

PROTECTING HERITAGE WITH UPGRADED RAIL CLEARANCE



The rail line connecting Toowoomba with Brisbane has 11 heritage tunnels dating back to the 1860s. International shipping companies and local cotton and grain growers are transporting through this railway between 86 to 96 containers daily.

With shipping containers increasing in size, the old rail tunnels will soon be too small to accommodate the larger containers. Worse still, along each tunnel the width varies, roof heights are inconsistent, and walls and roofs have irregular projections. Being heritage listed, most of the tunnels need to remain untouched. Queensland Rail therefore proposed to lower the floor and rail alignments to provide sufficient clearance while minimising the impact on storm water and other underground services.

To provide the necessary freight clearance, Bennett + Bennett, a firm providing advanced surveying, town planning and spatial solutions for nearly 50 years, surveyed 11 tunnels from up to 540 metres long.

The rail line is busy every day with passengers, coal freight and agricultural products. To minimise disruptions, full access to the tunnels was provided during a 48-hour track closure. Within this small window, Bennett + Bennett mobilised a team of eight specialists. An integrated laser scanning and detailed survey approach speed up acquisition and provided reliable data that ensured no further site visits are needed.

UNDERSTANDING THE TERRAIN WITH A CONVENTIONAL SURVEY

Bennett + Bennett exclusively uses Leica Geosystems laser scanning equipment, and sources its equipment and support services from C.R. Kennedy – the national distributor for Leica Geosystems solutions in Australia.

Using conventional survey methods with Leica Geosystems total stations, the team of experts was able to:

- Pick up ground surface topography
- Locate underground services
- Re-establish survey control along the rail corridor
- Survey drainage for hydraulic investigation
- Verify control points
- Measure rail monuments

ACQUIRING DATA WITH TERRESTRIAL LASER SCANNER

During the 48-hour track closure, various engineers, project managers, and geotechnical and heritage consultants were also working in the tunnels. With several teams working inside of each tunnel, mobile laser scanning from a rail mounted trolley would have been impractical.

Instead, the survey team used Leica P30 and P40 ScanStations to acquire the point cloud data from 250 locations, concentrating on features, such as the tunnel approaches, portals and interiors, and the tracks. Data was recorded on a grid smaller than 5 millimetres, and more than 100 GB of data was acquired for each tunnel. C.R. Kennedy made a P40 ScanStation available for hire to the survey team at short notice. It proved so efficient that the team ended up purchasing the laser scanner.



To provide the client with a realistic colour visualisation of the data, Bennett + Bennett took 360° panoramic photographs at each control point. This required lighting inside the tunnels so portable artificial lights were placed under the tripod of the ScanStations. The project area was also captured on video for quality assurance purposes.

CREATING A PRECISE 3D MESH OF EACH TUNNEL

The raw scan data and panoramic images were imported into Leica Cyclone software for processing and registration to survey control. All rail alignments were obtained with a high precision. Features such as string, vertex, and surface were extracted from the point clouds to form a detailed survey that was integrated with the conventional survey. High resolution was required to extract features like the track joins.

To create precise 3D digital meshes, the point clouds were imported to 3D Reshaper. Experts could experiment with point cloud sizes and mesh detail to deliver the optimum size for the client. Rail track designers will use a digital model of the new trains to ensure there is sufficient clearance to the features defined by the mesh created by Bennett+Bennett.



BETTER THAN BEING THERE

Leica TruView files generated from Cyclone were uploaded to TruView Global software, the industry leader for easily and intuitively sharing point cloud data, design models, mark ups and more. This allowed the project to come to life in dimensionally correct photorealistic digital reality, enabling everyone to view the project, pan, zoom, measure and mark up.

“TruView allowed us to deliver data to clients while other deliverables were being prepared. The clients, furthermore, found very valuable to eliminate the need for further site inspections and engineers felt TruView provided good context to complement other deliverables,” said Liam Thierens, spatial services manager at Bennett + Bennett.

DIGITAL REALITY FOR HERITAGE AND RAIL

This rail project ensures the freight hub cities stay connected while conserving the integrity and heritage status of the tunnels. Despite the short 48-hour window to acquire data, Bennett + Bennett provided high quality deliverables within two weeks of completing the field work and no further site visits were required.

All coloured point clouds, 3D meshes, TruView Global, video and detail surveys were issued within six weeks. By integrating survey data acquired from a variety of instruments, the Australian firm provided its client with high precision design criteria in a format the client can literally see, not just imagine.

Watch a sample of Bennett + Bennett’s digital reality of the tunnels: Laser Scanning - Toowoomba Range Heritage Rail Tunnels from Bennett + Bennett on Vimeo.

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For more information, visit railways.hexagongeosystems.com





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