

State of the art Waterview Tunnel. Smart traffic systems. Smart traffic flows.

CASE STUDY: WATERVIEW TUNNEL AND WATERVIEW CONNECTION – SEPTEMBER 2017



OVERVIEW

The 2.4 km twin bore Waterview Tunnel is breaking lots of records; it's the longest in the country and already more than 60,000 cars are using the Tunnel daily since it opened in July.

Monitoring shows traffic volumes on key roads in central Auckland are reducing and the Tunnel is providing a shorter journey time between the city to the airport.

Spanish systems integration company SICE is one of seven Sub Alliance partners of the Well-Connected Alliance (WCA), the consortium responsible for the design, supply, installation and

commissioning of the Intelligent Transport Systems (ITS) and electromechanical systems for the \$1.4 billion infrastructure project.

"It was a huge sense of relief the day the Tunnel opened. It was like, okay we finally did it. We prepared for the worst case scenario but it was a smooth operation and probably easier than what we expected and had trained for," says Emilio Marquez De Prado, Operations Manager of SICE NZ and Operations Manager for Waterview Tunnel Joint Operations (WTJO).

WTJO will now operate and maintain the Tunnel and the 5km of highway for the next 10 years. Emilio says the Tunnel is his utter focus, and he's very happy he and his family can continue to live in New Zealand.

"The new Waterview Tunnel and Waterview Connection represents the biggest change in travel patterns since the opening of the Auckland Harbour Bridge in 1959..." – NZ Transport Agency



BUSINESS CHALLENGE

Setting up and managing sophisticated ITS is a critical part of the Tunnel and associated new infrastructure, if it is to help unlock Auckland's potential as a world class city.

Emilio says that ITS for the Tunnel is controlled by centralised systems. The Tunnel and interchange is fully integrated with the Auckland motorway network through the Auckland Traffic Operations Centre at Smales Farm on Auckland's North Shore. Operators responsible for tunnel operation are based at the Auckland Traffic Operations Centre and provide 24/7 monitoring of traffic and tunnel systems.

The company responsible for designing and setting up the network technology is Fusion Networks, contracted by the Alliance to design the Tunnel's communication networks in line with the existing NZTA network across the rest of Auckland.

"Fusion supplied all the setup and configuration for the switches, the assets that connect to the communications networks responsible for delivering information from one place to another and to NZTA HQ in Smales Farm. It's an integrated system, but if we were only left with the Tunnel communications networks operating, it must be able to do so autonomously," says Emilio.

"The challenge was to connect to the existing networks and implement this in a way that didn't disrupt what was already there, and ensure business as usual. We

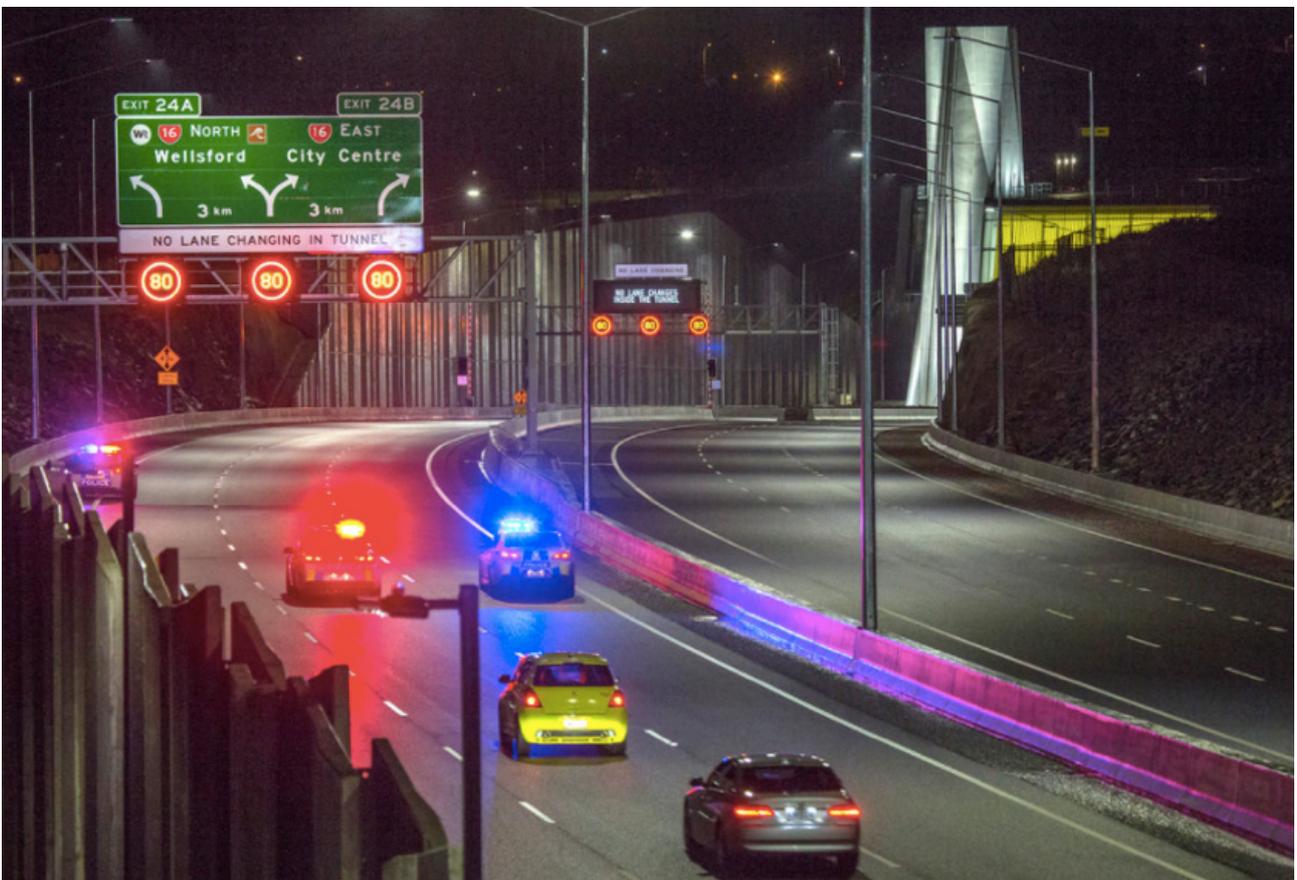
had a year of preparing tests. The first thing you need is communications and then you start testing the systems," says Emilio.

Fusion's challenges included establishing a full setup of the network and switches, plus extensive traffic and failover testing to ensure the architecture, EPSR technology and equipment worked as intended.

Fusion worked with the WCA team to develop the right approach to resilience; to configure and test the equipment, with detailed and extensive equipment testing of every single switch delivered.

Fusion MD Andrew Gurr says that the Tunnel uses the same technology from Allied Telesis as the rest of the NZTA network in Auckland, however the architecture uses the latest Allied Telesis 10Gb switching chassis technology in the core, with EPSR ring failover technology. EPSR is used to deliver resilience across the fibre network by allowing rapid failover of each fibre ring.

"Equipment in the Tunnel is connected to the network via Allied Telesis edge switches located in cross passage communications rooms. The Tunnel has two communications rooms at each cross-passage, one on the north and one on the south side. Each room is fed by an alternating fibre from one of two fibre rings running down each Tunnel, making a total of four fibre rings. The level of failover is significant, and the level of redundancy extends to the power supplies, and even the power feeding each cross-passage room," says Andrew Gurr.



First cars through the Tunnel

THE JAMES BOND MOVIE SPECTRE HAS NOTHING ON THE WATERVIEW TUNNEL

The Tunnel has been fitted out with a state of the art Fire Life Safety system to keep people safe. The system includes a deluge system to control fires or spills, fixed fire hydrants, incident detection cameras, a public address system, radio and mobile phone coverage underground, 18 cross passages linking the two tunnels for safe egress in the event of an incident in one tunnel, and incident response crews on duty 24/7 adjacent to the tunnel portals.

WTJO operates the centralised tunnel management system to control and monitor all tunnel systems and to guarantee maximum levels of safety and operation during both routine management and in emergency situations.

Emilio said a big challenge was setting up the fire systems within the Tunnel and testing these.

“Lots of systems must be integrated. For example if there is a crash in the Tunnel we have an automatic video detection system that tells us there’s a stopped vehicle. Then immediately an alarm goes off, we get a pop-up screen showing an image of the car. This is confirmed automatically and we get a Traffic Plan, for example we might close one lane, or two lanes and the signs on the road at the Tunnel entrance must receive and show the same message.

“You prepare the Tunnel for a fire and do most of the testing based on fire, but wish it never happens – a fire in a tunnel is low probability but very high consequence.”

“We have a 24/7 emergency response team – they are called to attend any incident and decide on the spot how to handle it. A tow truck might protect the accident vehicle until police ambulance arrives,” says Emilio.



WATERVIEW TUNNEL AND CONNECTION: FACTS

In November 2011 the Well-Connected Alliance won the tender for the \$1.4BN project (Fletcher Construction, McConnell Dowell, Obayashi from Japan, Beca, Tonkin+Taylor, Parsons Brinkerhoff, and the NZ Transport Agency). The Alliance also incorporates Wilson Tunneling (pre-cast concrete) and SICE (tunnel operations and maintenance) as sub-Alliance partners.

The \$2.4b Western Ring Route, including the Waterview Tunnel and Connection, completes the 48km Western Ring Route, a second motorway route through Auckland, and it includes a giant motorway interchange at Great North Road to connect the South Western and North Western motorways.

Twin 14.5m diameter tunnels were constructed using the world’s 10th largest tunnel boring machine (TBM) that was specifically designed and manufactured for the project.

The Waterview tunnels are 2.4km long, the longest road tunnels in New Zealand and twice as long as the Auckland Harbour Bridge.

There are 15 mined cross-passages between the main TBM tunnels with retained approaches up to 30m deep at each end.

The route benefits New Zealand by providing people and freight with a second motorway route through Auckland, bypassing the city, in addition to State Highway 1. It provides more transport options including bus lanes, and walking and cycling connections.

Construction for the project took five years. Tunneling first began at Waterview in 2013. The first tunnel was completed in 2014. Alice the Tunnel Boring Machine broke through on the second tunnel on 19 October 2015.

In keeping with mining and tunnelling tradition, Waterview’s Tunnel Boring Machine was named after a woman. An Auckland schoolboy chose Alice after he was inspired by the underground adventures of Alice In Wonderland.

The project’s innovation attracted headlines world-wide after completion of the first tunnel when the Tunnel Boring Machine was turned 180 degrees to excavate the second – an operation rarely undertaken anywhere for a machine of that size in a constrained space. 200 litres of sheep lanolin was used to help slide Alice the required 180 degrees.

Alice had a top speed of 8 centimetres a minute – that is also the top speed of a snail. The diameter of the Tunnel Boring Machine – 14.4 metres – is larger than the trunk of Tane Mahuta in Northland, New Zealand’s oldest and biggest kauri. Alice excavated 800,000 cubic metres of dirt – enough to fill 320 Olympic-sized swimming pools.

The two tunnels are fitted with 4000 lights, 62 ventilation fans, 400 kilometres of cabling and wiring (that is the distance from Auckland to Waiouru), and 50 kilometres of cable trays to support wiring and other equipment.

Five deluge storage tanks each hold 250,000 metres of water for fire control in the tunnels.

The infrastructure project employed around 1,100 people over a five year period and three different work sites.

WORKING WITH FUSION NETWORKS

Emilio says: "Fusion is really efficient, they know what they are doing. Ongoing we have a support contract with Fusion who will run and maintain the communication network."

"The tech we are using is very original; I remember we changed the model of the switches a couple of times to keep up with state of the art deployment. The guys from Fusion always offered us the latest, the next level, so basically we were not outdated with our technology. And we will keep upgrading because unfortunately with technology things get old quickly," he says.

"The Tunnel is showing to the public all the effort we put into it – before we opened there was a long time testing, and it's good to see people recognise this effort, it is all working well. It may be a medium-sized tunnel internationally, but in terms of quality the workmanship is probably one of the highest we at SICE have experienced. The design and systems are good, but how people executed the job with precision and attention to detail, this really shows... it works and it's good to look at..."

– Emilio Marquez.

The project's legacy includes several iconic landscape features – in particular the striking design of the ventilation stacks at either end of the tunnel and the suspended arch-shaped bridge for walkers and cyclists spanning the motorway in the South.



SUMMARY

Business

Waterview Tunnel Management
– NZ Transport Agency

Sector

Transport sector

Challenges

Proactive Traffic Control and performance for Waterview Tunnel.

Connect to the existing networks and implement this in a way that didn't disrupt what was already there, and ensure business as usual.

Network Solutions

IT infrastructure design, setup and ongoing technical and helpdesk support

Establish full setup of the network and switches, plus extensive traffic and failover testing to ensure the architecture, EPSR technology and equipment worked as intended.

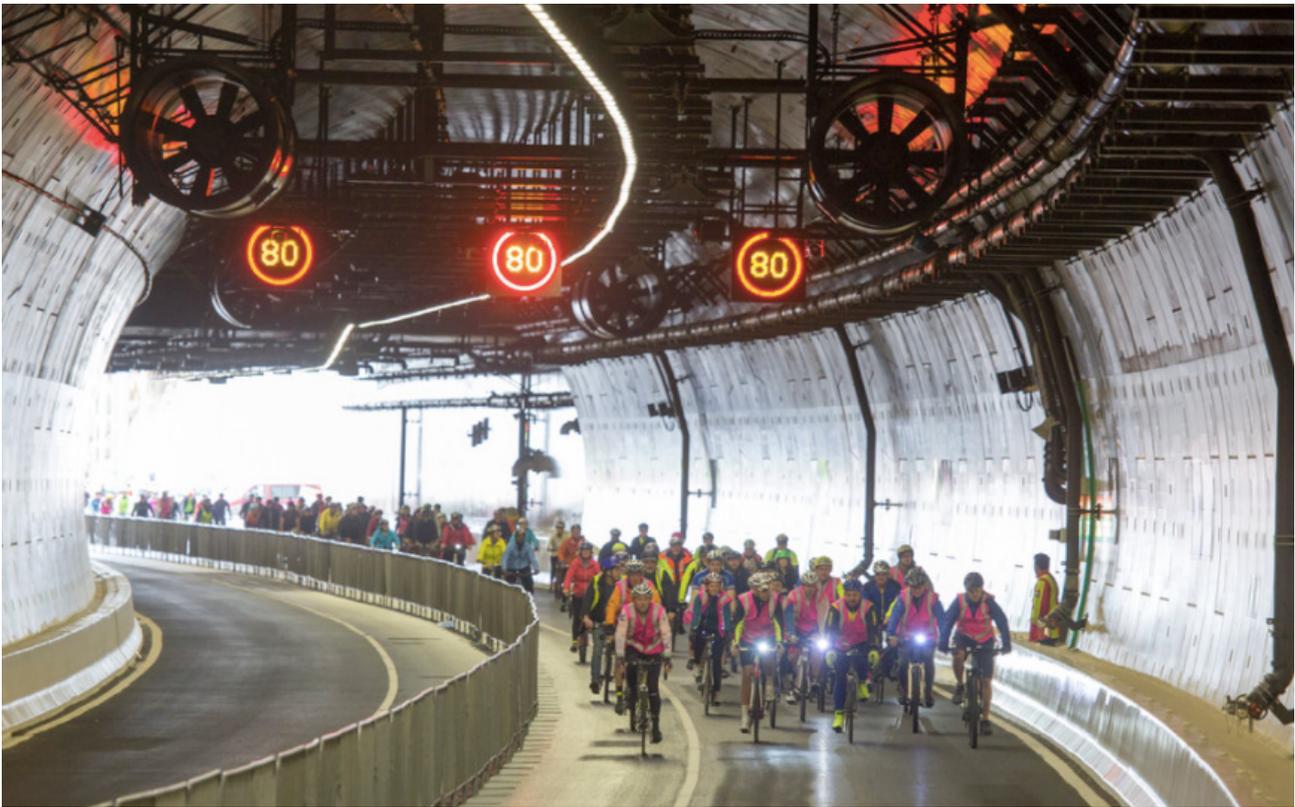
Deploy latest 10Gb switching chassis technology in the core, with EPSR ring failover technology from Allied Telesis. EPSR is used to deliver resilience across the fibre network by allowing rapid failover of each fibre ring across the networks.

Results

A centralised tunnel management system to control and monitor all tunnel systems.

Smart traffic systems and smart traffic flows.

The five year project has delivered Auckland's \$NZD\$1.4billion Waterview Tunnel and Connection, the largest and most ambitious motorway project ever undertaken in New Zealand, with minimal disruption to one of New Zealand's busiest sections of motorway.



A number of community-based works are part of the Waterview Connection Project. These included new playgrounds and sports facilities, walkways and shared paths.

FOR MORE INFORMATION

The Well-Connected Alliance

The NZ Transport Agency has retained the Well-Connected Alliance to design and construct the Waterview Tunnel and Waterview Connection. This major infrastructure project will provide a new five kilometre stretch of multi-lane motorway 2.5 kilometres of which is underground and an upgraded interchange.

The Well-Connected Alliance comprises Fletcher Construction, McConnell Dowell Constructors, Parsons Brinkerhoff, Beca Infrastructure, Tonkin & Taylor and Obayashi Corporation. The Alliance also incorporates Wilson Tunneling (pre-cast concrete) and SICE (tunnel operations and maintenance) as sub-Alliance partners. This arrangement brings together the knowledge and strong, home-grown reputation of leading NZ engineering companies with the tunneling expertise of its international partners to deliver a world class project with a distinctly Kiwi accent.

SICE

SICE's range of services in ITS includes the management, integration and subsequent operation of different projects. Thousands of people use traffic and transport infrastructure managed by SICE technology, including centralised traffic signal management and the management of highways, tunnels and tolls.

To date SICE has implemented its technology to bring smart systems to transport infrastructure in over 160 km of tunnels. SICE has a portfolio in the United States, Colombia, Chile, Australia, Spain and Portugal, and now here in New Zealand.

sice.com/en

Fusion Networks

Fusion Networks is a specialist technology integrator, helping clients on their technology journeys across a range of digital solutions. Fusion expects high performing IT systems and networks as the norm, not the exception, and works with clients to deliver proactive, flexible and cost-effective services. A kiwi-owned business, Fusion commits to bringing the right mix of intelligence to bear on problem solving, and the rapid resolution of any critical issues keeping the business running.

fusionnetworks.co.nz

