

M5 EAST TUNNEL FILTRATION PROJECT BY BAULDERSTONE FOR THE RTA



Roof concrete screed pour stage 1



Filtration equipment installation

Subcontractors and Suppliers

Managing Contractor
Principal Designer
Filtration Equipment supply, install and commission
Bulk Earth works
Tunnel Excavation
On Site Water Treatment Plant
Temporary Power
Tunnel Dust Extraction Equipment
Bulk Haulage
Formwork and Concrete Works
Craneage
Electrical Installation and High Voltage Reticulation
Civil Contractors
Traffic Control
Plumbing
Concrete Supply (including precast)
Environmental Monitoring
Survey
HVAC Installation
Fire Prevention Services
Steel Reinforcement Supply
Installation of Earthing Grid
Construction Noise & Vibration Monitoring
Supply & Install Ground Anchors
Building Fitout
Sandstone Facade
Structural Steel Fabrication and installation

Baulderstone P/L
Hyder Consulting
Filtrontec
Menai Civil
Fox Mining
Aquatic engineering
Rutherford Power
Eurofilter
Harry's Heavy Haulage
BKH Contractors
Melrose Cranes
A1 Electrics
Thirst Civil
Orbital Traffic Control
Brown & Moodie
Hanson Construction Materials
Manidis Roberts
Lynton Surveyors
Robert Mann Pty
Chubb
Active Steel
Power & Earth Control
Wilkinson Murray
Merrmac Australia Pty Ltd
Onsite Construction Group
The Stonemason Specialist
DMG Engineering

M5 East Filtration Project

The M5 East is a 10-kilometre freeway connecting the M5 freeway at King Georges Road, Beverly Hills with General Holmes Drive and the Eastern Distributor. A key feature of the M5 East is Australia's longest road tunnels – twin 4km, two-lane tunnels between Bexley Road and Marsh Street, and passing below Wolli Creek and East Hills Railway. During 2004, the M5 East tunnel carried an average of 91,400 vehicles per day.

The high volume of traffic using the M5 East is an indication of its success as a transport link in the Sydney region.

Haze in the M5 East tunnel is at times visible, even though haze levels do not exceed recommended levels set out in international guidelines.

Project

On 16th June 2006, the NSW Government announced an air quality improvement plan for the M5 East tunnel. The plan was designed to analyse, investigate and improve air quality levels within the tunnel.

On 18th July 2007, the Minister for Planning granted approval for the RTA to construct and operate a filtration plant to trial how effective the filters are in the M5 East westbound tunnel.

Over an 18-month period, the RTA will test the air filtration equipment, to see how best to operate this equipment and evaluate its benefits and costs.

The works to be completed include:

- A filtration pilot plant, Australia's first use of air filters for a road tunnel.
- A 300m road header-driven ventilation tunnel which extracts air from the westbound tunnel, transfers it to the filtration plant and then returns it to the existing M5 tunnel.
- A 40mx70m partially underground building to house the filtration equipment, substation and switch rooms, water treatment plant and office facilities.
- Three underground connections to the westbound M5 East tunnel
- Installation of various mechanical and electrical equipment.
- Installation of a waste water filtration plant to remove contaminants from the washdown water.

The RTA awarded Baulderstone the managing contractor contract for the construction of the project in April 2008.

Construction commenced in April 2008 and is scheduled for completion by December 2009.

Filtration Equipment

The filtration equipment used will be the first application of this technology in Australian road tunnels. The technology has previously had limited implementation in countries such as Spain, Japan and Norway.

The filtration plant will extract 200 cubic metres of tunnel air, treat it and then inject the treated air into the tunnel downstream of the extraction point. No air from the tunnel will be released to the surrounding atmosphere.

The filtration plant improves the existing tunnel air in two ways:

1. An electrostatic precipitator (ESP) which will substantially reduce particulate matter.
2. An oxides of nitrogen absorber, which treats 50m³/s and substantially reduces nitrous oxides through an absorption process, further improving the air quality.

The filtration plant will be fully automated with auto-washdown capability to remove the particulates collected by the ESP. The dirty water is then processed through an ultra-filtration treatment plant leaving a re-useable water product and a waste product that can be disposed of in a registered tip. The filtration facility will be remotely monitored from the existing M5 East control room.

Current Status

Vent tunnel works are drawing to an end. The filtration technology installation is in full swing with a majority of the equipment delivered on site and only installation and commissioning to follow. Final backfill of the roof and site will occur soon, allowing for landscaping works to follow to blend the site in with the local environment much more.

Site demobilisation works have begun and soon the temporary driveway will be demolished, and temporary hoardings and site sheds removed.

Future activities

After installation and commissioning, the air filtration system will be closely monitored during the trial for the initial 18 months of operation. The following will be monitored and recorded during the trial:

- In-tunnel air quality monitoring including carbon monoxide, total oxides of nitrogen, nitrogen dioxide and particulate matter.
- Availability and reliability of the filtration equipment.
- Electricity, materials, labour and other operating costs.
- The performance of the filters to remove particulates.

Construction Workforce

To date 865 staff and contractors have been inducted into the site. The managing contractor has a team of 15 supervising the design development, subcontract and materials procurement, construction scheduling and construction supervision including adherence to the Project Safety and Quality Assurance plans.

Construction Machinery

To date the project has involved excavators ranging from 2-30 tonnes, numerous trucks and dogs, Hiab trucks, boom and scissor lifts, concrete pumps, cranes including 30-350 tonne slewing cranes, as well as 18-20 tonne Franna cranes and various other specialised plant.

Tunnelling subcontractors Fox Mining used plant including a Mitsui S300 series roadheader, rockbolting machines, shotcreting machines, Schaeff loader and front-end loaders.



EUROFILTER ASIA PACIFIC LEADS THE WAY IN TUNNELLING EXTRACTION

Specialising in dust extraction, Eurofilter Asia Pacific was contracted by Baulderstone Hornibrook for the M5 East Filtration project. A company of 25 employees, five of which worked on this job, Eurofilter Asia Pacific has a solid reputation for high quality, high performance and innovation within the dust collection filter industry.

Eurofilter Asia Pacific provides integrated dust extraction solutions to environmental dust control problems, from initial site survey and quotation, through to the supply and installation of a complete fully commissioned, documented dust collection system to meet workplace Health and Safety requirements.

Their role on the M5 East filtration project involved extracting the dust from the cutter head of the tunnel boring machine, which cut approximately 20 metres per day. Specifically, Eurofilter Asia Pacific provided an EFC 160 Collector cartridge unit, which extracted the air borne particulate. The collectors were made up of a modular construction that was straightforward in its assembly and commission, and it was decommissioned and removed from site on completion of the 250 metre tunnel construction. All particulate that was extracted was conveyed along the inbuilt hoppers via screw conveyors and dropped into two bulka bags that were removed via forklift for ease of disposal.

“Eurofilter provided the Dust extraction system for the tunnelling operations. The collector provided a trouble free solution for the tunnelling phase of our project and was able to keep the air levels to



1/10th of the allowable limits. We were very happy with the unit and the backup service provided,” according to M & E Superintendent - Baulderstone Hornibrook - M5 East Filtration Project.

With an industry leading product portfolio Eurofilter Asia Pacific has the technology to provide filtration solutions for everything from the smallest dust collection requirements to gas turbine filtration and silo air dust extraction.

Eurofilter Asia Pacific operates under the parent company Eurogroup Enterprises, as does Eurofabrications—a steel fabrication business for quarry, mining and water treatment industries. Other projects they are currently working on include the Adelaide Desalination Plant.

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EXCAVATING NO MENIAL TASK

Menai Civil Contractors Pty Ltd would like to congratulate Baulderstone on their management of the M5 East Filtration Project. Menai Civil were able to complete the bulk and detail earthworks to Baulderstone’s specifications and to their satisfaction.

Due to the tight tolerances required by the client Menai Civil’s team of 15 on this project, headed by Roger & Lee Fahey, our resident engineer, Ryan Butler and Supervisor, Toli Alevras, Menai were able to saw cut to within + or – 10mm. This project was completed in six months which was as per the programme.

Menai Civil specialise in rock excavation and have the staff and equipment required to complete your project in a cost effective and safe environmentally friendly manner.

As Menai Civil have their own large fleet of plant including excavators, graders (including GPS), and backhoes plus a comprehensive selection of attachments including both tooth and diamond blade rock saws, twin headers, compaction equipment and an array of buckets we are able to satisfy most clients requirements.

Check out our website www.menaicivil.com.au.



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THE FUTURE IS ELECTRIX

A relatively new company established in July 2008, Aone Electrix specialises in electrical high voltage and low voltage installations and services. Recognising a need in the industry for electricians specialising in tunnel work, they focus their skills in this area. A team of up to 7 employees, headed by three directors, Aone Electrix has hit the ground running since its fruition.

Contracted by Baulderstone, Aone Electrix's work on the M5 East Filtration consisted of general electrical maintenance and the final stage fit out, as well as providing the tunnel's electrical support. Specifically, they supplied the electricity throughout the tunnel digging stage, which included all lighting, electrical works and assistance with repairing machinery. During the fit out stage they purchased, installed and tested the transformers and installed the high voltage and low voltage switchboards.

A unique and new forte for Aone Electrix on this project was the in house production of the low voltage switchboard, which was designed and built within their factory.

Having gained the M5 East Filtration contract just weeks after the company was established, this is a sure sign of Aone Electrix's expertise and high standard of services. Baulderstone are also utilising Aone Electrix for the Port Botany Expansion Work project, where they are working on the water filtration system design and installation and fitting out the barge. Another project Aone has been involved in is the Top Ryde Shopping Centre Development, which was completed in March 2009.

After just over a year of operation, Aone Electrix have firmly established themselves within the industry, and with future projects such as the City Metro Line, they are sure to see continued success into the future.

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FOX IN THE TUNNEL

Baulderstone Hornibrook contracted FOX Mining for their tunnelling expertise for the M5 East Filtration project. FOX excavated the 260m main tunnel and the three 7-12m connection tunnels, which connect the filtration tunnel to the motorway tunnel.

Utilising a Mitsui S300 roadheader for the stone cutting, the tunnel profile, grade and direction were maintained by a laser guidance system. The main filtration tunnel, which measures 8.2m in width and 5.2m in height, was partitioned to separate extracted air and the filtered air. This tunnel runs at a decline due to the surface facilities being located about 17m higher than the entry/exit connections, and it runs sub-parallel to the motorway tunnel and about 10m adjacent to it. The three connection tunnels branch out from the main tunnel—one to draw exhaust gas-laden air out of the motorway tunnel; and two tunnels to return the filtered air back to the M5.

A system of fully grouted rock bolts situated between 1.3 and 1.5 m apart and shotcrete, mostly at a thickness of 100 – 150mm, provided the support for the excavations. An Atlas Copco Boltec bolter was used for drilling, installing and grouting the rock bolts and the shotcreting was undertaken with a Jacon Maxjet robotic arm with remote controller.

Unable to close the M5 motorway tunnel for long enough to safely breakthrough from the connection tunnels and clean up after, FOX created a 1.5m deep niche at each of the three connection tunnels breakthrough points. Each niche was supported and shotcreted and then bulkheads were built across the openings to facilitate a safe breakthrough

upon completion of the tunnels. The motorway tunnel was closed for breakthrough overnight to minimise disruption to motorists.

Faced with strict environmental restrictions, weekly inspections were conducted by external, independent auditors. The tunnel entrance was located approximately 100m away from residential properties, so all possible precautions were taken against air, noise and contaminant pollution. This included ensuring all excavated material was removed from the site, and no surface traffic movements were permitted between 6pm and 7am.

FOX's diligence ensured that the project was completed without any lost time injury or significant incidents.

Supplying mining and tunnelling equipment and services, FOX is also a one-stop shop for mechanical, electrical and hydraulic repairs, maintenance and servicing. FOX prides itself on offering proactive solutions that are cost effective, innovative and compliant.

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