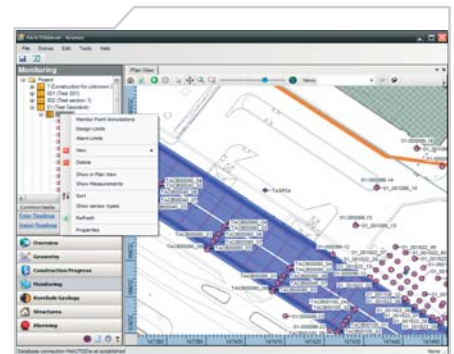


KRONOS Tunnel Information System

date: 06/2008

HIGHLIGHTS

- Modular design enables project-specific and customer-specific application
- Manual and automatic data capture
- Open interfaces facilitate import and export of data in many formats
- A variety of reporting functions with interfaces to web browsers
- Alarm and reporting functions can be freely configured



Overview of a subway section

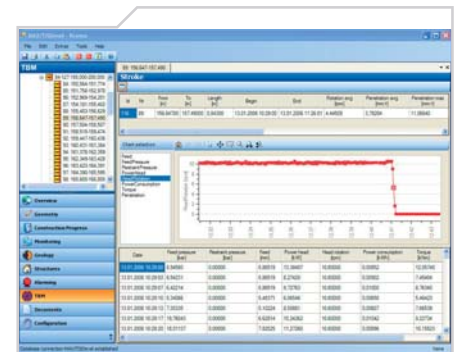
Field of Application

Today's quality requirements in underground construction render the efficient administration and documentation of all data indispensable. Immediate availability and clear visualisation and presentation of the data are an essential prerequisite to the economical completion of high quality projects.

For the sake of maintenance, the data base must also remain available in a suitable format during the entire lifespan of the object. The KRONOS tunnel information system is the most suitable tool for data acquisition, data management, automatic alerting and visualisation.

Data bases relating to geotechnical measurements, geotechnics and geology, support systems, 3D geometry and building data, construction progression and TBM data and surveying are specifically among the data managed.

This information system can of course not only be deployed in tunnel construction, but also in various other large construction projects and in mining.

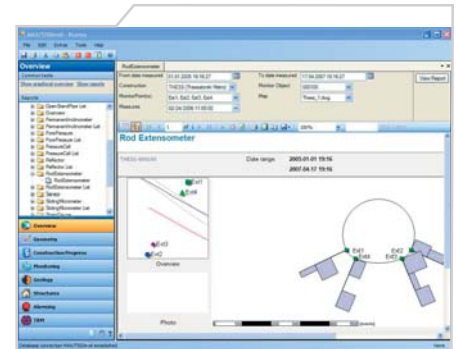


Visualisation of TBM-data

KRONOS Tunnel Information System

Main Features

- Uniform procedure for systematic storage of relevant data from different data sources, with intuitive graphical user interface.
- Visualisation of measurements in tabular form and as diagrams with associated information.
- Interactive graphical overviews, extensive reporting functions and availability of the reports on the Internet (Web reports).
- Administration of pictures, plans, drawings, borehole logs, measurement data etc., with the option for exporting and importing via open interfaces.
- Networking and multiple user capability
- Configurable conditions for automatic notification of an arbitrary number of addresses when conditions are critical (alarm) and automatic management of measuring programmes.



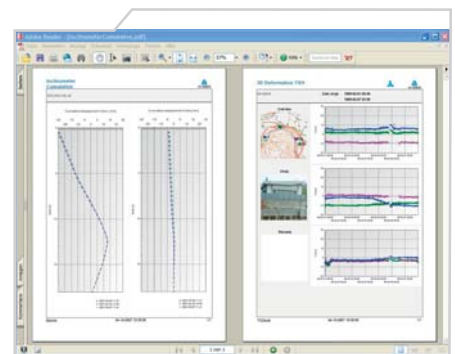
Cross-section related diagram of extensometer data

Description of Function

- Data storage
 - ✓ Modern and efficient relational database (Microsoft SQL server)
 - ✓ Combination of data from different sources in a consistent data scheme
 - ✓ Storage of images, drawings, graphs, bore logs etc. by integrated hierarchic data management system
 - ✓ Traceability from data changes due to a configurable history system
 - ✓ User specific allocation of access authorisation
- Data collection and -export
 - ✓ Manuel data acquisition
 - ✓ Definition of geometry (e.g. axes, profiles, etc.)
 - ✓ Systematic instrument definition
 - ✓ Measured values
 - ✓ Automatic data acquisition
 - ✓ Interface to Hermes© for secure transmission of data from different automatic measurement systems and from TBMs

KRONOS Tunnel Information System

- ✓ Open interface for import and export of measuring data (e.g. AGS, EUPALINOS, DAMOS, CSV, different text formats)
- ✓ SQL-interface
- ☐ Analysis
 - ✓ Visualisation of measuring data and attached informations (diagrams, charts)
 - ✓ Idle selection of analysis period and instruments
- ☐ Reporting
 - ✓ Integrated reporting with export options in different formats (Excel, PDF, HTML, CSV)
 - ✓ Web reports for access to reports from remote computers by web browser (no additional software installation is needed)
- ☐ Monitoring schedules
 - ✓ Generating, administrating and monitoring of measuring and monitoring programs
- ☐ Notification functions
 - ✓ Various recipients will be notified automatically in case of criticalities (exceed of thresholds, malfunction of system components) by SMS, E-Mail, etc. The notification rules are free configurable.
 - ✓ Automatic creation of monitoring schedules depending on defineable conditions (e.g. threshold values, construction progress, ...)
 - ✓ Automatic transmission of reports



Report

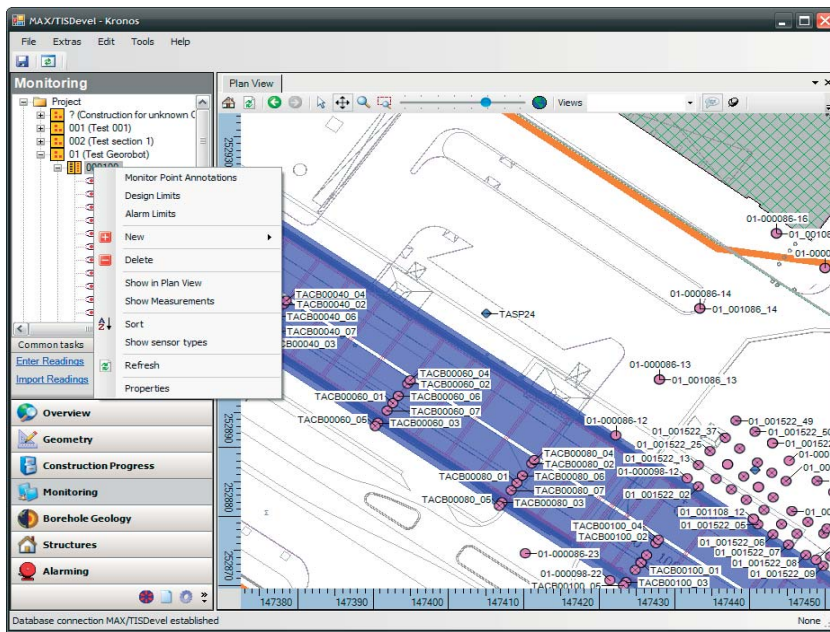
The following other data sheets are associated with this data sheet.

- Services: *GeoRobot - Automatic 3D-Deformation Monitoring System*
 TAUROS TBM Guidance System
 DAMOS - Automatic Data Acquisition System
- Systems: *Networks- and Control Survey*
 Construction Surveying and Setting Out
 Heading Survey
 Inventory Surveying
 Geotechnical Monitoring - Installation, Data Acquisition and Evaluation
 Optical 3D-Deformation Monitoring
 Settlement Levelling

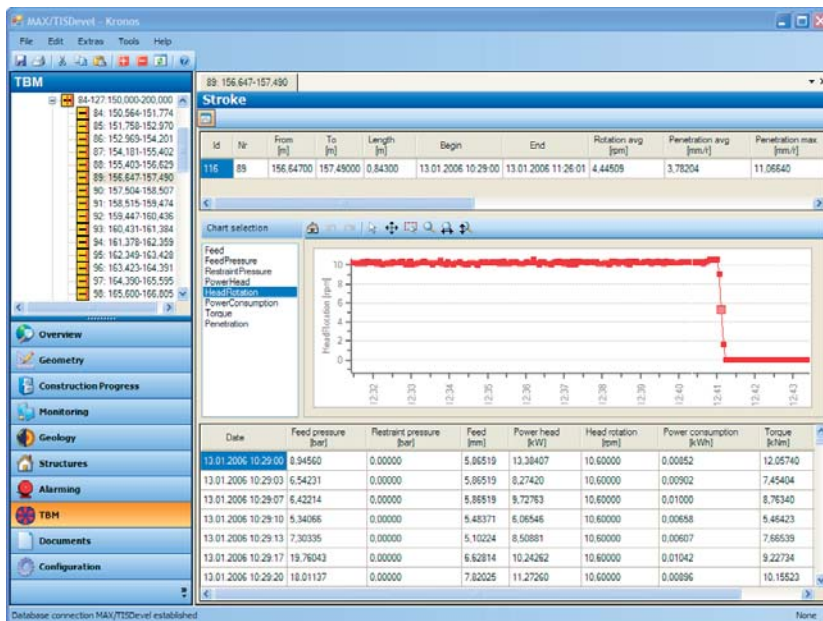
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Visualisation Examples (screen shots)

Overview of a subway section

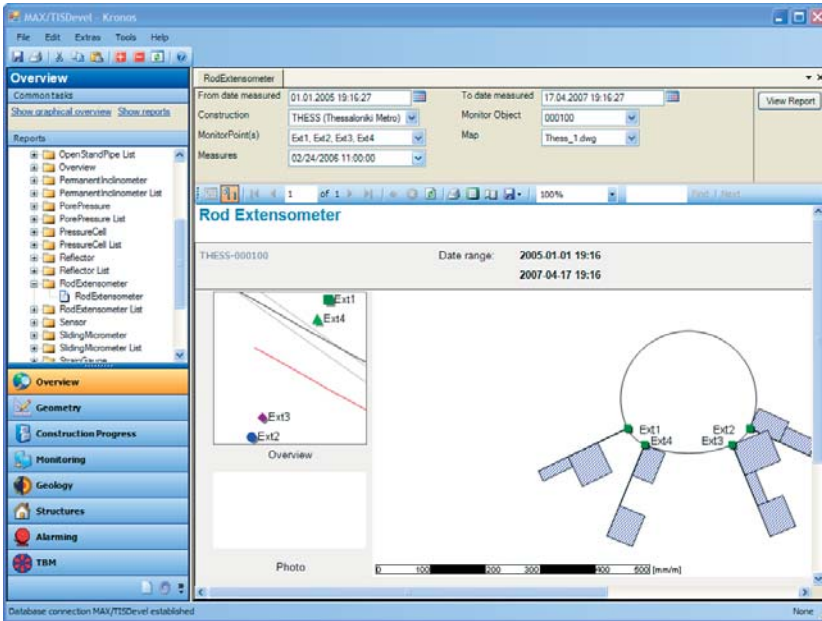


Visualisation of TBM-Data



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Cross-section related diagram of extensometer data



Reports

