



# The Bulletin Kaikōura earthquake update

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SH1 NORTH



SH1 SOUTH



RAIL

## INNOVATING ON THE JOB

Geotech teams working on State Highway 1 (SH1) and the Main North

Line railway have been breaking ground developing a new type of rockfall protection wall.

The 2016 Kaikōura earthquake caused over 50 landslides along SH1 and the railway, to the north and south of Kaikōura. As our geotech, earthwork and abseiling teams removed landslip material and stabilised rock faces they began to investigate and install rockfall protection. While many protection options are available, including installing mesh, fences, and earthen walls, a protection wall was needed to suit narrower parts of the corridor.

'Using a bit of number eight wire thinking, we had to come up with a new design which would work in tight spaces and could withstand relatively higher energy rockfall impacts. The solution needed to suit the changed environment north and south of Kaikōura and protect key transport routes from future rockfall events,' says lead geotech Charlie Watts.

The newly designed modular wall has a narrower footprint than traditionally used reinforced soil walls, but can still withstand enough of an impact to protect infrastructure to required standards.

Large five-tonne blocks, which are being used to build seawalls on the coastal side of the corridor, have been repurposed and used for the modular wall. These are being reinforced by two closed metal cage baskets known as gabions. One of these baskets is filled with sand, and the other basket with rocks. The two gabions are attached to the front of the sea blocks and positioned towards the rock face lessening the force of falling rocks.

'Taking up less space in a tight corridor is not the only advantage of the modular walls,' says geological engineer Rori Green.

'They are also quicker to build and require a smaller crew to install. As a result, workers spend less time working in rockfall zones and the disruption to the transport network is shorter.'

The new modular wall will be able to be used further afield in New Zealand and we expect it will be of great interest internationally.

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Standing proud as the new modular rockfall protection wall holds up in testing.



This weekly bulletin provides the latest information about the rebuild of road and rail networks damaged by the Kaikōura earthquake in November 2016. The bulletin is produced by the North Canterbury Transport Infrastructure Recovery (NCTIR) – an alliance representing the NZ Transport Agency and KiwiRail, on behalf of Government.

## Testing the modular wall

Full-scale physical testing was carried out in order to show the wall is up to the job. To do this, NCTIR joined forces with Stahlton NZ (which design the concrete blocks) and Holmes Solutions (which is renowned for its impact testing capabilities).

Together, they created a test 'bogie' to crash into the wall simulating a rock impact. The bogie hit the wall with energies up to 750 kJ, which is about 2.8 tonnes travelling at 90 km/h. The rockfall protection wall held up, proving it a viable option.



## STABILISING AND PROTECTING

A variety of tools in the rockfall protection toolkit are available to the geotech team. They generally fall into two categories: those which aim to stop rocks from falling (stabilising the slope) and those which act to catch falling rocks before they reach the road and rail (protecting the important things at the bottom of the slope).

One of the main stabilisation techniques we have used to stop rocks from falling is simply to remove the loose ones from the slope. This has been done by sluicing (using helicopters to drop buckets of water on loose rock), using abseilers to push and blast rocks from the slope, and using excavators to carve out more stable slopes. Another method used is to hold damaged rock in place by using a combination of rock bolts and mesh.

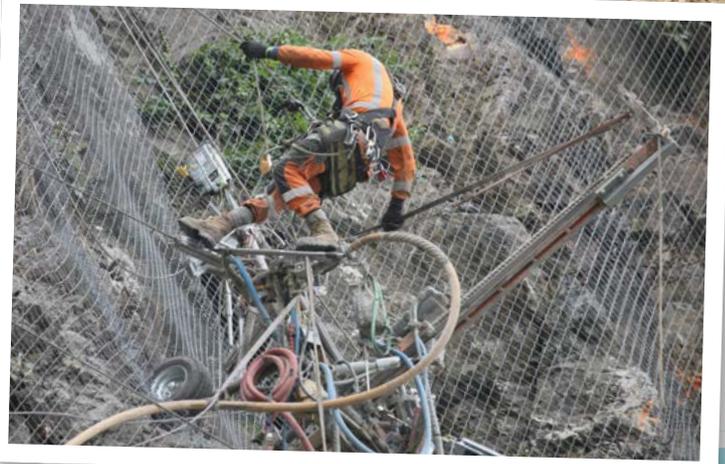
On the protection side, the design team is using flexible attenuator fences installed on the slope faces to slow falling rocks and reduce them bouncing. Catch ditches, net fences and walls are also constructed at the bottom of slopes.

The choice of the rockfall protection tool depends on a number of factors:

- what is on the slope
- how much material is left on the slope
- how big the rocks are, how high the slope is, and
- how much space is available at the bottom.

We have run rockfall models in the computer to help us understand the behaviour of the falling rocks so we can select and design the appropriate protection measures.

We will often use a combination of methods to create the safest outcome for our crews, the public and our transport infrastructure.





## ROAD USER NUMBERS

In the first month of State Highway 1 reopening, 139,000 vehicles used the route between Picton and Christchurch. Before the 2016 Kaikōura earthquake the daily average number was 3500 vehicles, although numbers usually spiked at between 5500 to 6000 vehicles per day during the holiday period.

After the highway reopened, the daily number of vehicles using the road has been between 3500 to 4000.

This varies day-to-day, with more than 5000 vehicles using the road on 22 December 2017 and 5650 on 29 December 2017. In terms of freight, there are an average of 600 to 800 freight movements each day.



## SIFTING AND SORTING

A special on-track 'ballast cleaner' machine was spotted on the Main North Line railway recently doing an important job of cleaning and screening the railway track ballast (stones). Ballast is the proper term used for the coarse stones, which form the bed of the rail tracks and support the track structure.

This ballast cleaner is an impressive machine - the specialist equipment is hooked together to create a train which is 230m long.

It works as a mobile screening plant and sieves out the 'good' stones from the 'bad' ones. It also removes any problematic vegetation, which can trap mud and dust and prevent the ballast from freely draining.



The ballast cleaner lifts the sleepers while sucking up and sifting through the ballast, disposing of the 'bad' stones, and redistributing the 'good' ones back on the track.

# WHAT HAPPENED AT OKIWI BAY

Okiwi Bay has significantly changed because of the 2016 Kaikōura earthquake. In the bay the beach has doubled in size and a more rocky shoreline is now exposed by seabed uplift. In the south of Okiwi Bay the earthquake triggered a landslide which covered the rail and road. Our teams had to remove 137,000m<sup>3</sup> of slip material and form a stable slope profile.



## THE LANDSLIDE

The earthquake triggered a landslide where weak rock collapsed along with the layers of loose gravel sitting above this rock. Our geotech and earthworks teams removed landslide material and reshaped the slip face to create flatter and more stable slopes giving it a carefully carved look. This new profile includes benches and catch ditches, and rockfall fencing will be put in to reduce the risk and impact of future rockfall.

To remove landslide material our earthworks crew created a route up the slip for diggers, which moved the slip material down to the base of the site. From the north side of Okiwi Bay a 3km access track was formed so machinery could get to the top of the hillside. From here, the earthworks team reshaped the loose gravel to reduce the upper slope height and to unload and improve the stability of the gravels.

The landslide wiped out much vegetation, but this should re-establish itself in time. On either side of the slip, the slopes withstood the earthquake because of the strength and quality of the rock present in these sections.



## CHANGES TO THE RAILWAY

Because of the slip, we moved the railway 7m out from the hillside to protect it from further rockfall. This year our geotech team will be replacing the containers, which are providing temporary rockfall protection at the base of the hillside, with permanent protection in the form of bunds and fences.





## CHANGES TO THE BEACH

The earthquake raised the beach by three metres, which is why there is additional seashore compared with before the earthquake, providing more space for beachgoers.

## WHERE IS IT SAFE TO STOP AND SEE THE CHANGES?

Here is a safe stopping area at the north side of the bay to stretch the legs and view the changes in the beach area. For safety reasons, please do not stop in any undesignated areas along this part of SH1.





## CONNECTING THE DOTS WITH LITTLE ONES

Since re-opening in December, SH1 from Picton to Christchurch has been bustling with travellers.

As of 8 January 2018, work has ramped up along the route as well. Kaikōura's Highway Helpers have been out and about informing visitors and residents of road conditions, estimated journey times, and sharing the [www.nzta.govt.nz/p2c](http://www.nzta.govt.nz/p2c) link for real time travel information. Last week they made some special visits to preschools to share messages with children and educators too.

Little Tamariki Montessori Preschool head teacher (albatross class) Judi Goff says the Highway Helper's visit was timely.

'It is current for what's happening in our town at the moment. The children have been talking about coming back on the roads from their holiday, and today at circle time we can come back to this. They can relate to the information they were getting as it was presented well.'

While adults plan and estimate travel times on SH1, children buckled into back seats make memories and form impressions of their own. Highway Helpers Liz and Tamara explained some of the basics of traffic safety and personal protection equipment and asked if the children had any questions, or if anyone had anything to share.

'I know what happened,' said one little girl, hand held high; 'they're doing lots of work on the roads because of an earthquake!'



## BACK TO SCHOOL ROAD SAFETY

When school is out traffic volumes traditionally drop off on most roads, but with the kids heading back to school next week the roads will be busier in townships along SH1, the alternate route and Inland Road.

### Tips for motorists:

- **Plan ahead and allow more time for your journey.**
- **Remember there will be more pedestrians and cyclists about, many of them young - and they can be unpredictable.**
- **Be especially careful around schools and watch your speeds.** Even small increases in speed result in a much greater increase in stopping distance, which can mean the difference between life and death for pedestrians.

If you're a parent or caregiver then it's also worth checking in with your kid - especially if they are going to be travelling to school on their own.

### Tips for parents and caregivers:

Help your kids choose the safest route to get to school and do a few practise walks or bikes with them so they're familiar with the route and the safest places to cross

- Remind them that any time they are crossing the road they must stop, look, and listen for any cars, bikes or cyclists before they step out.
- Set a good example and stick to the road rules. If you break the rules, kids can think it is okay to do it themselves.

**For educators wanting to teach road safety, check out these resources:**

<http://education.nzta.govt.nz/resources/primary>

<http://education.nzta.govt.nz/resources/secondary>



## THIS TIME LAST YEAR

North of Kaikōura, just past Halfmoon Bay, the 2016 earthquake triggered slip covered the road and pushed the rail line off its tracks into the sea. Since then, our crews have cleared 140,000m<sup>3</sup> of slip material from the road, rail and hillside, and restored the transport links at this location. Our earthworks and geotech teams created benches on the hillside to capture any landslide or rockfall. Hydro sprayed grass seed onto the hill has taken root and started to grow. This vegetation will help reduce erosion on this site.





## SAFETY AND AMENITY IMPROVEMENTS ON SH1 BETWEEN CLARENCE AND OARO

While work continues on SH1 to bring it back to its pre-earthquake state, the NZ Transport Agency and NCTIR are now looking at the detailed scope of the Safety and Amenity Improvements Package announced last year. The cost estimates for the package of improvements between Clarence and Oaro are being reviewed and more information is expected in March after the NZ Transport Agency Board meets.

The delivery of the Safety and Amenity Improvements Package is expected to extend beyond 2018.

## SH1 DEVIATION THROUGH KAIKŌURA UPDATE

The NZ Transport Agency has deferred a decision on the Kaikōura Urban Access Improvement (SH1 deviation) until March 2018 to enable it to fully consider all the feedback and potential impacts of the proposal.

For example, the project consultation has raised flooding and geotechnical issues.

There are also social and cultural sensitivities within the designated corridor being assessed, along with other suggested opportunities for concept design refinement.

The Transport Agency is also reviewing the cost estimates for the project and will consider this alongside all of the SH1 safety improvements between Clarence and Oaro. There are many competing factors in this proposal, which leads to a complex decision-making process, currently underway. The final decision is therefore expected around March. The Transport Agency understands this may be a stressful time for affected parties and thanks everyone for their patience.



## EXPECTS DELAYS ON SH1 SOUTH AND NORTH

Over the next month, between 7am-11am (excluding weekends), we will be operating stop/go traffic at Parititahi Tunnel (south of Peketa) and north of Kaikoura at Ohau Point. This will mean delays of up to a maximum of 10 minutes at each site. The NCTIR team will be using helicopters to move high risk heavy loads over and above the road.

We appreciate everyone's patience while this work is underway. For travel journey information please check [www.nzta.govt.nz/p2c](http://www.nzta.govt.nz/p2c) or call 0800 4 HIGHWAYS (0800 44 44 49).

**Driven along SH1 north or south of Kaikoura since 15 December 2017?**

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