

## **Airport Link Project – Permanent Tunnel Shotcrete Lining**

### **EFNARC Nozzleman Assessment**

#### **General**

The Airport Link project is a major road infrastructure project in Brisbane, Australia, creating an underground connection from the city, at Bowen Hills to the East-West Arterial Road at Toombul which links up with the Airport Roundabout flyover.

At its completion it will be the longest road tunnel in Australia, with an approximate length of 6.7km.

The tunnel is constructed by a Joint Venture of Thiess and John Holland (TJH), using a mixture of tunnelling excavation methods such as roadheaders, drill and blast and tunnel boring machines.

Prior to installation of the permanent lining, the tunnel is lined with a PVC sheet membrane for waterproofing purposes.

The permanent tunnel concrete lining is predominantly cast in-situ, using both, 10m and 12m long slip forms, which can be transitioned to suit different tunnel profiles.

In areas of tunnel transitions, in certain cross-passages, sumps, underground substations and other special structures the tunnel is permanently lined by using the sprayed concrete method (shotcrete).

An approximate volume of 9,000m<sup>3</sup> of permanent shotcrete lining will be installed at the completion of Airport Link tunnel construction.

#### **Shotcrete Trial & EFNARC Nozzleman Assessment**

Before commencement of permanent shotcrete lining a methodology had to be established to ensure sufficient bond between membrane and the sprayed lining.

As part of the planning and methodology a trial was held in the Airport Link tunnels in May 2010. Its purpose was to prove, that the chosen method of application was meeting the high quality standard required in the project specifications'.

During this trial, several Nozzlemen employed by TJH were applying shotcrete onto PVC sheet membrane in different configurations and setups to see what methodology works best. They were supervised and assessed by an EFNARC Certified Examiner, who trained them to use a specific method of applying shotcrete onto the sheet membrane.

In addition to the practical component of the trial, the Nozzlemen attended a four hour theoretical training course, delivered by the EFNARC Certified Examiner.

The training course delivered by the Examiner covered the most important theoretical aspects around shotcrete works:

- Shotcrete materials (Cement, Water, Aggregates)
- Shotcrete Admixtures (Accelerators, Retarders, Hydration Control Admixtures)
- Fibres (Steel, Synthetic)
- Shotcrete application methodologies
  - Preparation works
  - Hand spraying
  - Robotic Spraying
  - Dosing of admixtures
- Correct use and maintenance of shotcrete equipment
- Safety

### **Trial Outcome**

The trial was a success as it was the basis for the ongoing planning and methodology for the installation of the permanent shotcrete lining works on the Airport Link project. The trial established a methodology to apply the permanent shotcrete lining onto PVC sheet membrane and to achieve a high quality lining product.

The Nozzlemen who took part in the trial were involved in the works from the beginning and were involved in the planning. The Nozzlemen became part of the permanent shotcrete lining crew which was established to spray the final lining. Their feedback on the practical and theoretical training was positive as it gave them the chance to expand their knowledge in their field.

Each Nozzleman who attended and participated in the training was additionally assessed and received an EFNARC certificate to recognize that he had successfully completed the Nozzleman assessment.

Thiess John Holland Joint Venture became the first civil works contractor in Australia, to have Nozzlemen certified by EFNARC.

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