

Lessons learned from one of New Zealand's most challenging civil engineering projects: rebuilding the earthquake damaged pipes, roads, bridges and retaining walls in the city of Christchurch 2011 - 2016.

Trial Anchors through Existing Gabions

Story: Refurbishment of Gabion Walls with Anchors – a Trial

Theme: Design

A paper describing the procedure and challenges associated with installing anchors through gabion baskets.

This document has been provided as an example of a tool that might be useful for other organisations undertaking complex disaster recovery or infrastructure rebuild programmes.

For more information about this document, visit www.scirtlearninglegacy.org.nz



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Trial Anchors through Existing Gabions

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Introduction

Anchoring through gabion baskets has been proposed as a method for the repair of two existing walls at SCIRT. This solution has the potential to provide a cost and time saving because baskets would not need to be removed and therefore significant volumes of excavation and backfill could be avoided. Over all this could provide a sustainable solution with a reduced construction time. It is anticipated that drilling through the baskets maybe difficult and therefore two test anchors were installed by Rock Control in March 2014 to assess the feasibility of this solution.

The anchors were drilled on 6th March using self-drilling anchors and sacrificial drill heads.



Figure 1 Anchor drilling through an existing gabion basket

Two anchors were installed. The first was 25mm diameter with a 70mm diameter anchor head. The other was 32mm diameter with a 90mm diameter drill head.

These were grouted using the hollow core of the anchors. The smaller anchor was only partially grouted. This was thought to be due to a blockage in the anchor tube.

Anchor testing was against a plate 1.0m wide and 0.6m high. This was not packed against the basket because packing it could cause additional deformation to the basket once the load is applied.



Figure 2 Anchor testing equipment

The testing was conducted and deflection measured. As the load increased the gabion deformed further so as the plate used for measuring moved. This caused the anchor angle to change and at 70kN the gauge slipped off apparatus due to the deformation.

The anchor was then unloaded and loaded to 125kN with no measurements taken. The load reduced when held because of ongoing deformation of the basket. The load was held at 125kN and deflection measured:

Table 1 Deflection measured during anchor testing with a sustained load of 125kN

| Time (min) | Deflection (mm) |
|------------|-----------------|
| 0 | 6.39 |
| 5 | 6.51 |
| 10 | 6.54 |

Then the kit was unloaded.

The anchor was then reloaded to 170 kN. This was considered to be the maximum load so as not to exceed 80% of bar capacity.

The load was released and the basket 'relaxed' and returned to shape.



Figure 3 Resulting anchor head showing basket damage

Lessons learnt

- Drilling of the anchors was possible and while the basket mesh at the rear of the basket was awkward to penetrate, it could be done.
- During grouting there is no grout recovery and therefore there is less certainty regarding how complete the grout is. Therefore all anchors must be load tested.
- Galvanising and sacrificial steel are the only corrosion protection measures for self-drilling anchors.
- The testing regime needs consideration because measuring deflection may prove challenging. Therefore to load an anchor and only measuring deflection while holding the load may be appropriate if this will satisfy the designers testing requirements.
- It is suggested that loads for anchor tests are derived for individual or zones of anchors so as the load is not excessive. i.e. don't just find the largest load for the whole wall and test all anchors for this – be more specific.
- The gabion baskets were damaged by the plate used in testing. Therefore using a textile layer or other protection under the plate may be advisable. Alternatively the basket may need to be patch repaired.
- Anchors should be installed in the middle of baskets to allow sufficient space for the plate to span.

Conclusion

The trial anchors through gabion baskets have been completed. Both the installation and testing of the anchors were successfully completed.

Adopting the above lessons learnt into the design and specification for anchors through existing gabion baskets is recommended.