SILK – Information System for Railway Lines

PKP Polish Railway Lines (PKP PLK) - as the manager of the national railway network in Poland - has implemented IT solutions to present and analyse the developments in railway network in the country. It achieved that through the use of dedicated GIS-class tools that enable comprehensive collection, processing, analysis and visualization of different data on railway lines.

Client needs
PKP PLK (www.plk-plk.pl) collect and process vast amount of information about railway lines and objects and events that occur on these lines. The data have been collected over many years, both in the traditional paper-based form or locally created files, and in distributed systems. The need emerged for the provision of such a large amount of information in an easy to administer, modern and user-friendly application. The client also expected effective graphical presentation of multiple data on one map simultaneously. The presentation was to take into account the holistic approach of the issue by showing the spatial relationships between different data. It was expected that such presentations can significantly facilitate the rapid analysis of large amounts of information and at the same time enable current and effective business decisions.

SILK supports decision-making in relation to the formulation and oversight of investment processes, operational works, management of railway infrastructure and working out a strategy for development.

The system is also identified as one of the sources of information about railway lines in the Spatial Information Infrastructure Construction Programme at the Head Office of Geodesy and Cartography (GUGIK).

Key benefits

- Effective exploration of spatial relations and dynamics of the phenomena concerning railway lines
- Capability of defining, editing and visualizing the course of railway lines, based on the geometric and logical model
- Cross-sectional information about objects, processes and phenomena concerning railway lines with a capability of locating data in the content-rich thematic map
- Graphic representation of the network reference system with data from domain systems
- A multi-user and parallel access to technical documentation and spatial information
- Availability of all data in accordance with national and international standards (e.g. RINF and INSPIRE)
- Supporting processes of transport interoperability and modularity
- Comprehensive knowledge of railway property
- Support for the analysis of processes related to environmental protection
SILK - main modules and functions

Linear Reference System (LRS)

The railway line network model – Linear Reference System (LRS) is one of the main modules and provides a uniform spatial reference for many of the related IT systems used by the PKP PLK as well as maps and station diagrams. To accommodate the increased detail of the network model, the mechanisms for handling the LRS were developed for track geometry, railway track section management mechanisms and database control mechanisms were introduced, and analysis mechanisms were adapted to support railway lines and tracks. Today, the main functions of the module are:

• construction of the LRS network graph and allowing the gradual increase in the accuracy of surveying parameters,
• access to read and visualization of railway data from other modules for a given kilometre section and/or surveying coordinates,
• retrieval of information and visualization of search results on the map,
• creation of thematic maps of the railway network using data from different systems,
• performing spatial analyses.

The LRS system features a very useful functionality that allows the preparation of the mechanisms for visualization of the results of the analysis prepared for any business-relevant data on the geometry of the railway line and the rail track based only on the reference system (line/track number and kilometre section).

Property Module

This module is in response to the need to consolidate the information which has so far been distributed in the PKP PLK within various offices and facilities. The application makes it possible to centrally collect information about property in the open graphical and descriptive structure of the Oracle Spatial database. Information about the location of the kilometre section made in the course of the implementation of this module included:

• feeding the database with different data sources distributed within the client’s company,
• migration of descriptive data concerning the properties transferred to the database,
• import of geometric data from the pre-project documentation created in the context of the modernization of the railway line (situational-elevation maps for project purposes),
• defining the coordinate system for the data (the state coordinate system in 1992),
• providing the data model logic that takes into account the administrative division of the country and districts belonging to the zones of the coordinate system 2000,
• automatically assigning the mileage to individual parcels and buildings by linking them with the LRS module.

In the context of product development the Property module has been enhanced with a module for supporting the implementation of the plan for the acquisition of properties for investment purposes. Thus, it is possible to monitor the current status in the acquisition of property.
Documentation Module

The module supports the cataloguing and storage of documentation, enabling broad use and management of the available information. By using the Geospatial Server solution that is based on the Bentley ProjectWise technology, the central repository of documentation generated in the process of the railway network management was created. The goal is to create a "single source of truth", eliminate storage outside the system of local copies of documents and the ambiguity of the versions of the same documents used in parallel. The use of versioning, relationship of the supremacy and subordination of the individual documents and electronic communication system has enabled the generation of multiple versions of documents with stored information regarding modifications and start of notifying the users of the changes in the repository. Through the defined model of railway line data (including structure, directories, dictionaries, metadata, system data, forms) describing the generated documents, it is possible to efficiently collect and then retrieve information about the generated documentation, visualization of search results on the map and performing spatial analyses and reports. The repository collects and manages documentation in virtually all formats, such as:

- text documents localized indirectly, by reference to a line, a point or a specific area,
- business documents (such as MS Office, PDF),
- drawings, sketches, plans, photographs localized indirectly, by reference to a line, a point or a specific area,
- georeferencing (with the assigned location - such as maps, projects aerial photographs).

Geographical reference documents are automatically localized based on the coordinates projected automatically onto the section of the railway line kilometre, and the other - indirectly by reference to a specific geographic or business area. Moreover, the transformation of the data collected on-the-fly in different reference systems was allowed. The implementation of the Documentation module also allows for efficient cooperation and exchange of electronic data with external units (e.g. local governments, public institutions, design studios). The ProjectWise technology combined with SHH solutions has been applied across multiple organizational units in terms of the management of technical documentation and it integrates all the data stored in the system with the two types of reference systems:

- Linear Reference System (LRS);
- surveying flat spatial reference system.

The locating interchangeability should be accentuated – any document on the map can include an automatically calculated mileage, and any document described by mileage can be shown on the map in its location. The open structure and scalability of the system made it possible to create a number of functionalities; users are provided with, among others, the capability to use the following features:

- versioning of project files resources, working on files offline without connecting to the system (mobility);
- modelling the flow of documents both from status to status and between subsequent users (authors) of the documentation;
- capturing conflicts in the spatial documentation (disclosing problems at an early stage of analysis);
- automatic notification of changes in the projects documented by the system.

MILK - Interactive Map of Railway Lines

The MILK directly uses the data stored in the LRS and Property modules and other PKP PLK systems, so it always provides the up-to-date information about the railway lines in the spatial context. The MILK includes tools for publishing spatial and descriptive data about the infrastructure of the internal users with the PLK (intranet) and, to a limited extent, it will be made available on the Internet for external users.

The map has been updated with general geographic information which is necessary to carry out the internal operations of the client.
Administrative Panel

Under the SILK project, an administrative network application was created to manage the content of the MILK - Administrative Panel railway mapping portal. This software supports the daily work of the users through the facilitated creation of map compositions, including the content retrieved from the associated databases used in other applications in the PKP PLK. With the supplied tools, the PKP PLK geoinformation personnel independently edits web page content by creating on-demand thematic maps and quick analyses.

Contracts Module

In the context of the SILK development, the Contracts Module has been developed and implemented, allowing the user to systematically and securely store and manage data, which has been covered by the contracts: D-50, D49, N48 and D67 between the PKP PLK and the PKP Main Department. In addition, the Contracts Module is integrated with - the Property Module, making it possible to clearly identify the owner and manager of the property lying under the railway line, as well as its location in the geographical space. Once again, the openness and flexibility of the modules should be emphasized; the best proof of this is the storage location of the documents relating to the annexes to the D50 contract - they are stored and displayed directly from the Documentation Module.

Access Rights Module

The Access Rights Module has the overriding role to the applications and modules described above; it is another tool created in the context of the development work to manage and authorize access to applications and data of the SILK system. The Access Rights Module assigns rights to users by integrating with an external solution - SAP HCM database.

Operators involved in the project implementation

- Properties and Surveying Office of Rail, PKP Polish Railway Lines (Biuro Nieruchomości i Geodezji Kolejowej PKP PLK)
- IT Office, PKP Polish Railway Lines (Biuro Informatyki PKP PLK S.A.)
- PKP Informatyka
- SHH