



Testimonial Statement

Product: TUnIS.moving station | Project: Thames Tideway

The science of tunnel navigation is an area of technology that over the decades has moved from the simplest of surveying techniques to the modern complex IT supported systems we have today. VMT has always been at the forefront of such developments and has recently introduced the latest innovation TUnIS.moving station.

TUnIS.moving station is an assistance system that enhances a laser and target-based navigation system in large diameter tunnelling. With TUnIS.moving station, the total station is not mounted on the tunnel wall, but travels on the gantry of the tunnel boring machine (TBM).

TUnIS.moving station determines and calculates all data and information that is necessary for navigating the TBM along a tunnel axis. The high information content of the data displayed ensures optimum control of the machine position and thus helps to maintain a uniform shield run with small deviations from the desired route. The position and tendencies are continuously displayed to the shield operator. This allows vertical or horizontal curves to be easily and precisely controlled.

Three prisms installed on the tunnel wall with an active electronic laser target in the shield of the TBM are used for exact determination of position. In the first step, the exact current position of the total station is determined using the prisms. In the second step, the current position of the laser target is determined and thus the position of the TBM.

This new system has recently run very effective trials on the Thames Tideway Tunnel project in the UK. The trials were so successful that the tunnelling operation has now been moved onto the new system replacing the existing VMT standard navigation system for the remainder of the current tunnelling operation.

Subsequent to the trial Roy Behrend, Chief Surveyor for the BAM Nuttall, Morgan Sindall, Balfour Beatty joint venture (BMBJV) constructing the west section of the tunnel was interviewed by VMT's Steve Wojtkowiak to obtain his views on the TUnIS.moving station.



TUnIS.moving station



Chief surveyor Roy Behrend

Q. Why did you choose the VMT TUnIS.moving station product when there alternatives/competitive solutions?

A: BMBJV was using VMT's original fixed position Total Station Navigation System (TUnIS Navigation TBMLaser) which uses two stationary inter-visible brackets mounted on the Ring Segments. These brackets, the Total Station as well as the reference prism were moved and relocated as the TBM advanced.

VMT tested an innovative new Navigation Assistance System called 'TUnIS.moving station'. This system uses a Total Station that is mounted on the TBM's first gantry and moves with the TBM. The system uses three reference prisms temporarily fixed to the ring segments for position coordination. BMBJV is currently using the Moving Station TBM guidance system for the remainder of the tunnel drive.

Q. What were the main arguments that convinced you to go with the VMT product.

A: VMT installed and tested the new Moving Station guidance system on our TBM. The Moving Station and the original fixed station guidance systems were operated simultaneously to check for coincidental position accuracy and system comparison. The advantages of the Moving Station were evident and the system has been implemented and adopted for the remainder of the tunnel drive.



“The advantages of the system can be accredited mostly for improved time efficiency resulting in cost saving.”

Roy Behrend, BAM Nuttall, Morgan Sindall, Balfour Beatty Joint Venture

Q. Did the VMT solution generally fulfil your expectations? Did they perform as expected?

A: Yes, all expectations were fulfilled by VMT.

Q. What were the main benefits that the systems delivered and do you have any ‘hard data’ that highlights the benefits, for example cost reductions, reduction in staff/time etc.?

A: BMBJV was about 50% completed with construction of the 7 km TBM drive when the TUnIS.moving station was implemented. The advantages of the system can be accredited mostly for improved time efficiency resulting in cost saving. These efficiencies included:

- Total station fixed brackets are no longer required to be drilled and bolted onto the Ring Segments. This is a saving of time for the Engineer to drill and mount about 270 bracket positions for the remaining 3,500 m of the tunnel drive. Also, there is a time saving by not having to repair the drilled holes once the station position is changed, so the original finish of the Segment is maintained.
- With the original system the Total Station continuously measured to the active laser target unit (ALTU) to update the TBM position during the advance. With the TUnIS.moving station, a geometrical TBM position is only required once before the start of each advance when the total station is stationary. This allows for free movement of the TBM crew and no longer provides a conflict with staff blocking the laser beam during the advance especially with our TBM’s gantry design.
- With the TUnIS.moving station, the Engineer updates the TBM position remotely by use of a mobile device App and WiFi data communication with the TUnIS software. This App allows ‘hands free’ Total Station operation and position calculation which is efficient and easy to use.
- With the TUnIS.moving station, the Total Station nor the radio modem require external battery charging and replacement. It is powered continuously from mains power.
- The TUnIS.moving station did not reduce the staffing requirement. The Engineer still operates the guidance system as before, but the improved time management for the system operation has made it a less onerous task.

Q. How do you rate your collaboration with VMT in terms of:

- in negotiation/consulting phase
- during testing phase on TBM and later implementation
- support during the project

A: Communication was really good with VMT for the testing and implementation of the new system. There is always immediate ongoing support for VMT’s navigation systems and TUnIS software. Support is also available remotely online via Team Viewer.

Q. Do you have any proposals for improvement of our technologies?

A: Not at this time.

Q. Would you opt for a VMT product solution again and work with VMT as a partner?

A: The TUnIS software package is well developed and menu systems allow for ease of use. The system is very well supported by VMT. VMT Support Engineers have remote access to the system which allows for easy system maintenance and testing. I would not hesitate to recommend or use VMT products again.