

Lift shafts stabilised for disabled access to Museum Station



INDUSTRY

Civil infrastructure (Rail)

STRUCTURE

Lift shafts

PROBLEM

Excavation support

LOCATION

Sydney, New South Wales

DURATION / YEAR

5 days, 2016

TECHNOLOGY

Terefil®

BUSINESS UNIT

Mainmark Australia

Summary

The Museum Station Easy Access Upgrade Project involved improving disabled access to Museum Station, located on Sydney's City Circle train line in the CBD. The project included three new lifts; one of which would connect the entry of the station to the underground concourse and two would connect the underground concourse to the platforms.

As part of the construction of the two lift shafts that would connect the underground concourse to the platforms, it was essential to support the surrounding rock to ensure stability and prevent the ground from collapsing. Furthermore, it was vital to place grout at the top of the lifts between the roof slab and the underside of the rock to prevent voids from occurring, ensuring the rock-face was fully supported both on top of the lifts and beside them.

Mainmark was engaged to carry out the backfill and contact grouting to ensure the two lift shafts were safe and fully supported.

Access to the site was exceptionally limited, requiring grout lines to be run across distances of approximately 50 metres, including elevated portions to ensure unfettered pedestrian access to footpaths.

The project was complex and had to be staged over a number of weeks to ensure each section was completely stable before moving onto the next. Mainmark applied its unique Terefil material, a light-weight cementitious based fill, and completed the project successfully over five days.

Objectives

To adequately support each section of the lift shafts, Mainmark was asked to provide a grout that would achieve 1 MPa in less than 24 hours for each pour. The Terefil was placed in lifts of approximately five metres each. Once it had achieved 1 MPa, the steel supports

Lift shafts stabilised continued

could be moved to facilitate the placement of the next five metres of lift shaft.

Additionally, Mainmark had to contend with extremely limited site access. This was due in part to the project's inner-city location. Pedestrian access to footpaths had to be maintained and vehicles could not be moved on site. The available area for pumping operations was smaller than 10 square metres while the laydown area on site was a significant distance from the lift shafts, requiring a highly-pumpable grout that could travel the distance easily.

Each pour was separated by a week, which meant Mainmark had to fully set up all equipment, place the Terefil, and then remove all the equipment within a single day.

Solution

Mainmark used its proprietary, highly-pumpable cementitious grout, Terefil. It was ideal for this project given its ability to be pumped across significant distances and its ability to reach 1 MPa within the 24-hour time limit. Achieving this fast setting time required Mainmark to trial different mixes to ensure it would fulfil the project's needs.

Mainmark's extensive experience and international resources came to the fore as the company developed a mix that would reach 1 MPa in 24 hours while remaining easily pumpable over more than 50 metres. This helped overcome the tight site restrictions and meant that the project stayed on track.

The Terefil material was used to fill a large volume, with some spaces up to three metres across. It was highly effective and successful.

In addition to supporting the lift shafts, Mainmark completed contact grouting between the top of the shafts and the rock ceiling to prevent any voids from forming. This specialised work required Mainmark to pressure-pump a high early-strength grout through thin tubes placed between the lift roof slab and the waterproof membrane covering the rock above. Mainmark placed the grout from the rear so that it would move air out of the space and push the waterproof membrane up against the rock itself.

Completing this task accurately and without any voids was essential to eliminate the potential for the rock



With a very congested site, the pumping operations were located between the gantry and pedestrian walkway



The excavation to be filled extended under Elizabeth Street

over the shaft to collapse. This would have created a significant danger to people's lives as well as causing widespread damage to the surrounding area.

Mainmark achieved good contact between the rock and the roof, delivering a result that was stable and reliable.

According to the contractor, Mainmark's contribution to the project helped its overall success. A company representative said, "The project used Terefil as a lightweight backfill material for the two newly-constructed lifts connecting the station concourse and platforms. The construction methodology was very complex with a number of critical stage activities. Backfill was completed over a number of staged establishments and successful completion and confirmation of a nominated compressive strength was most often required for work to progress on each area. With these two lifts on the critical path for the project, successful delivery by Mainmark was absolutely critical to the project and was achieved."