VDMS
Process Data Management System
for Mechanised Tunnelling

- Optimally control and continuously improve construction processes
- Always have a view of costs and risks
- Ensure and document quality efficiently

VMT

VDMS | Process Data Management System for Mechanised Tunnelling

Digitalisation, BIM (Building Information Modelling) and Building 4.0 are elements that are also increasingly used in mechanised tunnelling and significantly influence all processes — this provides customers and construction companies with interesting opportunities for optimisation.

VDMS, the "VMT Data Management System", is a software platform independent of operating system that helps you in realising these potentials. Originating from many years of direct project experience, VDMS bundles the expertise of VMT GmbH in a forward-looking system solution. VDMS can be used immediately in its standard configuration, however it can also be flexibly adapted as required.

**Which benefits does a process data management system create?**
The digitalisation of construction sites, BIM and Big Data become a daily reality with a process data management system. Such a system stores all occurring data in the course of your projects from many different sources at a central location, correlates, analyses and visualises these data in various output forms and finally ensures reliable archiving of all project data — irrespective of how many TBMs (tunnel boring machines) or other machinery and equipment are involved in the project.

Finally, digitalisation helps your construction sites to extract the considerable value of the occurring process data to be able to plan and control current and future projects even better and more efficiently. This concerns not only the advance but also all other project processes. In this way, you gain process reliability, minimise risks, reduce costs and save resources.

At the same time as the process data recording, you meet the contractual documentation obligations to your customer and also possible legal requirements. In contrast to manual recording, the effort needed for acquisition is considerably reduced. As a result, your employees gain more time for their main tasks.
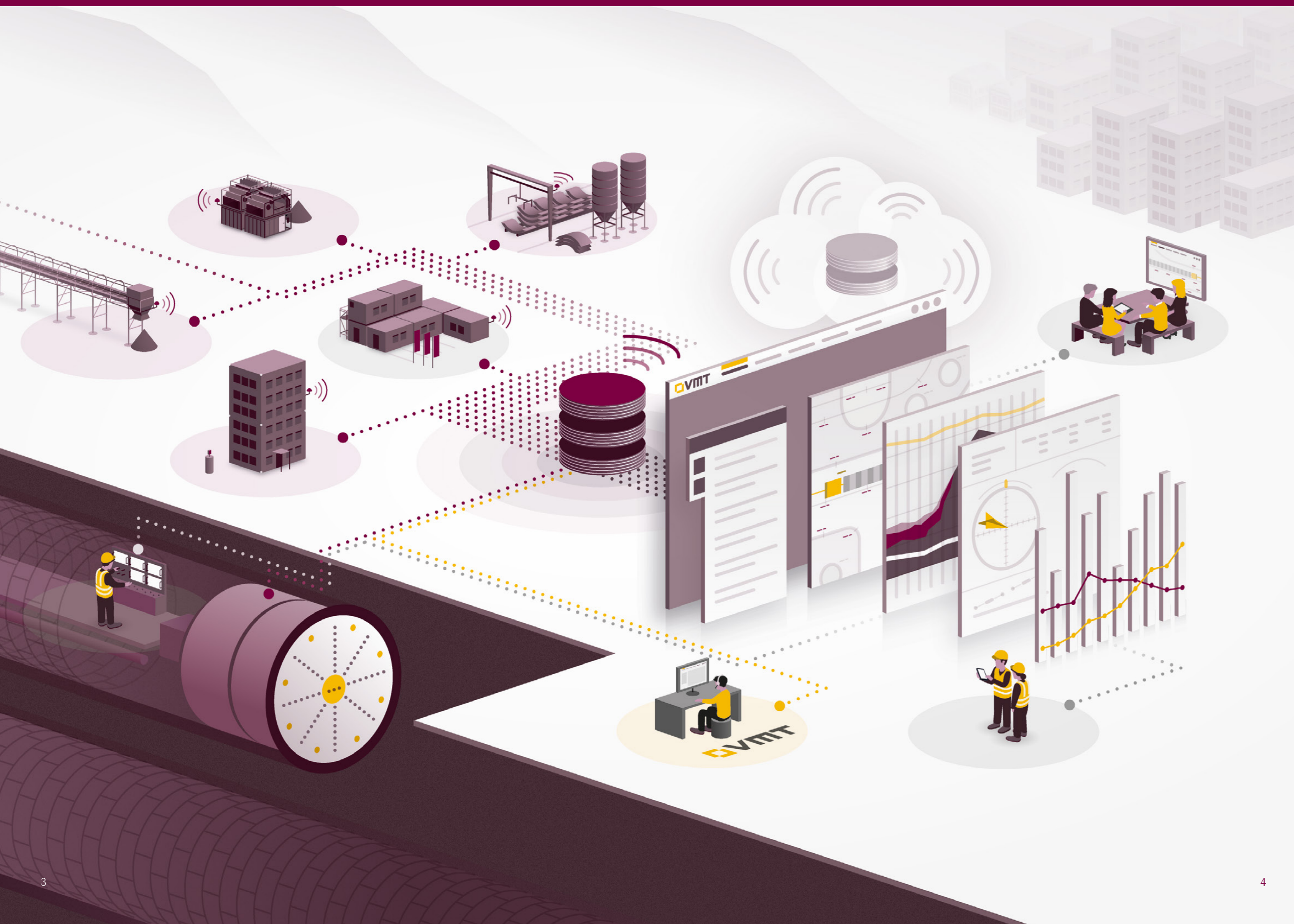
The VMT Process Data Management System VDMS is a browser-based process data management system for mechanised tunnelling. VDMS prepares correlated data from different sources, analyses and visualises the data and makes them available worldwide in various output forms with defined access authorisations.

Which functions and benefits does VDMS provide?
VDMS is a web application. It functions in common modern web browsers and is compatible with many different types of hardware. VDMS does not have to be installed on the computers of the users and kept up to date there. All data are available to each user on the construction site or even worldwide.

VDMS consists of several modules. Each individual module contains powerful functions for a special range of tasks. Each person involved in the project only has to use the modules that support his special tasks within the project – this makes familiarisation easier and shorter.

Practical orientation guarantees high acceptance
As VDMS has its roots in the daily practical experience of real projects, its modules provide the users with specific added value or a clearly reduced workload.

VMT GmbH has been operating successfully for more than 20 years as a system provider in the tunnelling industry and provides system solutions for TBM navigation, segment lining production and logistics, industrial measurement and deformation monitoring. VMT is a subsidiary company of Herrenknecht AG, a global market leader in mechanised tunnelling systems. Using VDMS, you and your employees benefit directly from this wide and sound experience.

VDMS links all areas of your construction site into an efficient workflow network

In contrast to other process data management systems for tunnelling, VDMS is characterised by its unique wide range of the processed data. As a subsidiary company of Herrenknecht AG and as a system provider for software solutions in the tunnelling field, VMT has unique know-how for integration of the many different systems. This concerns not only Herrenknecht machines and in-house VMT systems such as VMT Segment Documentation System (SDS), TUnIS Navigation, TUnIS Ring Sequencing or VMT Deformation Monitoring MODUS. Thanks to flexible interfaces, connectors to other systems can also be created and their data integrated into VDMS Process Data Management. Thus VDMS is not an insular solution but always provides the widest possible process data management for tunnelling from one source.

VDMS | Process Data Management System for Mechanised Tunnelling

The core function of VDMS consists of the **merging, evaluating, displaying and archiving** of all process data from a mechanised tunnel construction project. Sensor data from all TBMs, data from other systems (e.g. from surface monitoring), excavation, personal data, shift data and others.
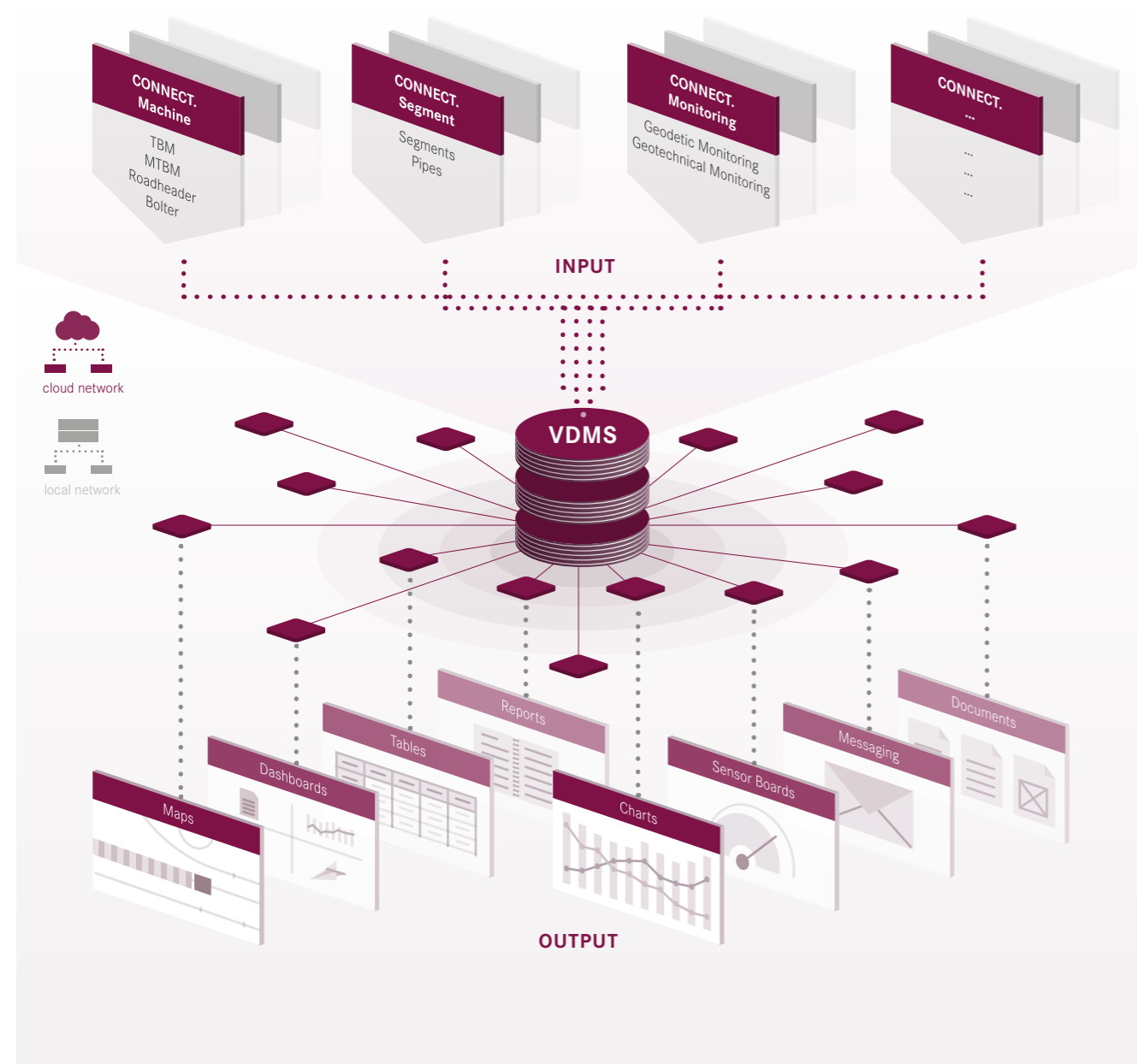
VDMS supports you with the optimisation of your tunnel projects

A powerful process data management system like VDMS provides many benefits and great optimisation potential. The following list gives an overview of the most important benefits.

Benefits

Easy information exchange and transparency for all involved

- Central data storage with simple access for all authorised persons involved in the project enables rapid and well-founded decisions to be made
- Optional access to selected data for customers and building supervision authorities creates transparency and makes communication easier
- Condensing of the plethora of information to Key Performance Indicators (KPI) and their clear presentation on dashboards support rapid and well-founded decision-making
- Archiving and long-term documentation of all important process data create legal bases for compliance requirements and claim management

Cost reductions and improved profitability

- Automatic documentation and archiving reduce employee workload and prevent errors
- Fewer and shorter downtimes due to better project planning
- Process optimisation using analysis of past data

Optimum quality and safety on the construction site

- Monitoring of the pressure and gas levels and notification if limit values are exceeded
- Alarming in the case of unusual events such as variations in the excavation balance and as a result of imminent soil settlements
- Compliance with quality standards by continuous monitoring and process documentation
- Risk minimisation by evaluation of past data

Hardware-independent, worldwide availability and maximum data security

- Can be executed in web browser without installation at every workplace without particular system requirements for the workplace computers
- As "Software as a Service (SaaS)" completely maintenance-free for users; server installation, monitoring and support by VMT
- Can also be used for very heterogeneous IT infrastructure of those involved (e.g. in joint ventures) without having to create a common basis
- Can be used on desktop, laptop or by mobile app
- Central data storage and archiving not on the construction site but in powerful, fail-safe data centres (optionally, local hosting in the framework of the construction site infrastructure is also possible)
- Worldwide or entire construction site access to the current state of all data
- Failure safety due to redundant data storage; in the case of interruptions in data connections, local buffers of the data and automatic upload after connection is restored
- Automated, regular data backups
- Comprehensive user and permissions management, protection of confidential data against unauthorised access
- High number of users and freely configurable user groups
- Encrypted data transmission using HTTPS

Benefits

Data mining and continuous know-how growth

- Central data storage with redundancy-free, consistent database enables evaluation of large quantities of data from heterogeneous systems
- Linking of the data shows previously unrecognised correlations
- Due to the archiving of all important process data, subsequent additional analyses can also be performed
- Regular evaluations create the basis for internal knowledge management and thus for continuous know-how growth
- Gain additional planning reliability for future projects due to well-founded experience values

Preconfigured, but can nevertheless be flexibly adapted

- Numerous proven sensor boards, dashboards, charts and reports are preconfigured
- Templates can be adapted globally at any time as required – in the case of changing requirements also still during a running project resulting in optimal alignment with the needs of the respective construction site
- New templates and evaluations can be added yourself at any time
- Option to integrate further process data sources using additional interfaces (connectors)

Future-proof and always up to date

VDMS in its standard version already has many connectors for data import and for the visualisation, evaluation and archiving of the acquired data.
The basic scope of VDMS is constantly expanded with new connectors and adapted to current technological developments and new interfaces. Thus, VDMS also remains an important long-term support tool for structure documentation, in tunnelling.

Various functions for maximum efficiency

The large range of functions of VDMS always provides best the possible support. Not only in standard cases but also if a project has individual special features. Due to the modular approach of VDMS, every user can only use the subset of functions that support him in his tasks and provide a specific added value to him here. As a result, despite the many functions, the application remains clear and simple.
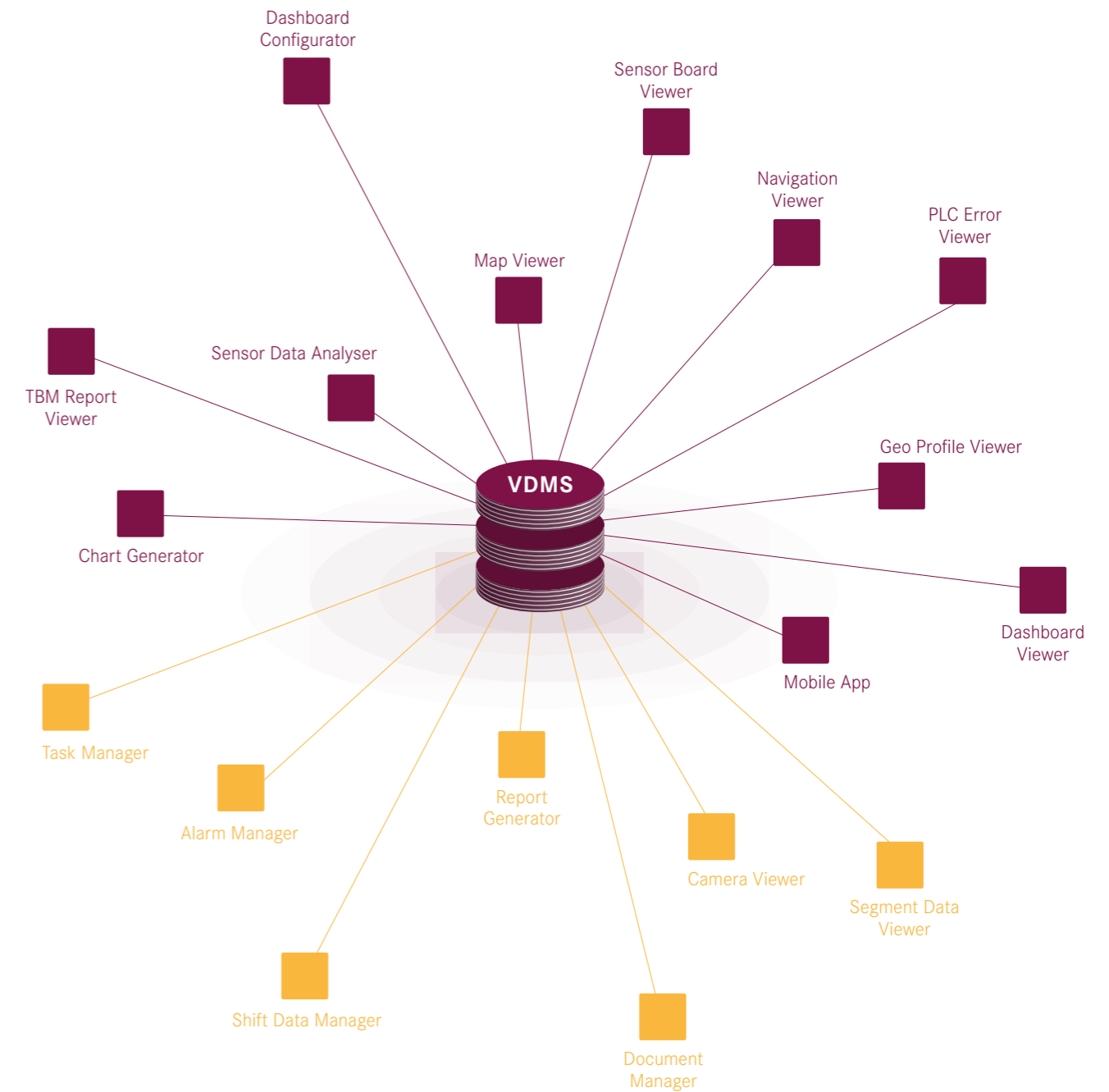
Standard Modules   Optional Modules

Overview of VDMS modules and functions

Chart Generator

Users create graphical displays and evaluations of process data using the Chart Editor. The charts can be retrieved and evaluated not only in the Chart Editor but also integrated in dashboards.

- Interactive selection of the displayed data based on time, ring number, chainage or tunnel distance
- Representation of values dynamically calculated from other values ("virtual sensors")
- Multiple graphs in one chart simultaneously; multiple y-axes in the chart for data series with different units of measure
- Additional information can be displayed, e.g. ring numbers, min. / max. values or geoinformation
- Creation of chart templates
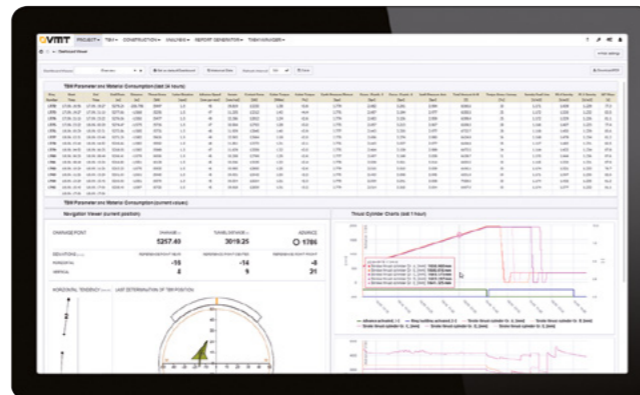- Sharing of chart templates with other user groups

Chart Generator

Dashboard Viewer and Dashboard Configurator

Dashboards show the data of various VDMS functions summarised on one screen.

- Examples: charts, sensor boards, navigation view, cameras, maps etc.
- Capability to combine data from different machines and equipment

Dashboard Viewer and Dashboard Configurator

Geo Profile Viewer

As a supplement to the Map Viewer, the Geo Profile View shows the current machine position and the finished rings on a geological longitudinal section. This simplifies decisions for optimisation of the performance and estimating possible underground risks.

- Import and display of map material as image file
- Automatic display and update of the current TBM positions and rings
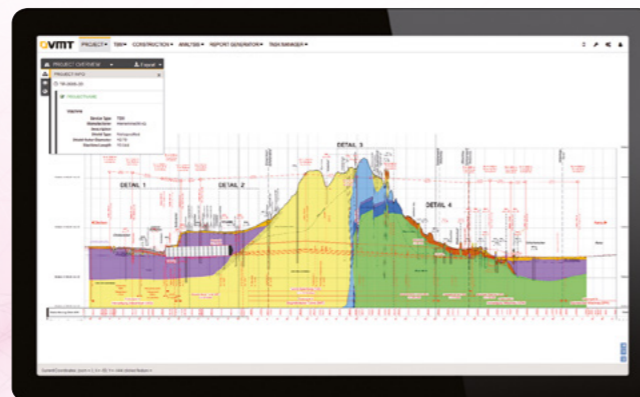
Geo Profile Viewer

Map Viewer

The Map View shows the current position and the current status of all TBMs and other machines and equipment on the projected tunnel alignments as well as a top view of the rings. Further status information is obtained by clicking on the machine or ring.

- Optional display on map or satellite image
- Display including geographical coordinates
- Control Panel for quick access to favourites and related information
- Optional organisation of the data on different image planes that can be shown and hidden individually
- Pop-up window can be displayed for each machine and each equipment item with the most important parameters


Map Viewer

Mobile App

The mobile app also enables mobile access to important VDMS data on a smartphone or tablet (iOS and Android).

- Display of the current positions of the TBMs and other machines and equipment on a map or on a satellite image
- Display of Key Performance Indicators
- Monitoring of the machine status using specially adapted sensor boards
- Display of charts
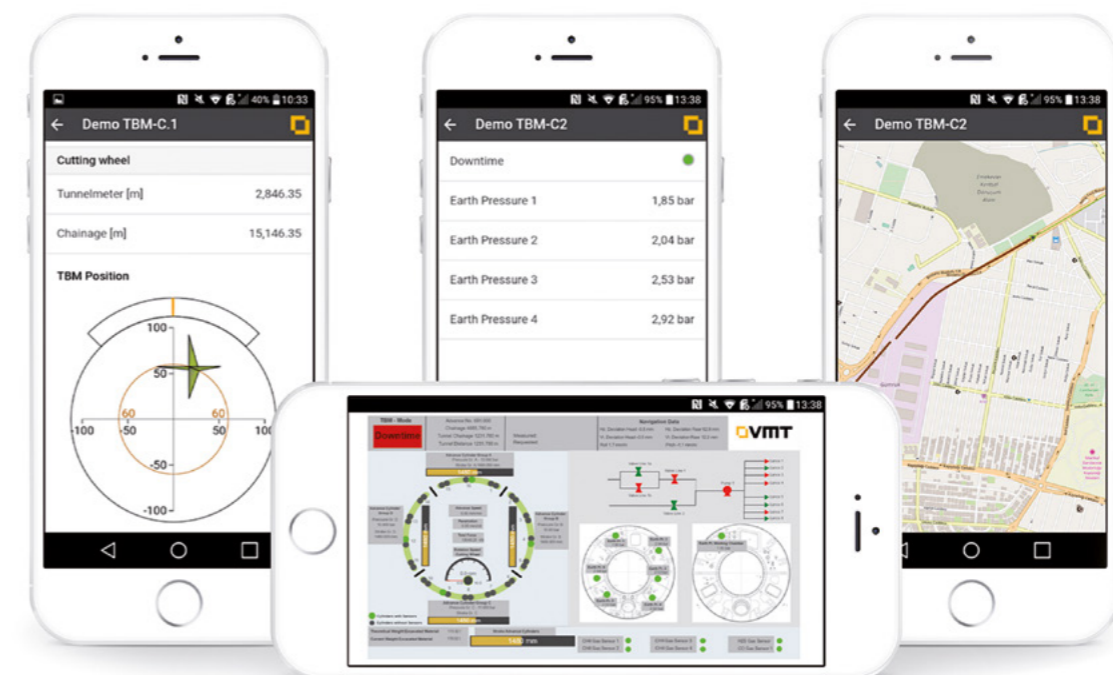
Navigation Viewer

The Navigation View visualises the alignment of a TBM and its possible variations from the planned tunnel route. This makes compliance with and reduction of tolerances easier and in this way helps to prevent additional costs due to increased excavation and use of concrete.

⌐ Graphical and numeric display of nominal values and variations

⌐ Look back in time with display of the value from the previous process

⌐ Display of two navigation views simultaneously is possible


Navigation Viewer

PLC Error Viewer

The PLC Error Viewer is a powerful aid for finding the causes of errors that have occurred. The chronological occurrence of the PLC error values can be tracked using the Error Viewer. Other bit values can also be shown in parallel with the display of error states whereby previously unknown correlations can be detected.

⌐ Combination of error state sensors and bit values in clear Gantt charts

⌐ Graphical display of multiple values simultaneously makes the discovery of correlations easier

⌐ Easy moving forwards and backwards through the history according to date and time, chainage, ring number or tunnel distance

⌐ Zoom in and zoom out

⌐ Export of the data as Excel files
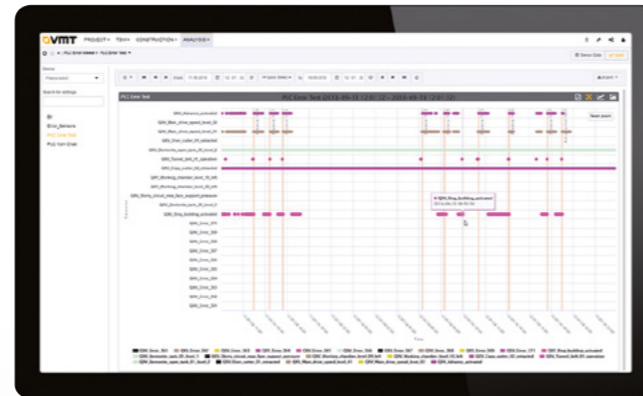
PLC Error Viewer

TBM Report Viewer

The TBM Report Viewer provides users with easy and central access, particularly to PDF reports of TBMs outside VDMS and the VMT systems installed on them. The relevant reports are automatically uploaded to VDMS by the systems outside VDMS and are then directly available to users there.

⌐ Display and download of reports directly in the browser

⌐ PDF reports generated by TBMs

⌐ PDF reports of the VMT TUnIS system such as navigation and ring building reports
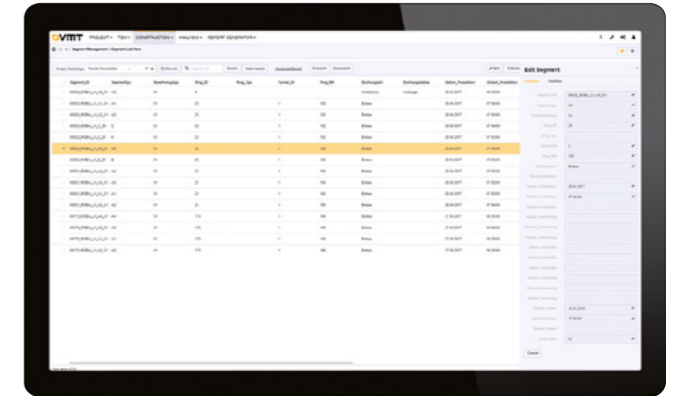

TBM Report Viewer

Sensor Data Analyser

The sensor data analysis shows sensor data in table form. These tables can contain either current or historic data

⌐ Tables can be compiled easily

⌐ Sharing and commenting of tables with other users

⌐ Export option to CSV, XLS or XLSX for statistical evaluation in external programs or for external archiving

Sensor Data Analyser

Sensor Board Viewer

Sensor boards provide a graphical overview at a glance with status displays and values of sensors.

⌐ Schematic illustrations for the individual process components

⌐ Capability to combine numeric values, tachometer displays, progress bars, colour displays, images, text, lines, shapes and other graphical elements

⌐ Sensor boards adapted to the machine type
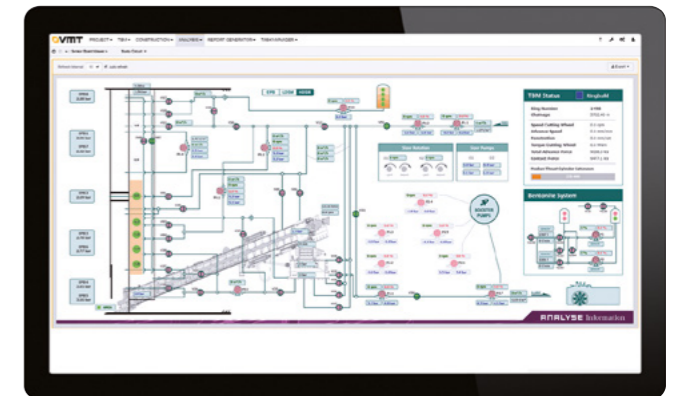
Sensor Board Viewer

Optional VDMS modules

Alarm Manager

Using the alarm management, alarm zones can be set for sensors; VDMS triggers an alarm if these thresholds are reached or exceeded. This creates safety and relieves management from continuous, manual setpoint monitoring.

- Notification by pop-up or email
- Alarm level can be saved in alarm diagrams
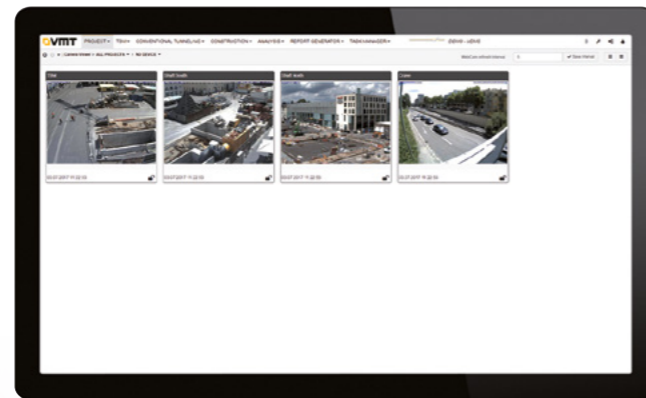- Different alarm diagrams for various user groups are possible
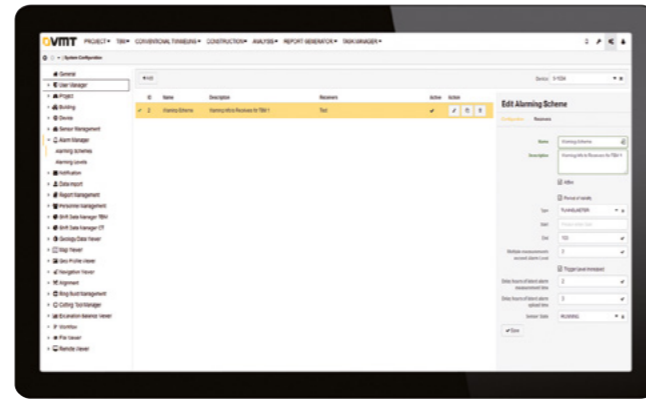
Camera Viewer

The Camera View enables monitoring of the running work and thus the recognition of risks and support for problems.

- Connection to IP cameras in the site network and web-cams possible (if technical requirements are met)
- Targeted access to the cameras of specific construction phases
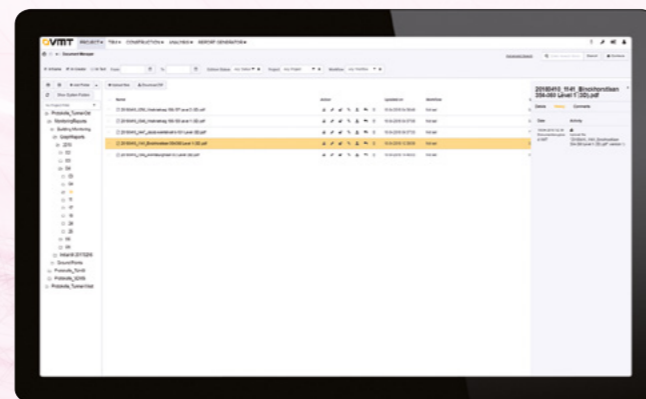
Document Manager

The document management is the hub for the storage and exchange of all relevant documents for a project. This applies both for the documents created by VDMS as well as for those imported from other sources and documents uploaded to VDMS.

- Examples: Log files, reports, Word documents, PDF files, Excel worksheets, design drawings, photos, videos
- Convenient import of complete directory structures
- Access protection using individual allocation of authorisations
- Global search for specific documents
- Generation of time-limited download links for persons without VDMS access
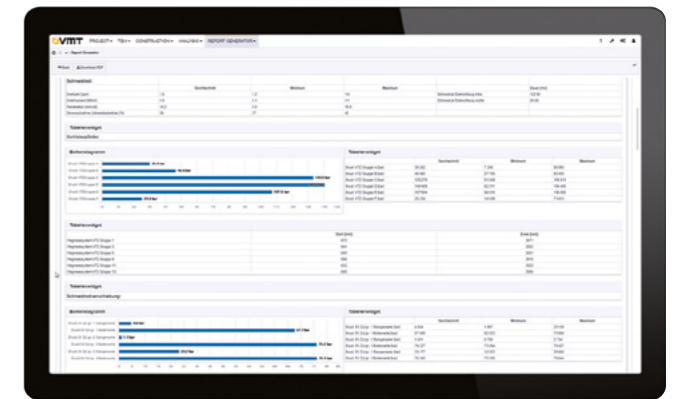
Report Generator

Many modules of VDMS have a report function. The Report Generator is a central place for creating reports and shift reports.

- Reports can combine data from multiple data sources
- Predefined widgets can be integrated in the reports

Alarm Manager

Camera Viewer

Document Manager

- Summation and presentation of data daily, weekly and monthly, also according to tunnel distance or ring, are possible
- Report templates make the work easier and guarantee standardised reports over the entire project duration
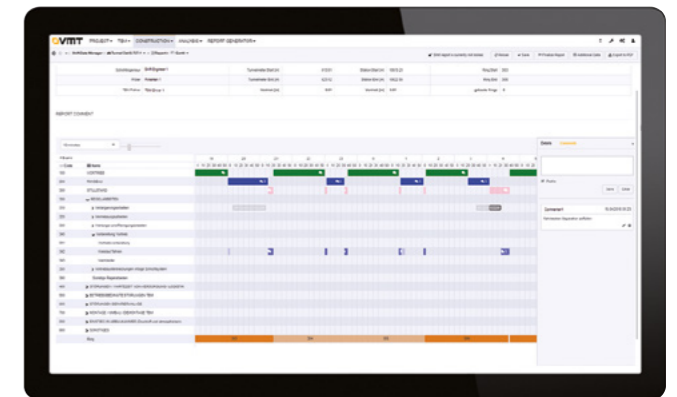
Shift Data Manager

Using the Shift Data Management, project teams can easily create shift reports and document and evaluate all work performed during a shift there. In particular, shift reports also document standstills and their causes and are thus an important basis for the later billing.

- Gantt Chart
- Automatic detection and recording of advance, ring building and standstill
- Fast recording of other work using selection list and code numbers
- Export of shift reports to PDF and CSV

Task Manager

The task management makes the coordination of the persons involved in a project easier.

- Easy creation of tasks for all users and attachment of documents
- Application example: Creation of a task for particular data or incidents to obtain an expert opinion or decision
- Capability to link to charts and sensor data tables
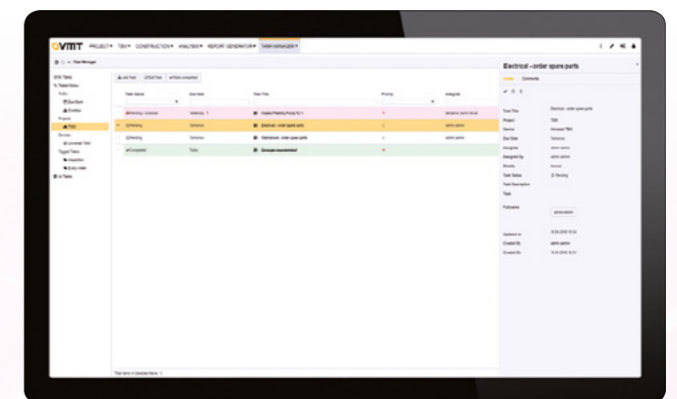
Segment Data Viewer

The Segment Data View provides assistance with the tracking and documentation of the segmental lining.

- Database for manual collection of parameters such as segment ID, production date, concrete type, reinforcement type, date of delivery to store, installation date, ring number
- Data import from files, for example files provided directly by the segment lining manufacturer

Report Generator

Shift Data Manager

Task Manager
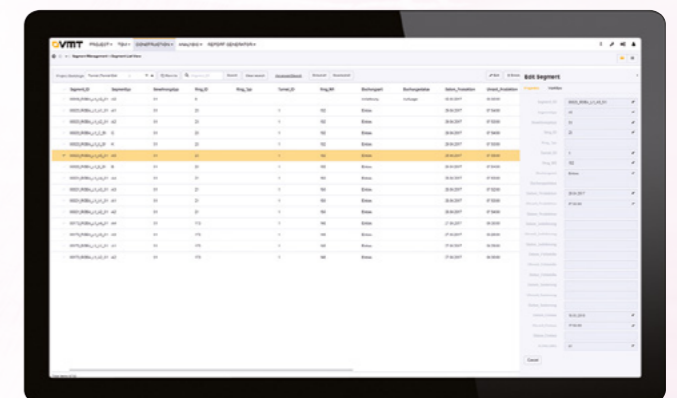
Segment Data Viewer

Feature set / Functions

Chart Generator
for creation and evaluation of charts with sensor data

Dashboards
with a summary of the most important data from different VDMS modules functions at a glance

Geo Profile Viewer
with already built rings and current TBM position

Map Viewer
with current geographical positions of the alignment, the TBMs and other machines and equipment on a map or on a satellite image; visualisation and interactive access to the built rings

Navigation Viewer
with display of the actual position of the TBM and any variations from the set course, possibility of a look back in time

Sensor Data Analysis and Output
in table form

Sensor Boards
for graphical display of status and sensor values

Task Manager
for simplified coordination of the persons involved in the project

Reports
Numerous preconfigured reports with the option of generating these reports manually in relation to time, tunnel distance or ring

Shift Data Manager
with semi-automatically created shift reports for documentation of responsibilities and standstills

Segment Data Viewer
for the tracking and documentation of the segmental lining

Alarm
Automatic alarm signalling if selected sensor values are exceeded

Camera Viewer
for central overview of all areas of the construction site using access to various IP cameras

Document Manager
with worldwide access to documents created by VDMS and to external documents assigned to the project

Mobile App
for also monitoring important data on iOS or Android devices

VDMS as a Service

A process data management system used on a construction site imposes high requirements for performance and availability of the IT infrastructure used. This starts with the switches to be installed directly on the TBM and computers for the data acquisition and ends with the servers in the data centre, on which your valuable process data are stored and archived in fail-safe form with the required performance.
We provide you with support in all phases from the planning to the operation to the later final shutdown.

Software as a Service

⌐ Deployment completely locally on the construction site or in the cloud

⌐ Regular installation of software updates

⌐ Optional integration of VDMS with other VMT products and other external process data suppliers

⌐ VDMS modelling and configuration

⌐ Training and support of the project engineers

Infrastructure as a Service

⌐ Web hosting through renowned cloud computing providers provides the possibility to intercept and scale performance peaks quickly and easily

⌐ Continuous production and operation monitoring of your VDMS projects in productive operation (server monitoring, VDMS monitoring)

⌐ Fast automated recognition of acute problems with short response time

⌐ Proactive detection and resolution of foreseeable problems already before the occurrence of negative effects

⌐ Regular data backups

⌐ Final shutdown including data archiving

As a result, we ease the workload on your own IT personnel and create maximum process reliability due to the optimal qualification of our support with short response times.

Dashboard configuration for maximum ease of use

Dashboards inform the user about the most important data at a glance. The particular benefit thereby is that the dashboards can display the data from multiple VDMS modules simultaneously: charts, sensor boards, navigation view, cameras, maps and many more.

This saves time-consuming paging to and from in the software interface and ensures nothing is overlooked. Because every project is different and because everyone involved in the project has different requirements, the dashboards are configurable.

VDMS Process Data Management System for Mechanised Tunnelling

TBM Process Steering

The modules for TBM Process Steering provide assistance for the optimal control of the entire process and its diverse subprocesses. As a result, quality, costs and deadlines are correct at the end:

- PLC Error Viewer
- Sensor Data Analyser
- TBM Report Viewer
- Chart Generator
- Sensorboard Viewer
- Dashboard Viewer
- Navigation Viewer

Monitoring

The modules in the framework of monitoring continuously provide information about all important process data. They form the basis for quick, well-founded and correct decisions:

- Map Viewer
- Geo Profile Viewer
- Navigation Viewer
- Camera Viewer
- Sensor Board Viewer
- Dashboard Viewer | Configurator
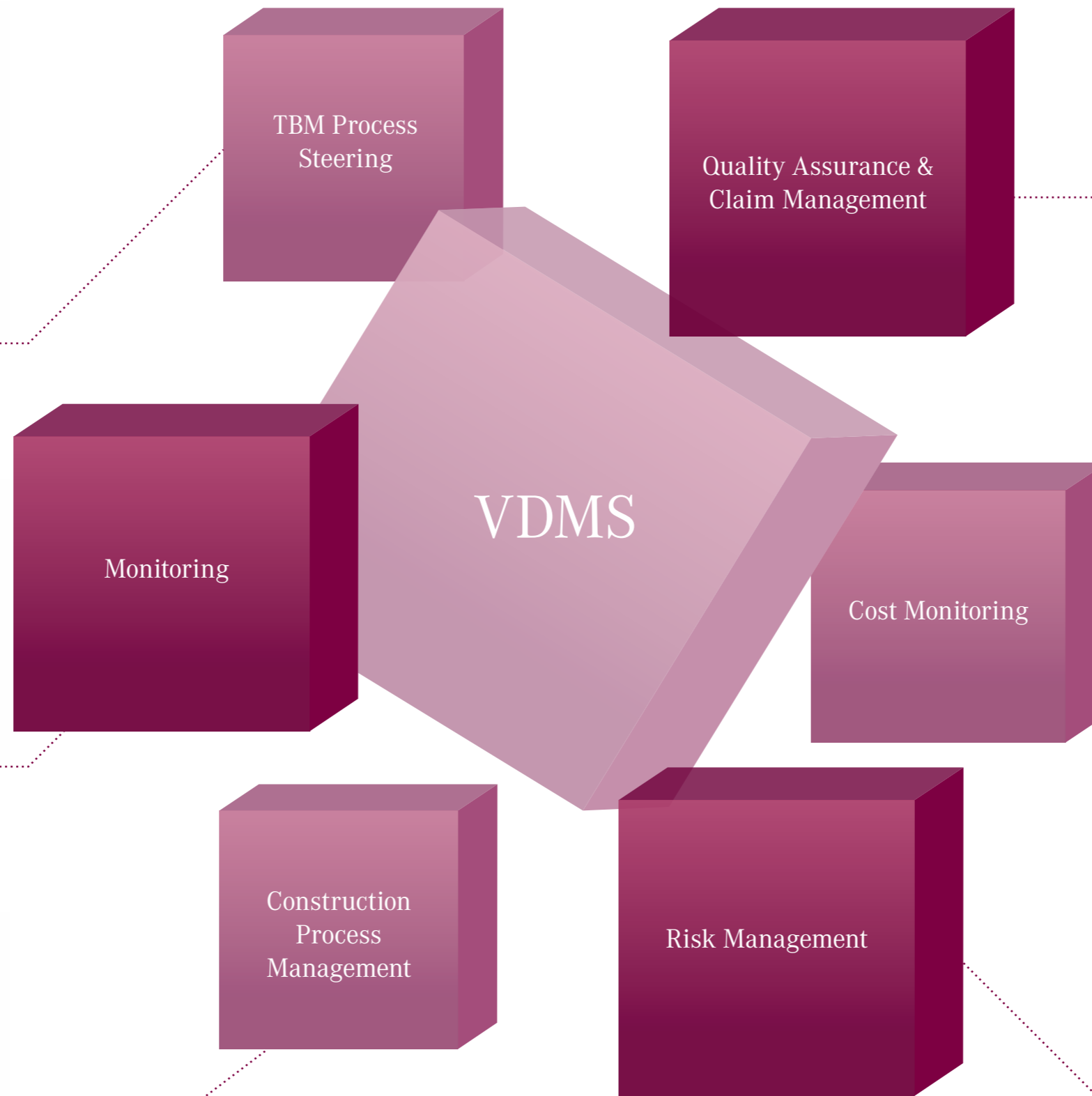
Construction Process Management

The modules of the Construction Process Management provide comprehensive support for the organisation and daily development of a machine tunnelling project:

- Report Generator
- Document Manager
- Segment Data Viewer
- Shift Management
- Task Manager
- Alarm Manager

Quality Assurance & Claim Management

Using the VDMS modules that support Quality Assurance and Claim Management, important quality factors are verified and documented:

- Document Manger
- Segment Data Viewer
- Chart Generator

Cost Monitoring

The functions for Cost Monitoring monitor and document the essential cost factors on the construction site. Plan variations can be detected in good time:

- Shift Manager
- Report Generator
- Chart Generator

Risk Management

The functions of the Risk Management modules make it possible to react quickly and competently to unusual events and not to let any critical situations arise – neither for life and health of the jobsite personnel nor for the project process:

- Alarm Manager
- Camera Viewer
- Chart Generator
- PLC Error Viewer

TBM Process Steering

Quality Assurance & Claim Management

Monitoring

VDMS

Cost Monitoring

Construction Process Management

Risk Management

References

Argentina | Buenos Aires
Riachuelo Outfall Lot3

Project start	March 2018
Tunnel length	11.9 km
Diameter	5.2 m
Machine	1 TBM
Data sources	TBM Data | Navigation Data Ringbuild Data

Qatar | Doha*
Metro Green Line

Project start	November 2014
Tunnel length	6 × 5 km
Diameter	7.0 m
Machine	6 TBMs
Data sources	TBM-Data | Geodetic Monitoring Data Geotechnical Monitoring Data

Spain | Barcelona
Barcelona Aeropuerto

Project start	September 2017
Tunnel length	2.8 km
Diameter	10.24 m
Machine	1 TBM
Data sources	TBM Data | Navigation Data Ringbuild Data

New Zealand | Auckland*
Waterview Connection

Project start	October 2013
Tunnel length	2 × 2.4 km
Diameter	14.46 m
Machine	1 TBM
Data sources	TBM Data | Navigation Data Ringbuild Data | Segment Production Data

China | Changshu
Sutong 1000KV High Voltage Cable Project

Project start	June 2017
Tunnel length	5.5 km
Diameter	11.6 m
Machine	1 TBMs
Data sources	TBM-Data | Navigation Data Ringbuild Data

Germany | Ruhr*
Sewer Tunnel Emscher BA30

Project start	September 2012
Tunnel length	44.8 km
Diameter	1.6 m – 2.8 m
Machine	7 TBMs
Data sources	TBM Data | Navigation Data Bentonite Lubrication Data Interjack Station Data

> " ... VDMS* allowed us to effortlessly supervise the progression of tunnel boring machines around the clock. Its various features, such as sensor board visualization, chart analysis & report generator to name a few, serve as an efficient communication platform between my team on site, our management in Japan and the local authority..."
> Shigeo Kawasaki, Tunnel Manager

*The reference refers to the VDMS predecessor product IRIS

VMT | Your partner in tunnel building

Navigation and supplementary systems Large Diameter Tunnelling

Navigation systems Microtunnelling

Deformation monitoring system

Modular production and logistics management system

Process data management

Industrial measurement solutions

VMT with its measurement systems and services has been a leading provider in tunnelling and industrial measurement for almost 25 years. More than 1,500 successful projects document the capability and innovation of the VMT product portfolio in the areas of navigation technology, production and logistics management, deformation and process monitoring, and data management.

VMT considers itself as competent, reliable partner for customers and contracting company in each phase of a project.

The personal advice, the active support and the full commitment of all VMT employees – whether on-site project engineer or IT developer in the office – have top priority in the company philosophy and are proven every day.

Locations on 4 continents guarantee short paths, local support and independence from national borders and time zones.

GUIDED BY VMT