

# Ground strengthened and building re-levelled at large shopping centre

PROJECT PROFILE

Z15Y036

mainmark



1.

## INDUSTRY

Retail

## STRUCTURE

Shopping Centre

## PROBLEM

Liquefaction

## LOCATION

Christchurch, New Zealand

## DURATION / YEAR

3 months / July 2016

## TECHNOLOGY

Liquefaction Mitigation,  
JOG Computer-  
Controlled Grouting

## BUSINESS UNIT

Mainmark New Zealand

Pictured above:  
1. Keyhole Liquefaction  
Mitigation delivery in  
progress.

## Summary

Northwood Supa Centa is a large 33,283m<sup>2</sup> shopping centre in Christchurch, New Zealand, that is home to a number of 'big brand' retailers. The centre experienced liquefaction induced ground deformations following the 2010 and 2011 Christchurch seismic sequence. The site required extensive remediation work to bring the building back to 100% NBS (New Building Standard).

The seismic activity had caused differential settlement by as much as 160mm, and liquefaction beneath the shopping centre required the ground to be improved and strengthened to address subsoil densification.

The project was required to meet significant operational challenges due to the shopping centre's large floor area, and the client's request for work to be carried out with minimal interruption to retail trading.

Mainmark undertook this challenging project using its JOG Computer-Controlled Grouting to re-level the foundations, and its proprietary Liquefaction Mitigation engineered solution to improve the subsoil. Liquefaction Mitigation played a critical role in the success of this project, being the only known solution on the market that can be applied beneath an existing structure.

## Objectives

The main purpose of the remediation work was to address the building's underlying liquefaction vulnerability and re-level the foundations, helping to ensure the building would achieve a 100% NBS (New Building Standard) percentage score.

The ground engineering solutions and installation process undertaken by Mainmark needed to be quick, clean and tidy, and adhere to public health and safety regulations.

## Ground strengthened and building re-levelled at large shopping centre continued



2. Customised installation of required hoses and cables allowed tenants to remain fully operational during the project without compromising health and safety. 3. Internal injection works carried out at night; full store operations restored by opening everyday.

It was also necessary to deliver engineered (PS 1, 2, 3 and 4) ground improvement beneath the existing structures to mitigate liquefaction vulnerability under SLS and ULS design, ensuring minimal impact on building occupants.

## Solution

Mainmark's Liquefaction Mitigation offering is the only solution of its kind and can be applied retrospectively beneath existing buildings or structures. The ground beneath the Northwood Supa Centa was treated via more than 3,000 injection points to a depth of between 4m to 8m below ground level, and across the building's footprint.

Extensive pre and post installation CPT (cone penetrometer testing) was undertaken to ensure the solution provided the designed soil improvement and resistance to liquefaction, thereby satisfying section 112 of the Building Act 2004.

Once the ground improvement was completed, JOG Computer-Controlled Grout injection was used to correct the building's settlement and re-level the building. This was a precise process with corrections applied beneath all load bearing foundation elements,

including the internal party walls for three adjoining structures.

Mainmark also developed bespoke technology and equipment for the Northwood Supa Centa project to capture and assess the large amounts of data for each of the 3,000 plus injection locations.

From an operational perspective, the Northwood Supa Centa project was a significant undertaking for Mainmark. Its project team worked tirelessly on site effectively 24 hours a day, six days per week over a three-month project period while the centre continued to operate uninterrupted thanks to a clean and non-invasive remediation process. The internal works were completed outside of trading hours throughout the night, while external works were executed during the day, without the need for retail tenants to close their stores or be impacted by mess or noise. Alternative methods to address the site and building issues would have turned the centre into a dirty and dangerous construction zone requiring businesses to vacate the premises for several months.

The shopping centre remediation works have since achieved a 100% NBS result, which will help ensure that it is protected against the effects of future earthquakes.