Maxwell
GeoSystems

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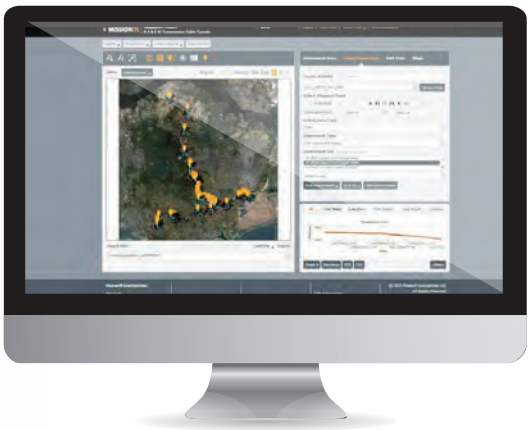
Data
you can
build on

CONSTRUCTION DATA MANAGEMENT SYSTEMS

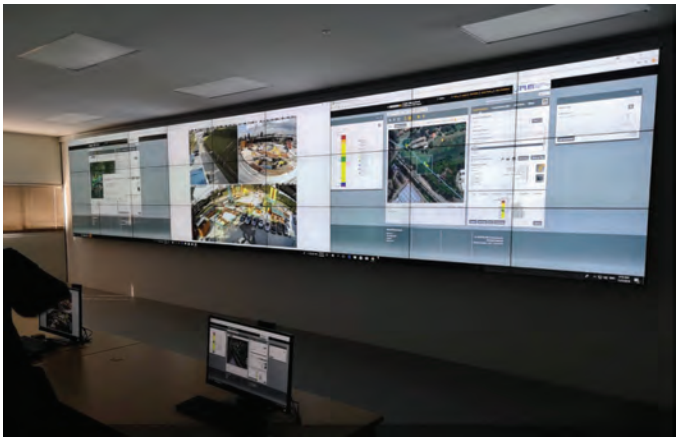


MissionOS is a bespoke software platform for the display and interpretation of construction data. The software utilises a robust back office database to process the construction data before displaying it on a fast, ultra-light web interface for rapid interrogation anywhere that has an internet connection.
The key features of the back office database include the processing and auditing of all types of construction data. Efficient storing of the data means that web-based queries from the portal interface are much faster.

Loading, processing, audit, management, analysis, display & reporting

- Import any data format for any data source
- Data checks on import
- Transparent calibration processes
- Automatic error correction
- Heartbeat function
- Manual and real-time data capture
- Audit control for alerts and alarms
- Adjustments for temporal effects
- Alarm issuing
- Automated Reporting
- Powerful Analysis

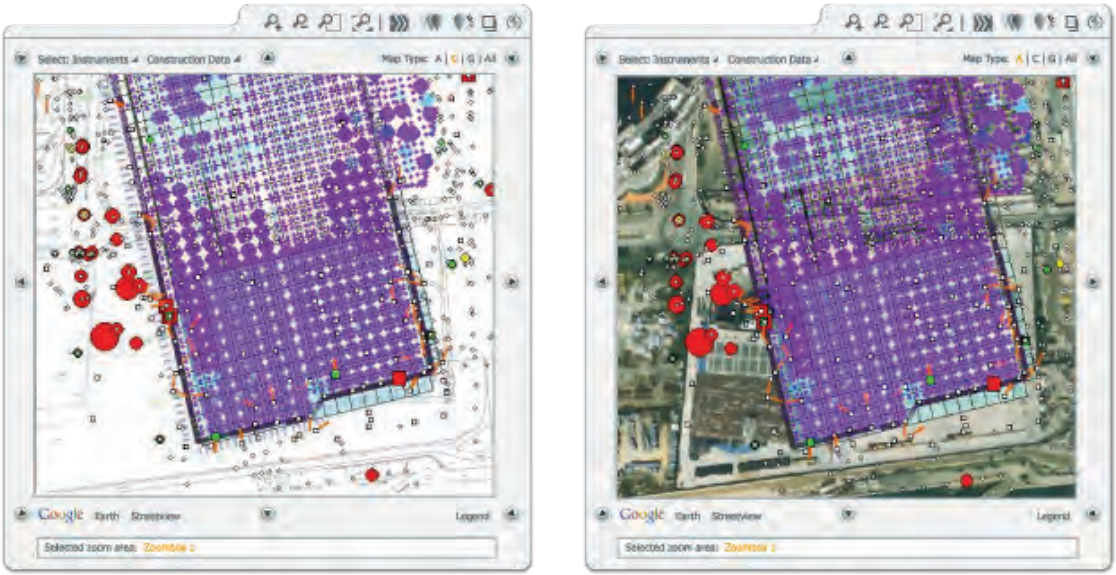
The web-based interface provides a much more visual representation of the data making spatial interpretation quicker and easier. Areas where problems are developing can be rapidly identified and action taken to mitigate if necessary.



Portal Interface

- GIS interface with customisable mapping (aerial photography, construction drawings) using a variety of coordinatate systems in plan and section
- Data visible based on user allowing user hierarchy
- Instrument theming by review level and/or type
- Fast graphing of instrument data
- Rapid multiple instrument selection & graphing using a variety of spatial & data query tools
- Contouring
- User defined cross sections
- Ability to add documents, photographs and annotations to instruments and pins
- Combined instruments for inferred readings (such as shear and angular distortion)
- Canvas sheets for user defined dashboards of critical instruments
- Batch reporting for record purposes as required
- Instrument filtering to identify “hot” zones
- AAA information
- Blogs for user commentary

The systems have been implemented on construction projects for excavations, tunnelling, ports, slope stabilisation, dams, mines, structures and reclamations.



Instrument and construction activity data overlaid onto Construction Map View (Left) Air Photo View (Right)

MissionOS System Description

Flexible web based Mapping system comprising access to the following layers:

- INSTRUMENTATION
- PROGRESS
- PROGRAMME
- PRODUCTION QA/QC
- GROUND INVESTIGATION DATA
- MAINTENANCE DATA
- WEBLOGS
- CANVAS REPORTS and REPORT BINDER
- 3D

Other layers can be provided as part of the MissionOS Prime package

Platform

Windows, iOS, Android

All common browsers (Explorer v6.5+, Chrome, Firefox, Safari)

Touch screen compatible

Designed by engineers developed by programmers

Architecture

LAMP (**L**inus, **A**pache, **M**ySQL, **P**hp)

MySQL database engine (options for Postgres or other database if required)

No third party software required

Speed and Performance

Ultra-light IT footprint runs on entry level PCs and Macs, tablets & handhelds
Bandwidth friendly – operates effectively on standard 3G (1MB/sec) connections
Advanced pre-processing of data volumes gives speed and responsiveness even with massive data sets which is best in breed. Plot 50 real time instruments with 2 years of data in < 10 seconds. Plot 100 TBM ring data (original data size > 500MB) in map or section in under 20 seconds

Custom Mapping Base with Plan Section

Based on a Custom Mapping Base platform with zoom, pan, region of interest functions
Any referencing system can be used (image, map, drawing, in plan or elevation).
Interactive Map objects – points, lines and polygons, interactive query and summary of data and graphs
Data highlighted by colour and size relative to triggers or magnitude o type.
Data viewing rights configurable by user, contract and region with definition of interfaces
Definition of active zones of variable shape
Construction progress displayed as interactive vector graphics
Constantly updated as data changes.

Drag and drop functionality for easy adjustment and setup.
Historical review of data at any time.
Show data as change maps for instruments and progress
Apply filters to focus on current information
Interactive keys to define layers and labelling

Section View

INVESTIGATION, DESIGN & MONITORING DATA

MissionMonitor & MissionDesigner

Mission Monitor focuses on measurement data and provides a fully customisable platform for the collection processing and reporting. This can be further extended with a variety of tools to enable Observational Engineering. This is Mission Designer

Data Types

Design instrument models from scratch or make use of the Maxwell GeoSystems library of data models and generic data loaders including:

Settlement points, settlement plates, casagrande, pneumatic and vibrating wire piezometers, recharge wells. rod extensometers, multipoint borehole extensometers (rod and MEX), inclinometers, vibrating wire instruments strain gauges, crack gauges, load cells, tilt meters and electro levels, 3D points, convergence monitoring, hydraulic profile gauges, shape accelerometer arrays, vibration and sound meters

Other instruments can be added as “general” type

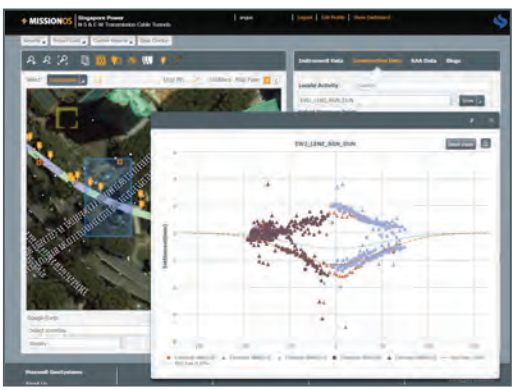
Ground investigation from AGS version 3.1 and 4

Configurable geographic hazard and sensitive structure schemes with digitiser tools

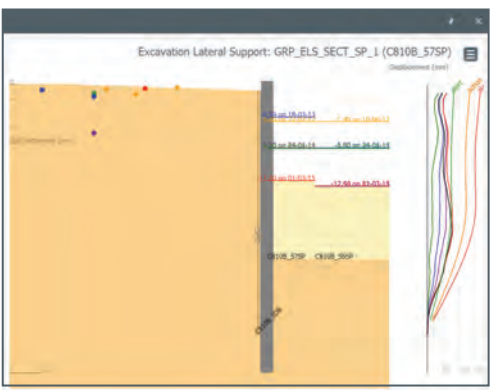
Groups

Combine instruments to form new instruments using custom “GROUP” facility (eg. Tilt, distortion, stability etc.) Combine instruments in new ways to provide design feedback eg Excavation Lateral support groups, Tunnel Settlement prediction groups. Observational engineering in real-time.

Combine Gaussian Settlement Curves
With Real-Time Data



Design feedback analysis
for retained Excavations



Data Input

Built in ergonomic features (individual, multi records, input by group)
Input from files (xls, csv, txt, dbf) to any predefined custom structured format.
Automatic import of industry standard formats including:
Cambell , Datataker, RST, Geokon, Slope Indicator, Soil Instruments, Leica, Topcon and many more.....
Library of generic data loaders .
Interactively define data import from any dataloggers – multiple channels.

Data Audit and Control

Automated internal audit of data for integrity checking
Full change record
User access statistics

Enhanced User Interaction

Add documents and photos to GIS objects
Add pins for non-object specific data
Digitise object direct to cloud and annotate
Custom blogging tools for user response management eg AAA reports

Automated Data Processing

Configurable data access and change rights
Transparent processing stages easy for checking
Accommodates raw or processed data
Remove effects of temperature and tides
Correct for background long term movements eg. of benchmarks
Correct for changes of pipe top elevation
Auto revision for re-instatement, extension and pipe cutting

Analysis

Custom graphs for a variety of instrument types Y vs time, Y vs chainage, Y vs X with common time or chainage, Y1, Y2 graphs.
Linear or log axes
Create overlays of programme events
Produce multi-plots of data to allow comparison.
Animate the data: Sophisticated interpolation and timeslicing engines get rid of holes in the data enabling animation of the construction progress to show the relationships between instrument reading and construction parameters.
Forecasting tools help predict future trends and assist decision making.
Load prediction data from analyses (Flac, Plaxis, Sigma/W, Seep/W etc) and compare results vs. prediction.
Assess progress vs programme

Alarm Systems

Design custom alert, schemes including: (absolute or function e.g alarm = f(x) where x = depth of excavation, distance from tunnel face etc.)
Set alarms as functions of predictions
Set alarms upward, downward or both
Set alarm frequency, filters and repeats
Remove effects of natural fluctuations and natural error to avoid repeats

Display and Reporting

Export raw data to Excel at any time for custom analysis.
Custom interactive graphs
User define cross sections of data
Include surface modelling ion cross sections
Large suite of PDF report types in library
Save graph definitions to canvas library
Build user defined reports and screens using the canvas builder.
Combine canvases into complex reports using the binder function

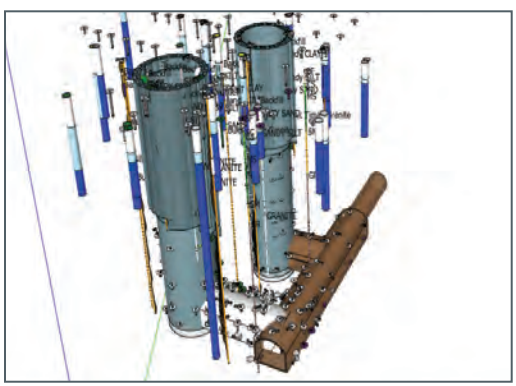
Site Process Management

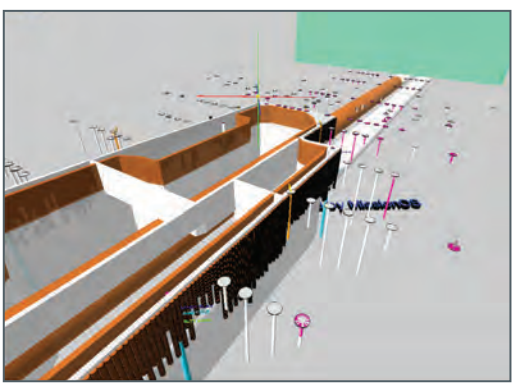
Generate data for daily meetings quickly
Automate alarm response reports using blogging
Conduct daily meeting using live data direct to the web

Data Visualisation in 3D

Autocreation of 3D models of all numerical metadata built in seconds using WebGL. 3D, 4D and 5D plots
Incorporate DEMs of the site stripped from .DWG and .DRG or from SURPAC strings and Laserscan point clouds
Compatible with Google Earth

3D representations of entire areas, which contain both constructional and instrumentation elements.

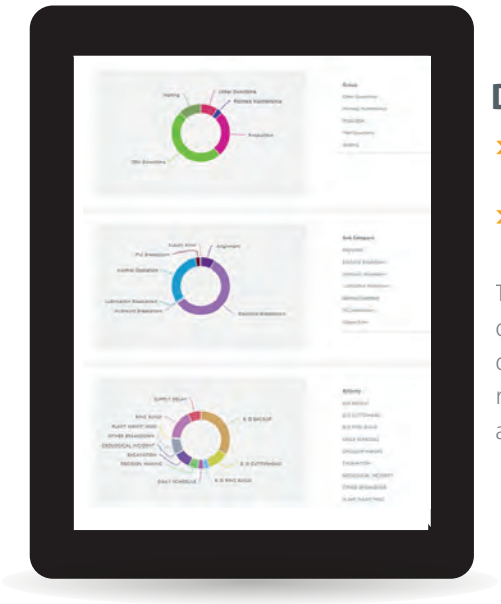




PRODUCTION DATA FROM CONSTRUCTION

Production Data Management Systems

MissionOS incorporates construction activities such that the cause of an observed effect can be identified giving better risk management on a project.
All construction elements are captured in a simple hierarchy such that site teams report progress in a short, standardized format.
The data can be used to generate a compatible 3D model directly without further human intervention, showing the status of the works in an illustrative, informative medium.



Data Management and Processing

- All construction activities classified for ease of data input
- Baseline programme included to map targets to actual progress

The portal allows the user to interrogate any of the construction data in a visual environment. When combined with the instrumentation data the relationships and correlations can be readily assessed and analysed.

Portal Interface

- Construction progress displayed by colour theming
- Graph progress of construction
- Combine progress with instrumentation data
- Bespoke grouped instruments to show instrument reaction to construction progress
- 3D models generated from progress data

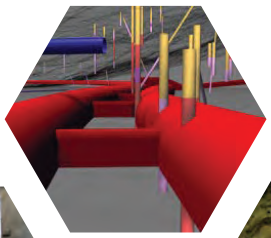
The MissionOS systems can be adapted to a wide spectrum of construction activities and have been successfully implemented on a huge range of projects for excavations, tunneling, ports, slope stabilisation, dams, mines, structures and reclamations. The system is highly effiicient, user-friendly and handles a stupendous volume of data that provides all types of reporting elements, that a huge enterprise solution demands.

MissionSite and MissionBuilder

Define, create and maintain quality data models to aid efficient management of your business

Flexible web based system comprising access to the following layers:

- Load predictions for key construction metrics
- Configure construction data models at your business level for consistent data recording
- Define data loading methodologies with manual and real time capture via FTP, dropbox, web service and email
- Audit control
- Configure shift reports for activity management with plant labour and materials recording systems
- Create rich useful reports with the canvas creation tool
- Combine construction data with other data feeds from instrumentation and design
- Analyse data based on defined production cycles
- Prepare forecasts in real-time

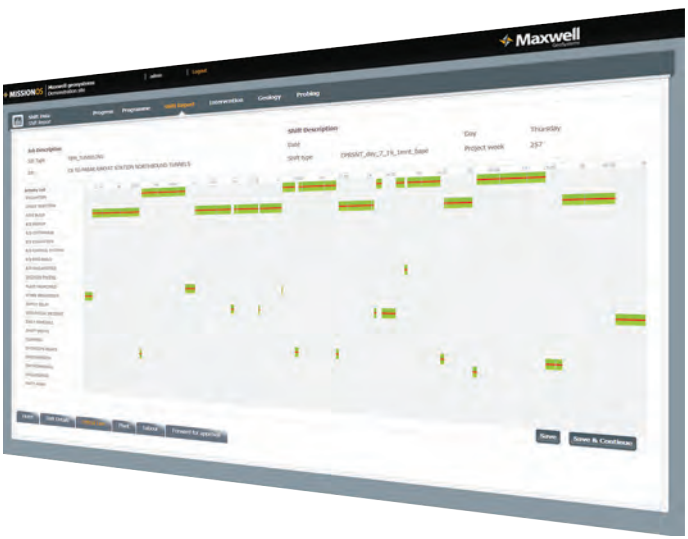


Data Types

Environmental data
Risk and hazard information
Setting Out data from .DRG and .DWG
Programme data from MS Project and Primavera
Shift data, Critical time definition, Plant and Labour
Drilling and grouting
Geological Mapping
Support installed
Pumping and water measurements
Materials testing
Site Inventory
CCTV and other streams
TBMs and other data loggers eg : measurements while drilling (MWD)

Shift Reporting

Define standard activities enterprise wide by job type and have the flexibility to add user defined activities
Simple interactive interface designed for field use
Add details to time bars
Identify critical time and codify through industry standard “black ball” codes
Identify site instructions
Identify variations and log direct costs (plant labour and materials)
Identify weather, site events including logging of safety events



Risk Management

Risk register implemented as data table linked to construction items, methods and materials

Automate preparation of site risk reports for each planned activity and link to method statements and relevant content

Geo-locate hazards for automatic early warning and inclusion in site risk reports

Safety Monitoring

Monitor site safety reporting using the online blog tool

Automate production of site safety statistics and reports

Data audit and control

Manage record sign off at multiple levels

Automated internal audit of data for integrity checking

Full change record

User access statistics

User Interaction

Simple consistent design language ensures use is intuitive

Set up projects with defined data for collection

Staged screen approach to guide users

Achieve results with minimum mouse clicks

Data Processing

Data automatically processed to cycle statistics for reporting based on metres, ring, day, week, month, blast, probe cycle as required

Processed statistics available real time to aid review

TBM and other data logged sources processed

TBM Cutter wear expert system

Analysis

Evaluate ground risk and forecast ground conditions for design and tender
Design construction methods and programmes
Assess progress vs programme and assess time delays by critical code
Forecast time and costs to completion and evaluate ground impact
Assess programme and cost risk in real time
Model alternative programmes and methods

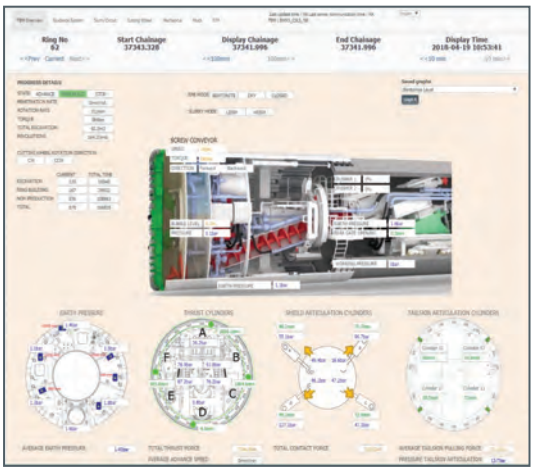
Dashboard

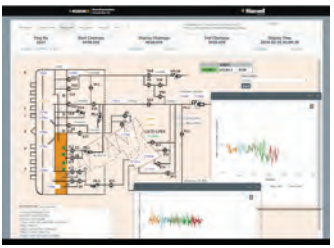
Project dashboard showing key progress and parameter
Key programme and cost metrics

Display and Reporting

Export raw data to Excel at any time for custom analysis.
Custom interactive graphs
Large suite of PDF report types in library
Save graph definitions to canvas library
Build user defined reports and screens using the canvas builder.
Site Process Management
Generate data for daily meetings quickly
Automate alarm response reports using blogging
Conduct daily meeting using live data direct to the web

TUNNEL DATA MANAGEMENT SYSTEMS

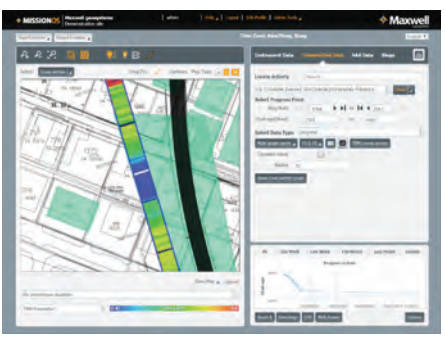




The **TDMS** is a module that can be added to **MissionOS** for the specific high risk construction activity of tunnelling. The module adds several layers of functionality to enable the user to effectively link data to the tunnel excavation and lining process to design, investigation and instrument feedback for better tunnel process control

Data Management and Processing

- Data capture of TBM parameter data in real time
- Ring file data file size reduced through post-processing to remove idle status data
- Cutter tool wear prediction
- Shift reporting
- Drill and Blast logging
- Rock mapping/face inspections
- Grouting details

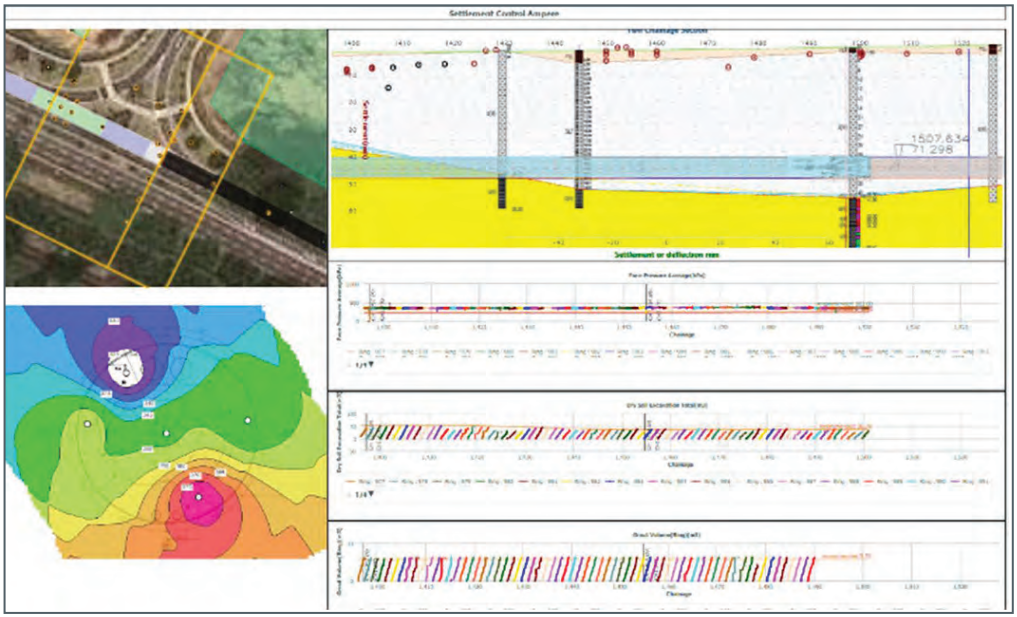


The portal allows the engineer rapid access to all the information associated with the tunnelling works. Any of the recorded parameters can be graphed for any section of the tunnel

Portal Interface

- Bespoke dashboard for key instruments or parameters
- Ring theming of any TBM parameter (min, max and average) for instant analysis
- Geological cross section
- Generic canvas screens (100m Lookahead, settlement contour, TBM control)
- Contouring of TBM parameters such as face pressure, cutter wear etc
- 3D model generation
- Volume loss analysis
- Combine geotechnical and TBM parameters into a single graph to assess correlations

The system has be utilised on numerous projects in **Hong Kong** (Regional Express Line, Shatin Central Link, Hong Kong West Drainage, Lai Chi Kok and Tsuen Wan West Drainage, Liantang Lam Tin and others), **Singapore** (SPPA cable tunnels), **Thailand** (MRTBLE) and **Malaysia** (KVMRT 1&2) , **United Kingdom** (Thames Tideway), **U.S.** (Los Angeles Metro), **Australia** (Brisbane Airport Link, Perth Aiport Link).



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