RVT protects the health of tunnel workers

September 2015

Farnworth Tunnel facts and figures

1835-1838
Hawkshaw's tunnel

- It was used as a double-track tunnel for 42 years.
- It took 30 seconds for a train travelling at 20mph to pass through it.

May-December 2015
The new tunnel

- Over 1,500 boreholes were drilled to establish the ground types.
- 500,000 tonnes of material was removed from the tunnel.
- Almost 2,000 concrete lining segments were installed.
- 7,500m^3 of foam concrete was used to fill the tunnel.
- The 293 tonne tunnel boring machine (TBM) has a diameter of 8.83m.
- 1.4m rings of concrete were installed by the TBM.
- The RVT extraction system used 30m of 800mm duct for the first phase and 270m of 300mm plastic smooth bore duct for the second phase.
- The project took 130,000 man hours to complete.

Pioneering engineering at **Farnworth Tunnel**

Farnworth's first two-track tunnel was engineered by John Hawkshaw, who was well-known for his work on the Severn Tunnel, a significant engineering feat. The Farnworth Tunnel was constructed for the Manchester Bolton & Bury Railway between 1835 and 1838. At the centre of the 270m tunnel, light shone down a shaft sunk from the surface, which was covered by a glass dome.

The 1838 tunnel was filled with foam concrete and a bigger tunnel was re-bored.

With the introduction of Pullman coaches on the Midland Railway route between Manchester and Carlisle, the track gauge proved too small. The tunnel was also in need of extensive repairs. Instead of enlarging it, the solution was to bore a second tunnel for the 'Down line'. This took seven months and it opened in December1880. The lining of the 1838 tunnel was repaired and thickened, and the two tracks were reduced to a single track in the centre. This tunnel was then used for the Manchester-bound 'Up line'.

The older tunnel was from the 'pioneering first phase' of railway building and was accorded a Grade II listing by English Heritage. However, with the next stage in its evolution in 2015 – the driving of a bigger bore on a different alignment – Hawkshaw's structure, along with its shaft and 13 passages, ceased to exist.

Key facts have been taken from Rail Engineer's authoritative article on this project – read the full article here: http://www.railengineer.uk/2015/05/11/boring-boring-boring/

RVT ventilation solution: key benefits

- Same-day solution provided, following the client's brief by phone and email.
- Speed of setup – this advanced solution did not hold up project schedules.
- Significantly enhanced air quality throughout the duration of the project.

We provided 24/7 backup and regular monitoring to ensure that air quality was maintained throughout the project. The positive air movement throughout the tunnel made dust and fume control straightforward and effective. We were a trusted adviser to the health and safety manager.

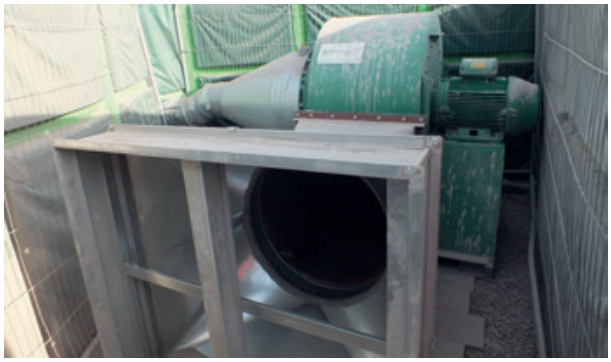
Scope of works

This £20.8 million project was completed as part of the North West Electrification Programme, with the conversion of the diesel line between Manchester and Preston to an electrified line. As neither of the tunnels could accommodate two tracks and overhead line equipment, a larger one needed to be re-bored in the older tunnel.

Firstly the 1880 tunnel, which had been affected by water damage, needed to be strengthened in order for a reduced train service to operate, while the new tunnel was being mined. Three groups of workers installed a mesh frame to the internal walls, sprayed 200mm shotcrete, and replaced the deformed lining along a 20m stretch. A diesel plant was operated within the tunnel.

The 1838 tunnel was to be filled with 7,500m^3 of specially formulated foam concrete and then re-bored using the UK's largest tunnel boring machine, 'Fillie', which took 12 weeks. Despite initial ground investigations, sand unexpectedly poured into the excavated area on two occasions, and 100,000 tonnes of material had to be removed by hand. As a result, the TBM broke through on 25 October 2015, 21 days later than planned. However, the new tunnel still opened on schedule, on 14 December 2015.

The system used an 800mm duct.



A filtration bank on the fan outlet extracted continuously from the workface.

RVT provides fresh air for tunnel crews

As the UK specialists in air quality control, we were pleased to assist with this unique project. For the first phase, J Murphy required a temporary ventilation system to ensure a constant flow of fresh air, for a safe working environment. Using an 800CF ventilation kit with an adjacent generator, we forced fresh air through the tunnel via 30m of 800mm duct, creating an entrainment of air. This kit was in operation for three months.

The second phase posed challenging conditions at times for the crew. We specified and provided a VENTEX 800CF fan to extract and filter the dust created by the boring works. The intake of the fan was connected to a 300mm duct and a filtration bank on the fan outlet. This system extracted continuously from the workface, via 270m of 300mm duct, at a rate of 21m^3 per second. In this way, the effect of the dust on the workers' environment was minimised.