

STRONGER, BETTER, MORE EFFICIENT

April 12, 2011. An unremarkable date for most New Zealanders, but a big day for one of the most important infrastructure assets in the country, the Auckland Harbour Bridge. GEORGE HULBERT explains.



30 MAY 2011 CONTRACTOR



On April 12, representatives of NZTA attended a gathering hosted by Total Bridge Services to celebrate the successful completion of a major, multi-year and award-winning piece of work to strengthen the box girders that underpin Auckland Harbour Bridge's clip-on decks.

This highly technical job has some big numbers attached to it: \$75 million worth of work, 906 tonnes of steel lifted and welded into two 1100-metre box girders, and up to 200 people working on the bridge during the two and a quarter year project.

The work has been undertaken by Total Bridge Services (TBS), a joint venture between TBS Farnsworth, Opus International Consultants and Fulton Hogan. The joint venture was formed in 1998 to maintain the bridge for the then Transit New Zealand, but has also carried out substantial additional projects on the structure over the past thirteen years.

Fine tolerances

TBS's project director, Graham Matthews, says that the most technically demanding aspect of the box girder strengthening work involved particular focus on strengthening the top and bottom flanges of the box girders in the main navigation span.

"This primarily required installing the longitudinal steel stiffening plates inside the box girders. Stiffening was applied to all spans of the bridge, as well as stiffening the

pier brackets supporting the trestle legs and carrying the load back to the main bridge piers," he says. "It required extremely precise work with fine tolerances - for example, 0.25mm on a four metre beam, surveyed to 35 microns."

To ensure that the work was completed within these super-fine tolerances, the team established new 3D laser profiling techniques for the stiffening elements. Information from the scanners was sent electronically and downloaded to the off-site cutting machines.

Matthews adds that this was not the only challenge for the team. "A fine balance had to be struck by the designers between adding strength, weight and overall load to the bridge. There's a breakeven point to how much more steel you can put into the bridge before it becomes a greater load than the strengthening it provides."

Matthews adds that the team of welders had to contend with dense fumes and 40+°C temperatures, which required the development of new ventilation and air monitoring systems to ensure that the welders had a safe and effective workplace.

Technical excellence in a specialist environment

The box girder strengthening work has been undertaken alongside TBS' overall project management of all activity on the bridge.



— Jon Patman





According to project manager, Jon Patman, specialist technical activities undertaken on the bridge are led by the daily inspection, observation and reporting activities that are intrinsic to successful asset management.

“Risk assessment is a critical part of ensuring the structural and operational integrity of the bridge. This is so much more than just a painting contract, for although we undertake ongoing abrasive blasting and apply protective coatings continually, we also carry out substantial mechanical and electrical maintenance, structural steel repairs and maintenance, the repair and replacement of expansion joints – as well as concrete repairs and bridge deck resurfacing.”

Patman adds that other major completed projects include replacing the two North Shore water mains under the central navigation span, a stormwater upgrade and spill containment system, adding 16 tonnes of steel plates to the underside of the deck to strengthen trusses, plus building the bridge climb walkways and installing the bungee pod.

An international best practice environment

At all times, TBS has sought out the best of new thinking from New Zealand and across the world to apply to the benefit of the bridge and its users, according to Patman.

“We have then applied only the most

appropriate and cost-effective solutions to the bridge, in order to save money and create benefits for NZTA and bridge users. These include the specialist ‘Bolidt’ bridge deck surfacing treatment programme, acoustic emission monitoring of weld fatigue cracking, specialist protective coatings, and studies into containment options to minimise operational discharge.”

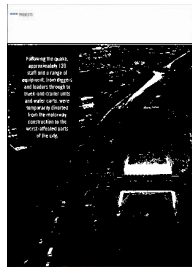
Over a decade of shared achievement

In Patman’s view, the success of both the box girder strengthening project and regular maintenance activities results from a shared view by the NZ Transport Agency and TBS, that they are joint custodians of the bridge.

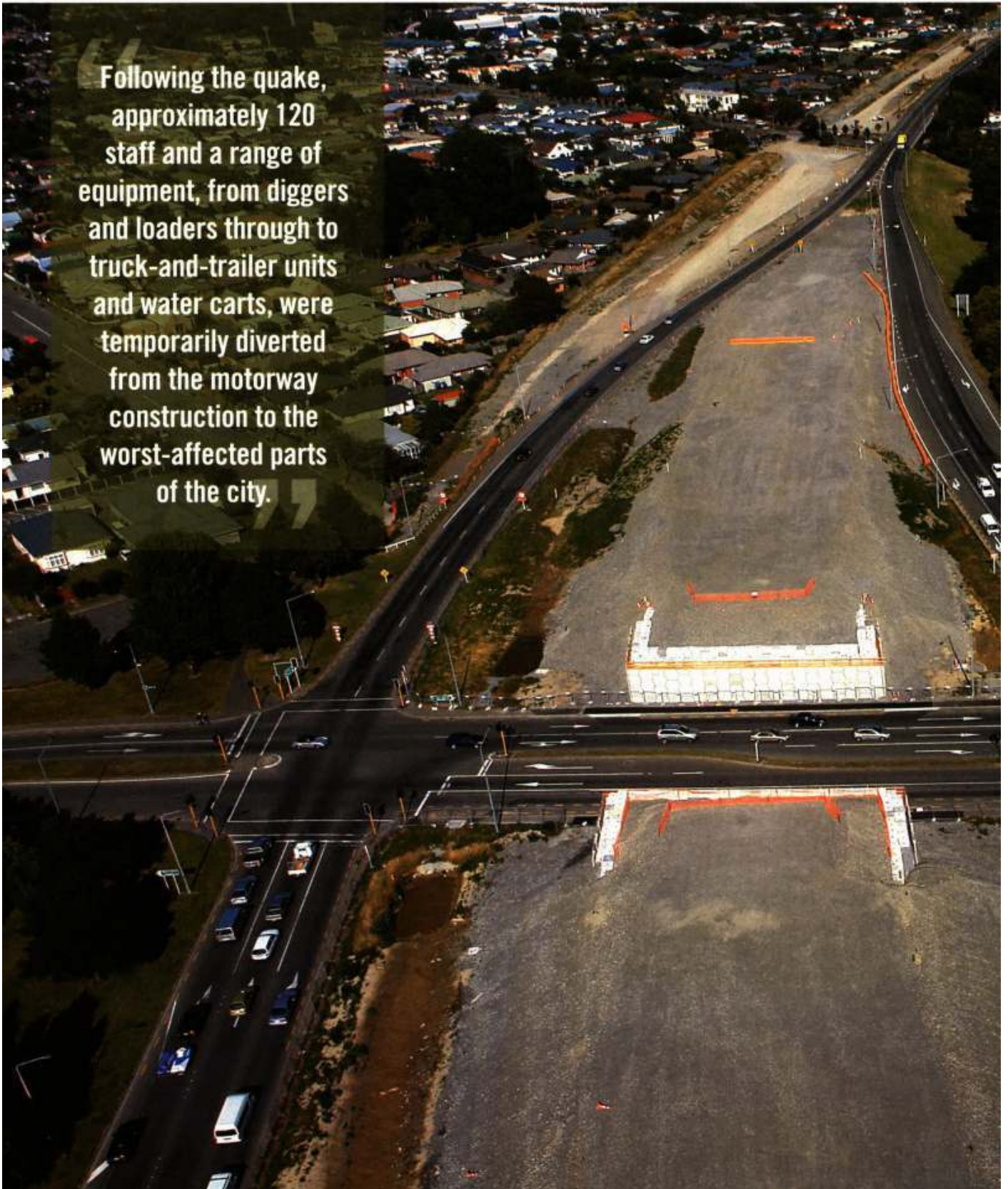
“It is our privilege to work on the bridge. We are immensely proud of what we have achieved together with NZTA over the years. We have built a formidable customer-first legacy on this key element of the nation’s strategic road network.”

Contract manager Jon Patman says that the joint team’s relentless focus on project and risk management has ensured no unplanned traffic disruption at any time during the 13 years and substantial volume of work.

“After seven million man hours of work have gone in, and over 700 million vehicles have crossed the bridge since we started work over 4500 days ago, we believe we have achieved the best possible result: bridge users do not notice the work taking place.” ▲

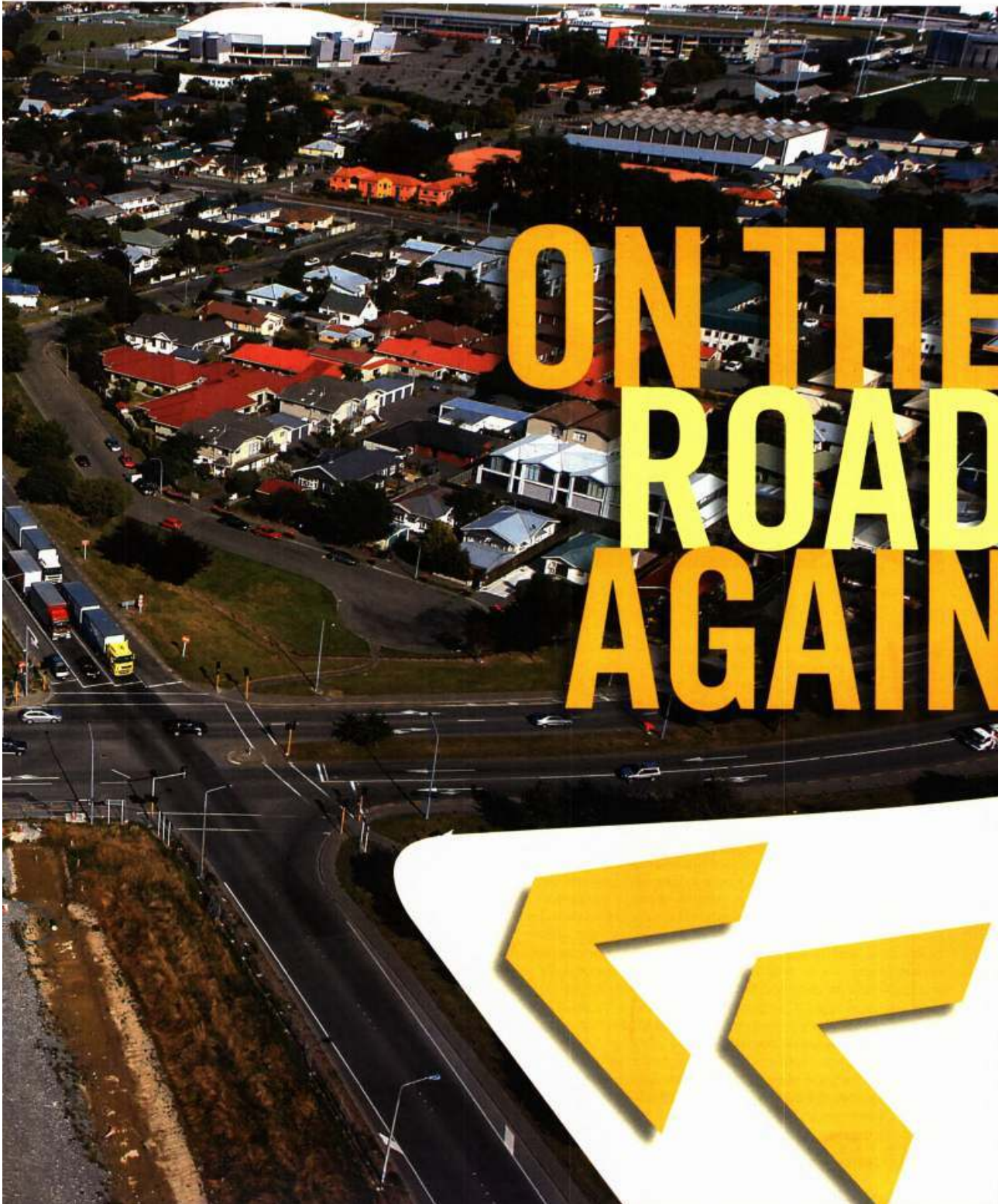


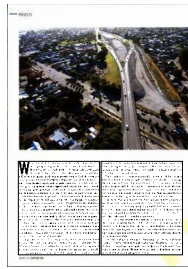
Following the quake, approximately 120 staff and a range of equipment, from diggers and loaders through to truck-and-trailer units and water carts, were temporarily diverted from the motorway construction to the worst-affected parts of the city.





Work on the Christchurch Southern Motorway has resumed and the project is beginning to approach full productivity following the tragic February 22 earthquake. HUGH DE LACY reports.





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Work by Fulton Hogan and its subcontractors had been progressing well on the Christchurch Southern Motorway project when the 6.3 magnitude earthquake devastated the city. In the two weeks immediately following the quake, work on the project stopped while resources were provided to the emergency response, and staff attended to their own families' safety and security. Approximately 120 staff and a range of equipment, from diggers and loaders through to truck-and-trailer units and water carts, were temporarily diverted from the motorway construction to the worst-affected parts of the city.

After this two week period, as it became clear that resources would begin to be released from the earthquake emergency response, a strategy was developed to progressively recommence work on the motorway project over a three- to four-week period.

Some staff and equipment previously used on the project are currently still involved in post-earthquake recovery work and will continue with this essential work as long as they are required. However, a large number of the staff and contractors employed on the project are no longer required for the recovery work and it is important for them and their families that they return to their usual work as quickly as possible. Their ability to do this will contribute to wider efforts to get people in Christchurch back to work and some sense of normality.

The project team told *Contractor* the interruption should not threaten the original planned completion date of February 2013. This was despite the need for the entire 10.4-kilometre alignment to be re-surveyed, and some re-design, as it had moved vertically to varying degrees from one end of the project to the other. This is

in addition to the considerable horizontal and vertical movement from the September 2010 earthquake. The team says this is a significant design issue, particularly with stormwater grades as flat as they are in Canterbury.

The Southern Motorway is a central component of the Greater Christchurch Urban Development Strategy that aims to manage the city's growth over the next 35 years by integrating land use with transport and the provision of infrastructure. As well as the NZ Transport Agency, the strategy brings together the Christchurch City Council, the neighbouring Selwyn and Waimakariri District Councils, and the regional council Environment Canterbury.

The most obvious contribution the southern motorway project will make to Christchurch's future is that it will free up access to the city's port at Lyttelton, its key export hub. This is important to the booming agricultural industries south of the Rakaia River and around port-less Ashburton, but a couple of other factors also drive the need for southern motorway.

The first is the residential capacity southwest of the city, at the southern end of the Port Hills, which is expected to grow by 30,000 over the next three decades. Then, further to the south, there's the rapidly growing satellite town of Rolleston and, no less important, expanding commercial areas in Selwyn District like the Izone Industrial Park.

The Christchurch Southern Motorway is being delivered in three stages, eventually following State Highway 1 as far as Rolleston. Stage One, now under way, will divert traffic north from Main South Road and Blenheim Road onto a four-lane, median-separated highway leading to Lyttelton.





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This first stage comprises three distinct sections. The first is a three-kilometre duplication of the existing two-lane motorway that runs between Collins Street and Curletts Road with full interchange access to both Barrington Street and Curletts Road. The five-kilometre second section goes from Curletts Road to the intersection of Halswell Junction Road and Springs Roads, with underpasses at Aidanfield Drive and Awatea/Dunbars Roads. The final 2.5 kilometre temporary connection to State Highway 1 Main South Road comprises an upgrade of Halswell Junction Road, with traffic lights at the Shands Road intersection and an upgrade to the Springs Road roundabout. Stage Two will extend this section of the motorway south from the intersection of Halswell Junction Road and Springs Road to Waterholes Road, south of Templeton, while Stage Three will four-lane State Highway 1 down to Rolleston.

Given that the motorway is primarily an urban project, it's surprising that about four kilometres of it - from Springs Road Junction to the A&P Showgrounds - is greenfields, something that might have made the job of both the specimen designer, Opus International, and the contract designer, Beca, a little more straightforward than if it had been entirely through brownfields areas.

Opus was involved in the project from 2003-2004 under contract to NZTA's predecessor, Transit NZ, and took it through the scheme assessment, specimen design, resource and tendering processes under the leadership of Tony Coulman. Opus continues to be involved as principal's agent with an on-site office, while Beca is Fulton Hogan's partner in the consortium and produced the final design.

Including subcontractors, Stage One will employ around 150 staff at peak. Preliminary work - relocating utilities, clearing the





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alignment, building access ways, and securing and fencing work-sites - began a little over a year ago, and was approaching full-speed when the February quake struck.

The major machinery component of the work at the moment is cranes, both mobile and fixed, which are working on the interchange and underpass bridges. Aside from subcontractors, Fulton Hogan is supplying most of the equipment from its own resources, though local quarries will get a slice of the action moving onto the site the 1.1 million tonnes of pit-run and river-run aggregate that the project requires. Surface sealing will be a mixture of chip-seal and asphalt.

The whole of the southern motorway project is covered by a master plan incorporating environmental, urban design and landscape features. Aimed at making the finished corridor as handsome as it will be functional, the drawing up of this plan involved a huge range of organisations and disciplines, among them of course the local authorities.

Coming as it did so soon after the stronger but less damaging earthquake of September 4, the February event brought Christchurch to its knees. But now, with infrastructure and building reconstruction under way, projects such as the Southern Motorway remind the city that it still does have a future. ▲



Pier construction at the Aidanfield Underpass.



Mechanically Stabilised Earth (MSE) panelled walls located at Barrington Street form part of the Barrington Street Interchange. These panels are created to visually represent the incised and buckled forms of the Southern Alps.



IMAGES: FULTON HOGAN