PROJECT PROFILE
Z18D038

Terefil® Provides Alternative to Gravel Raft to Address Soft Soil Beneath Auckland Substation

mainmark

INDUSTRY
Infrastructure

STRUCTURE
Substation

PROBLEM
Ground settlement

LOCATION
Auckland, New Zealand

DURATION / YEAR
8 days / April 2018

TECHNOLOGY
Terefil®

BUSINESS UNIT
Mainmark
New Zealand

Summary

The Hobsonville area, 20km northwest of Auckland in New Zealand's North Island, is undergoing significant growth, with commercial and residential developments transforming the once rural region into a bustling suburban district.

The former Royal New Zealand Air Force airfield was converted into a township and, with further construction expected, a new substation was needed to supply electricity to an estimated 7,500 dwellings and a large proposed commercial development.

The substation is located between a nearby residential area and Auckland's main water and wastewater pump station site, and was designed around the grid-connected Tesla Powerpack used at another substation in Glen Innes. The facility comprised of a switch room, transformer building, battery banks, noise wall, access road and services.

Geotechnical investigations at the site found the soil was weak, with 3m of silty clay fill over firm, organic silt, and groundwater flowing over its base. It was therefore deemed necessary to undercut the soil and install lightweight rafts to provide a stable platform for the substation's construction, and protect the site from possible subsidence, soil liquefaction and other issues that may arise due to the weakness of the ground.

The proposed rafts needed to be lightweight, but strong enough to support the weight of the structure and heavy industrial equipment, without increasing the load on the soft soil beneath. Excavation needed to be kept to a specified depth to avoid impacting future tunnelling works or the installation of underground pipes.

Mainmark was contracted by Connell Contractors to deliver a timely and appropriate raft solution that was both lightweight and strong enough to provide adequate ground bearing capacity while overcoming any risk of future settlement.

Objectives

The overall objective was to install three lightweight concrete rafts to support the substation switch room, transformer building, battery banks, retaining wall and part of the driveway, without increasing load on the soft clay ground beneath.

It was crucial to apply the solution to a shallow depth to avoid any impact on proposed tunnelling works, and to complete the project as quickly as possible to allow completion of the substation by early 2019.

Solution

Different approaches were considered for the project, including gravel rafts, however Terefil® rafts were identified as being the ideal solution to meet the tight timelines, and the desired geotechnical outcomes. Terefil is a specialist lightweight concrete fill that can solve a variety of geotechnical challenges, with its capabilities as a structural fill surpassing those of granular fills, aggregate materials, cellular or foam concrete, or foam cement.

Terefil creates a non-liquefiable cementitious layer with a uniform mat that provides structural support. It requires no compaction, causes minimal site disruption during application and is self-levelling. The environmentally inert solution has zero bleed water and can be pumped at greater distances compared with other concrete or cementitious void fillers, making it quicker to apply. It is a superior solution compared to traditional gravel rafting when site access is limited, or schedules are particularly tight.

Due to the variation in depths at each undercut site, and overlap between the sites, each raft pour was precisely planned to meet specific weight, depth and measurements, which prevented any likelihood of the Terefil escaping into the neighbouring excavation area as it was poured. With its superior strength, the Terefil formula helped to ensure that the combined weight of the rafts, structure and equipment did not exceed that of the undercut soil.

Mainmark collaborated closely with Connell Contractors onsite, confidently delivering solutions to overcome access challenges and carefully planning the location of each Terefil fill point to help protect the safety of workers at all times. Works were successfully completed across the entire site, totalling 665m^3, over 8 days, providing a much faster solution compared with the alternative gravel raft approach.

Connell Contractors Chief Executive Officer Lester Foxall said: *"The site of the new substation in Hobsonville Point had been challenging, with up to 4m deep excavations in weak soils. However, the project was completed on time."*

Above: the completed switchroom and transformer buildings on site. Images supplied by Connell Contractors.