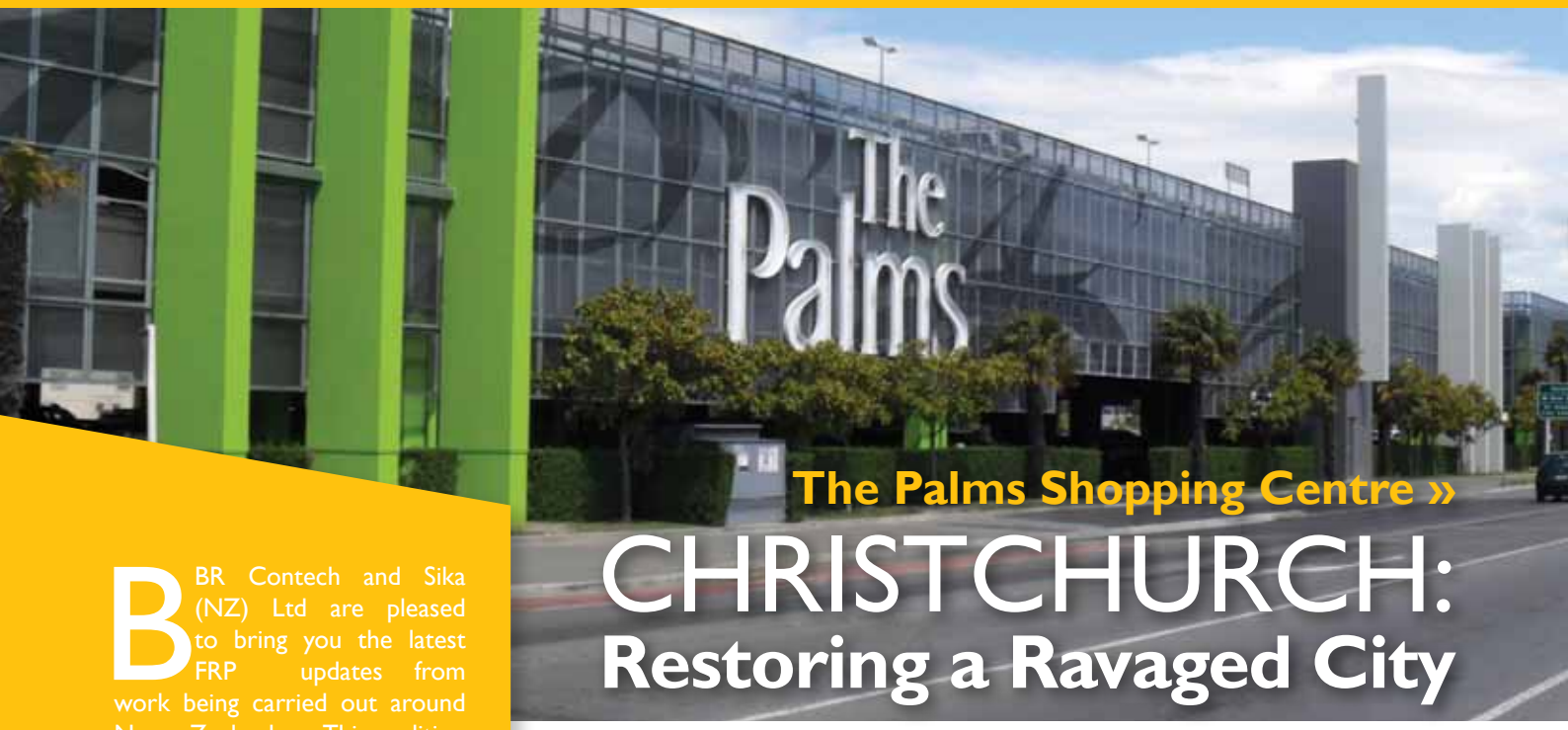
frp Leading technology

APRIL 2012



The Palms Shopping Centre »

CHRISTCHURCH: Restoring a Ravaged City

BBR Contech and Sika (NZ) Ltd are pleased to bring you the latest FRP updates from work being carried out around New Zealand. This edition features work undertaken on a range of structures as part of the Christchurch recovery programme including retail malls, commercial offices, hotels, clock towers and heritage buildings. In addition, we profile work on some well-known bridges and the ongoing research and development at the University of Canterbury. With experience in more than 150 structural upgrading projects in New Zealand and comprehensive FRP technical data, specification guidelines and design software, we would welcome the opportunity to assist you with any enquiries or upcoming projects.

A popular shopping centre badly damaged in the 2011 Christchurch earthquakes is now in great shape after a comprehensive repair and strengthening project.

The Palms Shopping Centre is situated in Shirley, about four kilometres from Christchurch's central business district. Covering about 34,000 square metres, it offers shoppers access to more than 100 retail outlets ranging from supermarkets to shoe stores and toy shops to travel agents.

With damage in the 6.3-magnitude earthquakes in February and June 2011, The Palms was forced to close for more than six months for a $20 million restoration project. BBR Contech was one of the companies engaged to undertake FRP related work - repairing and reinstating more than 250 damaged concrete beams and columns in both the shopping centre and its associated car-parking areas.

Working with main contractor Naylor Love and designers Buller George Turkington, BBR Contech repaired the columns by breaking out loose and spalled concrete and replacing it with Sika MonoTop Micro-Concrete, then wrapping the columns with SikaWrap carbon fibre. Any cracks identified in precast beams and carpark stairwells were repaired using Sikadur-52 epoxy resin.

After a thorough engineering inspection and independent safety checks, The Palms was given the all-clear and officially re-opened on 8 September 2011 – providing shoppers with some much-welcomed 'retail therapy' opportunities.

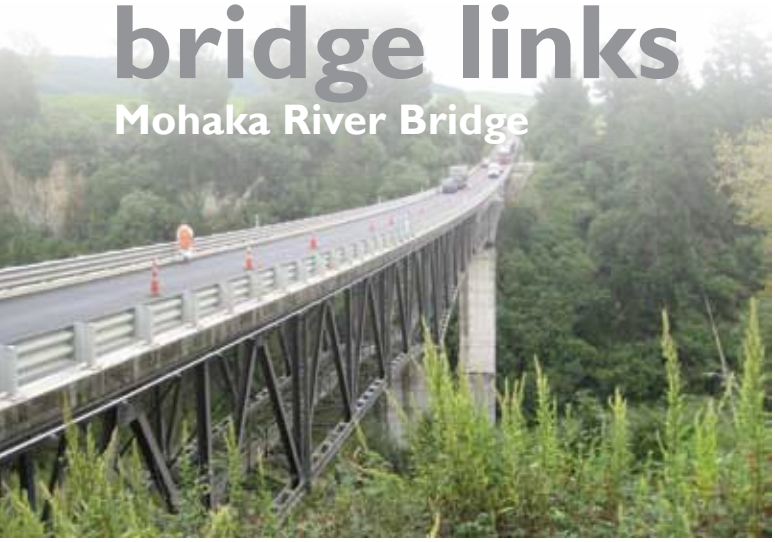
Client:	AMP Capital
Main Contractor:	Naylor Love
Project Manager:	Arrow International
Engineer:	Buller George Turkington

Sika BBR CONTECH SPECIALIST CONTRACTING

A joint venture in FRP technology

STRENGTHENING bridge links

Mohaka River Bridge



The effects of heavy transport on a critical bridge linking Hawke's Bay with points north and south have led to a significant FRP strengthening project for BBR Contech.

Built in 1962, the two-lane, steel-trussed Mohaka River Bridge is located in an isolated area along the Napier-Taupo Road (State Highway 5). Elevated 50 metres above water level on two reinforced-concrete piers, it stretches 215 metres across the river – providing a vital thoroughfare for freight and passenger traffic throughout the year.

Having undergone seismic strengthening in 2009, the bridge's concrete deck now requires FRP strengthening to cope with allowable heavier traffic loads. Working for main contractor Fulton Hogan, BBR Contech is responsible for three key components of work on the underside of the deck: injecting flexible sealant into more than 1200 metres of cracks in the structure; applying 740 strips of 1.85-metre-long Sika CarboDur to the concrete surface; and finally applying a corrosion-inhibiting coating to give extra protection against the elements.

The ten-week project poses a number of challenges, not least the need for rigorous safety measures given the requirement to work on scaffolding high above the river. Time and traffic management is also a key component, as one lane of the bridge is closed and the speed limit has been reduced to 30 kilometres per hour. However, the result will be worth the wait, with a bridge designed to cope with traffic for many years to come.

Client:	NZ Transport Agency
Main Contractor:	Fulton Hogan
Engineer:	Opus International Consultants

Aotea Quay Overbridge, Wellington »

In 1996, Wellington's Aotea Quay Overbridge became the first bridge in New Zealand to be seismically strengthened with FRP composite materials. In 2011 – and after 15 years of rugged performance in a corrosion-prone coastal environment – Wellington City Council commissioned BBR Contech to undertake further structural strengthening as part of a comprehensive repair and maintenance programme.

In the three-month project, BBR Contech repaired and strengthened an additional 65 columns, applying one layer of SikaWrap-930G followed by a coating of crack-bridging paint to provide essential protection against the elements. Checks of the FRP jackets installed in 1996 revealed they were still in good shape, providing confidence that this was a high performing and effective long-term total solution.

Client:	Wellington City Council
Engineer:	Spencer Holmes

PROTECTING New Zealand's important and historic buildings

St Andrew's College

BBR Contech's role as a specialist in structural strengthening techniques has come to the fore in a number of projects designed to protect New Zealand's important and historic buildings.

Our work on the 19th-century Christchurch Arts Centre – considered the 'cultural heart' of the city – is a case in point. A number of the Centre's 23 buildings were seismically strengthened before the September 2010 earthquake, and performed remarkably well in both that and subsequent shakes. The former Arts School building, which features FRP technology on five of its internal walls, is one of the few buildings to have survived with minimal damage.

Today the entire Arts Centre complex remains closed, while plans are made for what is likely to be a $240 million strengthening and restoration project. While this project is still in its early stages, BBR Contech has been retained to provide services associated with post-tensioning and concrete specialities. Some minor work has commenced and BBR Contech is looking forward to continuing its association with the Arts Centre, main contractor Fletcher Construction and engineer Holmes Consulting Group to find suitable solutions for the repair and strengthening of this iconic complex.

FRP has also been utilised to strengthen other historic structures including:

- seismic strengthening a three-storey boarding house at St Andrew's College, Christchurch. The work involved applying a layer of SikaWrap-600C carbon fibre fabric to 170 square metres of internal stairwell concrete-block walls and above-doorway beams.
- strengthening the Ashburton clock tower – a widely recognised symbol of the town that features a clock originally installed in the tower of the first Ashburton Post Office. The columns were strengthened by applying two layers of SikaWrap-100G glass fabric to the top and bottom 600mm, and the concrete slab with Sika Carbodur-S512 carbon fibre laminate. Sika CarboShear preformed 'L' shaped carbon fibre plates were attached at the slab edges to enhance the total performance.

Repair and strengthening strategies

The work following the Christchurch earthquake events has involved a large range of repair and strengthening techniques. The specific nature of any work will depend on the form of the structure, degree of damage and structural deficiency and what materials were used in the original construction. There are always some additional considerations when dealing with an historic or heritage structure. Typical techniques include crack injection, patch repairs, sprayed concrete and the application of FRP.

SUPPORTING 'ground-breaking' Research

Given BBR Contech's involvement in many earthquake-related projects, we are delighted to be participating in a six-year University of Canterbury earthquake engineering research study.

The research team has built a three-storey reinforced-concrete model building (to 40% scale) and has been testing it on the 'shake table' at the University's Structures Laboratory. The aim is to investigate the building's structural dynamics during earthquake simulations, both before and after the application of glass-fibre-reinforced polymer (GFRP) – a solution that's neither invasive nor expensive.

The team began by studying the building's response in earthquake conditions that matched those recorded in Chile's 8.8-magnitude earthquake in February 2010 and the September 2010 Christchurch earthquake. They then observed its response to the same conditions when repaired and rehabilitated by BBR Contech with GFRP.

The preliminary findings indicate that the GFRP solution worked as intended, by strengthening the building's weak points and moving the 'failure mechanisms' to other, less critical sections of the structure. This suggests promising potential for FRP in future, and we look forward to reading the final project conclusions and report, which are due for release in 2013.

FRP delivers OUTSTANDING performance

Pre-earthquake FRP strengthening has proved its worth for several Canterbury buildings including the University of Canterbury's Student Services Building.

Just five days before the September 2010 earthquake, BBR Contech completed strengthening 23 circular columns on the building. This involved exposing the concrete substrate on the columns, then applying two layers of SikaWrap-100G glass fibre in 600-millimetre-wide bands at the tops and bottoms. A post-earthquake inspection revealed that, despite new cracks beneath it, the glass fibre (and column) remained intact – exactly as intended.