Case Study 001: Piling and Rock Anchors

<table>
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<th>Client:</th>
<th>NZTA</th>
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<td>Duration:</td>
<td>10 weeks, April 2011–June 2011</td>
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<tr>
<td>Consultant:</td>
<td>Opus Consultants</td>
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Project Overview

Construction of Rock Anchor and Drilled Pile Retaining Wall.

This project involved the rehabilitation of approx 40m of SH65, where significant subsidence had occurred due to inadequate road pavement foundation. The original foundation of weathered granite was overlaid by soft fill material, the subsidence was caused due to movement that occurred at the interface between the two layers.

Opus Consultants provided the upgraded reconstruction design which included; rock anchors, and drilled piles secured to timber retaining / steel support whalers. This anchored retaining wall design provides improved durability to the road surface.

Rock Anchors

- RB32mm Reid Bar
- Installed depth 10 m
- Number of anchors - 17
- Double Corrosion protected – 2 casings of grout
- Drilled into moderately weathered granite
- Installed 20 degrees above horizontal
- Permeability tests on anchor holes
- Proof Testing of trial sample anchors
- Suitability and Acceptance testing of anchors

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Construction Methodology

Rock Anchors

An excavator mounted, Bulroc “Down the Hole” percussion hammer drill was used to form the anchor holes.

Depth: 12 metres total depth with a 6m embedment into granite bedrock, and 20 degrees above horizontal.

This drill rig is a 20 tonne directional drill and uses a J Drive casing system, that is suitable for greater diameter casing installations — as required in the soft overlying soils encountered on this project.

Our excavator mounted drill rig concept proved ideal for the constraints of this project, i.e; inadequate drilling access outboard of the drill holes necessitated the drill rig be located directly over the drilling area.

Proof Testing

Three test anchors were installed using 40 mm MacAlloy stressbar with minimum UTS 1295 KN. They were drilled 3m into competent rock then grouted. After a 28 day curing period these were proof-tested to BS8081 using approved hydraulic testing equipment. The proof test to 890 KN determined the “grout to ground” bond strength for the drilled granite material encountered.

Suitability and Acceptance Testing

We undertook onsite Suitability and Acceptance testing of the production anchors. Production rock anchors were subjected to a testing equivalent 85% of the design load. This both ensures the build quality of the bonded section and the free length function correctly.

Testing involved use of a hollow steam hydraulic jack capable of producing sufficient force to yield the bar. During testing the cyclic loading of the anchor was progressively increased while the elasticity over the unbounded section of anchor is measured. Measurements are taken using fine tolerance instruments, and the results measured against design criteria produced from the preceding Proof Testing exercises.
Piles

- Steel soldier piles 310UC
- Corrosion protected coatings to AS/NZS1111 and AN/NZS1252
- Installed depth ranging from 9m to 13m
- Drilled into moderately weathered granite
- Concrete encased 600mm dia full depth
- Number of piles - 18

Construction Methodology

Piling

Pile hole excavation to 600mm dia was undertaken using a rotary auger rock drill equipped with tungsten carbide rock picks, and mounted on a 26 tonne excavator. Pile casings were installed during drilling of the overlying soft fill soils to eliminate continuous material movement into the drill path and preventing oversize excavations.