

Airportlink Brisbane / Australien Guided by VMT End of "Blind Flight"

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December 2010

The "Airport Link Tunnel Brisbane" with 17 installed Road Headers and 2 EPB-Shield TBMs is currently Australia's biggest infrastructure project. The precise controlled excavation done by these machines helps to reduce both time and costs.



Australia belongs to one of the biggest boom regions of the world. Although sparsely populated there are many activities in traffic construction. Due to the long distances in this large continent with urban centres concentrated on the coast, the airplane is the most popular means of transport. So good traffic connections both to and from the airport are very important. At present there are many construction activities especially along "Gold Coast" around Brisbane (Queensland). In November 2008, after a relatively short planning period, the official starting shot for the mega "Brisbane Airport Link" -project was given. This tunnel-project, in total 15 km long, will connect Brisbane's centre to the access-highways to the airport and reduce the travelling time dramatically as of the middle of 2012.

This is a tunnelling-project of superlatives: the building costs are projected to 4.8 Billion AUD, 17 road-headers and two TBMs with EPB-shields with a diameter of 12 m are in action simultaneously and features ambitious time planning and cost saving ideas. For the consortium "BrisConnections" it was clear from beginning that all road-headers shall be equipped with the VMT guiding system "SLS Road Header" as they had previous experience with this system at a smaller project: in Melbourne, where the use of the SLS guidance system has cut down the amount of sprayed concrete by 20%, not to mention the additional time savings achieved.

"The SLS Road Header Guidance System terminates the 'blind flight' which was formerly common practice with such tunnelling. ", said Manfred Messing, General Manager of VMT GmbH, based in Bruchsal, Germany. Messing explains: "The machine driver can see on his computer display the exact position of the cutting head in relation to the required profile of the excavation. So the scheduled profiles can be excavated precisely with, no more over or under-profiles.

According to the ground conditions it is also possible to increase the excavating length without getting larger deviations. Surveying works for controlling the excavation are a thing of the past.” Without such a guidance system the machine driver had to operate the cutting head by observing the cutter-head itself, which is very difficult because of the dust dispersed during excavation. Many over and under profiles were the result.



Bad working conditions

Insiders know that guidance systems for Road Header are enormous technical challenges, this is due to poor viewing conditions, the many and relatively quick movements of the machine and the need to have a reliable position determination in short time sequences. Additionally the equipment is treated harshly from the operators especially with this type of tunnelling. Until recently such systems were not really well-engineered and capable in practice.

Only the know-how of VMT engineers, collected in 20 years around the tunnel-guidance, has enabled with the “SLS Road Header System” a real guidance system capable for tunnelling with road headers. The structure and operating mode is easily explained: a motorized high-precision total station is mounted stationary at the tunnel-wall behind the machine which determines in intervals of some seconds the position of two reference-points which are mounted on the chassis of the machine. Simultaneously an inclinometer which is also mounted on the machine determines continuously the pitch and roll of the machine. The lift, slew and any extension of the cutter arm are also entered. All these data are transferred in real time to the system computer and together with the stored target data it is possible to calculate the position of the cutting head in relation to the planned excavation. The graphical display on the monitor is self-explanatory and provides the relevant information at a glance.



Rigid Components

All components of the SLS-Road Header-System are extremely robust and tunnel proven:

1. The Inclinator is an in-house-development of VMT daughter-company Qbit and withstands vibrations up to 1000G.
2. The total station of the Swiss provider LEICA GEOSYSTEMS enables the reliable determination of positions in range of millimetre and due to the new function "Power-Search" it finds reference points automatically, quickly and steadily.
3. The system computer is an extremely robust industrial computer from Phoenix Contact, without mechanical hard-disc but including an integrated touch-panel.

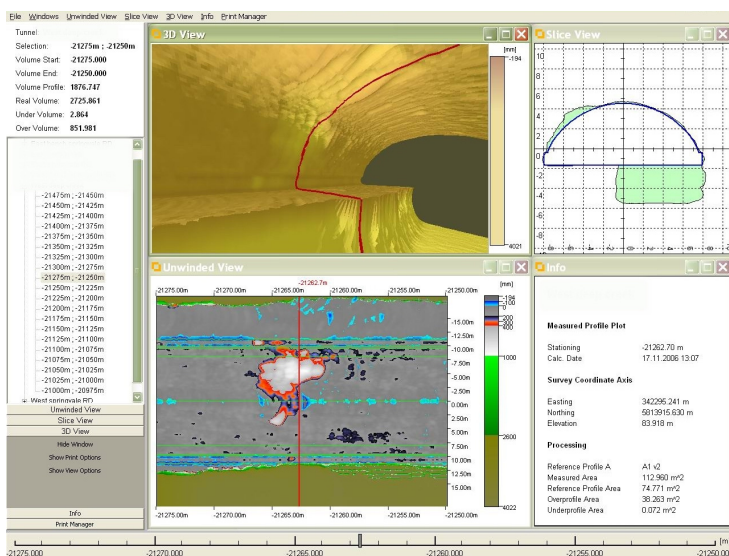
One interesting aspect of the systems installed in Brisbane is the cordless data-transfer between total-station and system computer with Wireless-LAN.

Data transfer via WLAN

Normally the system components on the Road Header are linked with the total station via radio transmission, handling the exchange of control commands and information. But the radio works in on a specific channel. Adding a third device, for example on the Bolter, could cause an interference of the communication with the other system. Under these circumstances the new Wireless-LAN Technology was brought in and adapted for creating a tunnel network system to enable a communication between the systems and the total station. In any kind of Wireless-LAN Network an Access Point is required to organize the features of the network, the client structure and security settings. In tunnels with more than one heading at least one Access Point must be installed on the tunnel wall of each tunnel heading. The clients are installed on the machines and the total station. The Access Point and total station can stay in the heading as tunnel advances even if the machines are moved from between headings. Another interesting feature is the connection of this Access Point with a network extender which links the tunnel with site-office via telephone line. Data transfer from site-office to machine for upload of new profile class or any change of configuration can easily be made. Also the production data of the excavated tunnel which is continuously calculated throughout the cutting process can be transferred to the office.

With this WLAN system on the Road Header it is possible for information and the data from any other sensors can be integrated. The data of the excavation are archived on the machine computer. Together with the information of the profile-checks which shall be carried out later by the site-surveyors the real thickness or the volume of the shotcrete can be determined.

Alex Höfer, the responsible project manager from VMT Germany, comments on the large flexibility of the SLS Road-Header-System: "There were road headers from three different manufacturers in use and on all machines our system could be adapted without any problems. It runs very reliably and helps the site to cut down on both time and money spent in creating the required profile. "

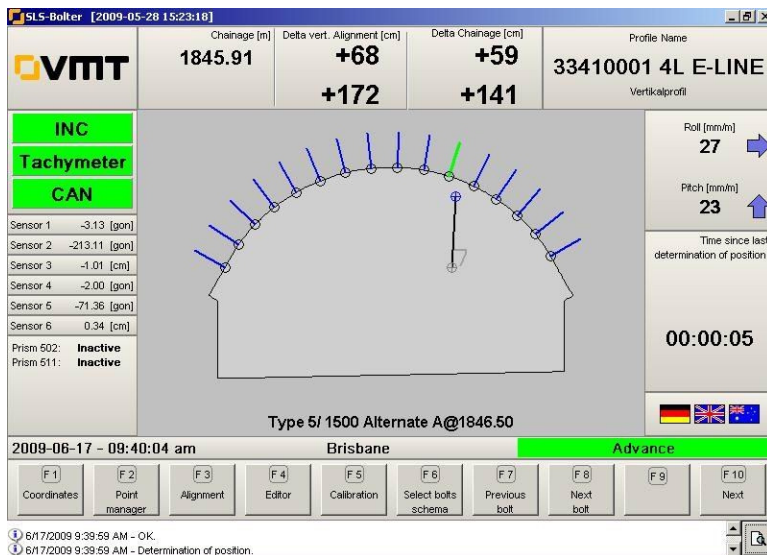


Controlled bolting

It is clear: the guidance systems of the 17 road headers of the AirportLink Brisbane represent the lion's share of VMT participation of this project. But the positioning systems on the 4 bolters at site, which cater for the precise alignment of the bolting units, are of technical interest as well.

"With our SLS-Bolter system the positioning of roof bolting is much quicker and can be recorded additionally", explains Höfer. In principle the determination of position of the bolting unit and the calculation of the corrections is nearly identical to the SLS - Road Header system.

Nearly routine are the guidance systems for the two huge Herrenknecht EPB-shields, each with a diameter of more than 12 m. It is in this area that VMT has gathered experiences since 1994 on several hundred projects world-wide.



Guided by VMT.....is the caption use on for several hundreds of tunnelling projects all over the world as the standard for the reliable navigation of tunnel boring machines. VMT guidance systems are used in various tunnel boring methods and diameters. The VMT GmbH was founded in 1994 and is mainly engaged in developing and supply of guidance systems for automatic tunnelling systems with segmental lining and pipe-jacking. The systems are well established in the market because of their excellent capabilities under various conditions. Experiences gained at home and abroad, the high motivated employees and the use of modern surveying-technology guarantees a good cooperation and a successful performance of current and future projects. Beside of the configuration and the supply of guidance systems VMT GmbH also offers the classic surveying services up to special metrology tasks e.g. high precision measurement of objects using laser trackers.



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