset classes and line categories.

The entirety of all measures for the management, control and development of maintenance is defined as <u>maintenance management</u>. There are multiple standards and guidelines for maintenance and maintenance management. The main ones are:

- DIN 31051 Basics of maintenance
- DIN 13306 Maintenance terms
- DIN EN 13269 Maintenance - Guidance on the drafting of maintenance contracts
- DIN EN 13460 Maintenance - Documents for maintenance

<u>Quality management</u> designates all organisation measures which serve to improve the process quality, activities and thus products of any type. In quality management, the term activities covers services, but also goes beyond the usual term and predominantly relates to internal activities within the organisation. DIN EN ISO 9001 Quality management systems should be observed here.

<u>Energy management</u> is a process which is focused on the formal processes and structures for the use of energy in organisations. It covers the entirety of the interrelated or interacting elements for the introduction of an energy policy and strategic goals as well as processes and procedures for achieving these goals and is set out in DIN EN ISO 50001. The objective is the analysis and improvement of energy efficiency. This can occur rationally with regard to the energy data dependent on the locomotive, the line and the load in a logistics or asset management system. On the railways, the energy demand forecast incl. return current generation is of increasing importance in order to maintain favourable conditions for energy supply through optimisation of the limit values and exact demand information. In particular, the temporally and locally variable consumers (which are also suppliers), the exchange of energy between the vehicles and the highly dynamic load profiles demand the use of an IT system.

The section of the management of an organisation which deals with the operational and regulatory environmental (protection) concerns is referred to as <u>environmental management</u>. ISO 14001:2009 Environmental management systems - Requirements with instructions for use is an applicable standard for environmental management systems and contains requirements for an environmental management system. Key areas on the railways are noise, waste water disposal and ballast recycling (see also noise and railway bonus, traffic route noise protection measures, environmental guidelines from the EBA [Federal Railway Authority] or the old ballast guidelines). In support of the noise bonus, for example, the data collected in an asset management system concerning wheel diameters, brake designs and tonne-kilometres travelled can be added together and used as evidence together with a report.

The initiation, planning, direction, controlling and completion of projects is designated as <u>project management</u>. Terms and approaches in project management have been established by now and are standardised in DIN ISO 21500 as well as DIN 69901 and DIN 69909. The implementation of complex measures during the course of projects (job bundling, including integrated bundling) can be tracked in an asset management system and is of particular importance on the railways since line closures, diversions and tight "time windows" demand the minimisation of interference with timetables.

<u>Knowledge management</u> is a generic term for all strategic and operative activities and management tasks which are aimed at the best possible management of knowledge. Knowledge management in engineering, i.e. the basics, concepts and approach, are set out in the VDI 5610 guideline. The communication of experience by experienced, long-standing employees, acquisition of best practice for the generalisation of good solutions and first insights from the introduction of new technologies, vehicles, etc. increasingly demand solutions in all rail freight companies. The classification of

information and knowledge can be done specifically by route, vehicle and component according to the structure stored in an asset management system.

Special requirements from the standards and regulations on the railways

Derived from the EU directives, the UIC regulations and some documents which are applicable for Germany, special requirements on the railways arise.

Below is a selection of EU directives for the railways which appear to be relevant for asset management:

Directive 2004/49/EC of the European Parliament and of the Council dated 29 April 2004 on railway safety in the Community with Directive 2004/49/EC for common security requirements for the entire railway system.

EU Regulations No. 1169/2010 and 1077/2012 on common safety methods (CSM) for conformity assessment in relation to the requirements for the issuing of railway safety approvals and for monitoring after issuing of a safety certificate or safety approval.

Directive 2008/57/EC of the European Parliament and of the Council dated 17 June 2008 on the interoperability of the railway system in the Community with Directive 96/48/EC on the interoperability of the trans-European high-speed railway system and Directive 2004/50/EC which formalises 96/48/EC and 2001/16/EC and aligns them with Directive 2004/51/EC.

The Regulation (EU) No. 445/2011 establishes a framework for the certification of entities responsible for the maintenance of freight wagons (ECM, entity in charge of maintenance).

Alongside the EU Directives, the UIC (Union Internationale des Chemins de fer - International Union of Railways) has compiled approx. 600 leaflets and classified them into nine sections. The following guidelines are particularly important here:

- 712 Rail defects
- 714 Classification of main tracks from a track maintenance point of view
- 725 Dealing with rail defects

Additional important documents are:

- IDM^{VU} infrastructure data management for transport operators from the VDV (Association of German Transport Companies)
- Guidelines for the certification of entities responsible for the maintenance of freight wagons (ECM, entity in charge of maintenance)
- The provisions of the EBO (Ordinance on the Construction and Operation of Railways)
- Texts from the VDV and guidelines and service regulations from DB
- Guidelines on the CSM (common safety method)

Summary

Information on ergonomic requirements, the individual management tasks in a company and railway-specific features in the three main requirement fields for every IT system in the field of asset management have been shown based on the applicable standards and relevant regulations. It is also clear that, with the use of an asset management system - such as zedas®asset, for example - which covers these three main requirement fields, the relevant EU Directives, standards and regulations in the daily work routine can be taken into account and adhered to.