

Worldwide Activities



TUNNEL DESIGN

TEMPORARY WORKS DESIGN

GEOTECHNICAL ENGINEERING

CONSTRUCTION MANAGEMENT

INSTRUMENTATION & MONITORING

WATERPROOFING & WATER CONTROL

TUNNEL REHABILITATION

MINING SUPPORT SERVICES

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Instrumentation & Monitoring plays a crucial part in any underground construction. Dr. Sauer & Partners supports all underground construction projects by providing expertise through the design of instrumentation layout for buildings, surface, subsurface, and underground structures.

Dr. Sauer & Partners' Instrumentation & Monitoring platform, ATMOS provides an easy-to-use interface that can be used by and is visible to all relevant parties involved in a project. ATMOS handles and stores all monitoring data for the project and supports the verification of the design assumptions. It provides a comprehensive picture of the ground behaviour and ground-support interaction, allows adequate adjustment of construction methods, ensures safe construction, and protects existing structures in an urban environment.

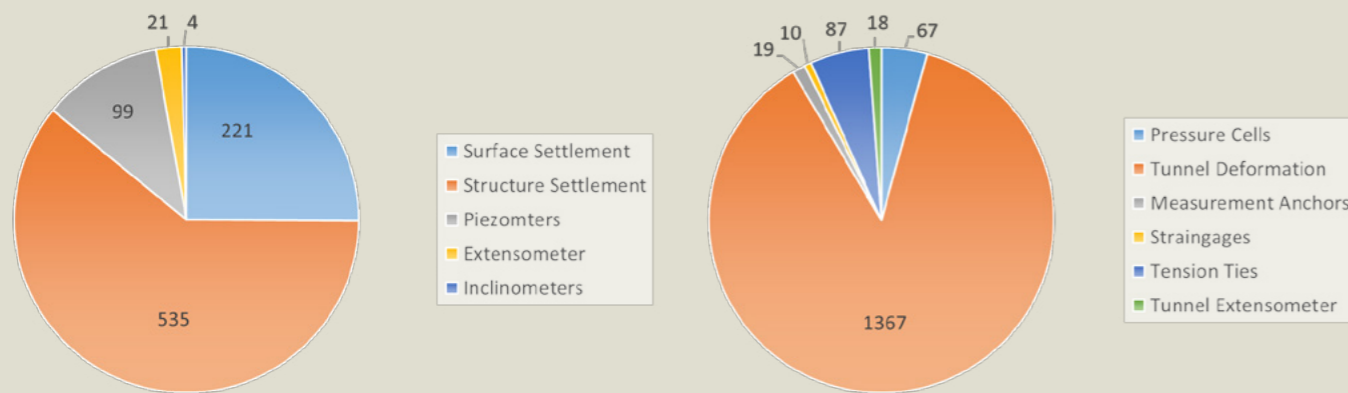


Figure 1: Instrument types and number of instruments installed at the surface. (Confederation Line, Ottawa)

Figure 2: Instrument types and number of instruments installed in the tunnel. (Confederation Line Ottawa)

BENEFITS OF ATMOS:

- **SIGNIFICANT TIME SAVINGS:** high level of automation through data upload, data analysis and report generation functionality
- **RELIABLE VISIBILITY:** all involved parties have a relevant and unique view of meaningful data
- **FLEXIBILITY:** unique and changing project requirements can easily be met, adjustments can quickly be made and implemented
- **FREES UP RESOURCES:** On-site personnel can focus on reviewing and interpreting the data.

TECHNICAL DETAILS OF ATMOS:

ATMOS is hosted in the cloud and is split into various modules. It is therefore virtually limitless in terms of space and processing power.

The system adjusts to demand like a modern web application.

The ATMOS platform was designed to be easily adjustable and extendable to satisfy project requirements.

It is possible to integrate any instrument type, and the system can interrogate data loggers directly for real-time monitoring.

Dr. Sauer & Partners' Instrumentation & Monitoring tool, ATMOS provides useful functionality to help in the delivery of geotechnical projects, particularly in close proximity to buildings and other structures:

• ACCESSIBILITY OF DATA

Data is both manageable and easily accessible. Logins control exactly what is accessed by different parties, ensuring data is also secure.

• GIS

The GIS system provides a holistic view of the project, all gathered data from the construction progress to the monitoring data is distilled here. Additional information such as utilities and buildings can be added to provide greater insight.

• SURVEY PLANNING

Survey planning enables the survey crews to read only the necessary instruments. This module sends automatically generated reports in PDF or Excel to all subcontractors, containing the list of instruments to be surveyed. The list is generated based on the excavation progress and other factors driving the survey location and frequency.

• ALERT VIA EMAIL AND SMS

Alerts are sent after an instrument reaches a predetermined trigger value. Alerts can be sent to a virtually unlimited number of mobile phones or pagers in all carrier networks.

• REPORTING

Concise monitoring reporting with a graphical presentation of monitoring results from various instruments in time-displacement diagrams, vector diagrams, and contour plots is delivered. On site and field documentation of ground conditions, construction activities, and construction quality is also available.

• DOCUMENT MANAGEMENT SYSTEM (DMS)

All reports are stored automatically as PDF files in the DMS for review. The DMS provides an auditable 'paper trail' documenting all monitoring results and can be accessed via an easy to use web interface.

• REAL-TIME DATA

Continuous monitoring devices upload data in real-time.

CONFEDERATION LINE

✓ Ottawa, CAN

Figures 3, 4 & 5: GIS maps of the OLRT project at different scales. The dots show the instruments, whilst the stars show excavation locations at a particular time. The red lines are the tunnel/shaft outlines.



Figure 3



Figure 4



Figure 5

The Confederation Line in Ottawa encompasses 15 stations and stops; its centre piece is a 2.5 km long tunnel with three underground stations underneath downtown Ottawa. Dr. Sauer & Partners handled the collection and reporting of monitoring data for the entire underground section of the project. Since no two construction projects are the same a system that could easily be customised was needed.

Dr. Sauer & Partners used its in-house monitoring framework, ATMOS for the project-wide instrumentation during construction at the Ottawa Light Rail project (OLRT). The flexibility of the system enabled the data from different sources to be combined, providing a holistic view of all the instruments installed, combined with the construction progress. A GIS interface was also provided, ensuring all the information was available in an easy to use dashboard available to all parties.

The Ottawa project consisted of more than 2,900 instruments ranging from absolute Geodetic to relative Geotechnical instruments. There was a total of 12 different instrument types. Even novel instruments such as Tension Ties could be added with ease due to the flexible nature of the monitoring framework used.