

20 Neilpark Drive, East Tamaki, Auckland 2013

Tension Testing of Galvanised Steel Screw Anchors REPORT ID: 154

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Abstract

Tension testing of Galvanised Screw Anchors for an indicative ultimate strength of the TransNet range of Screw Anchors. Results indicated typical mode of failure is in the weld of the helix to the rod. This study reports test evidence for the ultimate strength of each of the TransNet Galvanised Screw Anchor range. Results vary from 68KN to greater than 160KN. One random sample of each product was supplied and tested.



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1 Introduction

Tests are conducted by Ray Allsopp at Bridon-Cookes in Auckland using an IANZ calibrated 2MN horizontal tension test apparatus. Phillip Hogg and Brian Mathiesen from TransNet present to witness tests and compile report. Testing was completed on 1/9/2015. The testing configuration required a custom made plate in order to allow a relatively uniform load to be applied to the helix of the screw anchor. The construction is as follows from 450MPa tool steel:



Figure 1: Test configuration. 4 plates with 4x M16 Forged Eye Bolts.



Figure 2: Testing Plate Dimensions.

2 GSASM20X180X1750

2.1 Setup GSASM20X180X1750

Part Number GSASM20X180X1750 is the smallest screw anchor for testing. Photos of the configuration including sand bags for distributing the load to the helix:



Figure 3: GSASM20X180X1750 Setup within horizontal test bed.



2.2 Results GSASM20X180X1750

The load was applied to the test sample until a peak load is established.

Tension Testing Report

1.Certificate No. : GSASM 20 X 180 2.Customer : TRANSNET NZ LTD 3.Operator : 4.Date : 9/1/2015 5.Time : 12 AM 6.Temperature: 7.Speed :100.00 8.Test Style : Break Test 9.Standard : MNFCT 10.Specimen : GSASM 20 X 180 X 1750 SCREW ANCHOR 11.Spec.Length: 1750.00 m 12.Notice : 13.Filename : C:\Documents and Settings\Administrator\ My Documents\Test Certs\September 2015\GSASM 20 X 180.tst



Figure 4: Results of tension testing peak load = 8961Kg.





Figure 5: Mode of failure: Weld between helix and rod.



Figure 6: Deformation of helix as well as ultimate failure of weld.

Sample resulted in peak load of 8961Kg (87.8KN) before catastrophic failure of helix at weld.

3 GSASM24X210X1800

3.1 Setup GSASM24X210X1800

Part Number GSASM24X210X1800 is the 24mm Diameter screw anchor. Photos of sample configuration (same):



Figure 7: Re-applying plates for testing GSASM24X210X1800.



Figure 8: GSASM24X210X1800 in test bed before load applied.



3.2 Results GSASM24X210X1800

The load was applied to the test sample until a peak load is established.

Tension Testing Report

1.Certificate No. : GSASM 24 X 210 2.Customer : TRANSNET NZ LTD 3.Operator : 4.Date : 9/1/2015 5.Time : 12 AM 6.Temperature: 7.Speed :100.00 8.Test Style : Break Test 9.Standard : MNFCT 10. Specimen : GSASM 24 X 210 X 1800 SCREW ANCHOR 11. Spec.Length: 1800.00 m 12. Notice : 13. Filename : C:\Documents and Settings\Administrator\ My Documents\Test Certs\September 2015\GSASM 24 X 210.tst



Figure 9: Results of tension testing peak load = 7012Kg.





Figure 10: Mode of failure: Weld between helix and rod.



Figure 11: Deformation of helix as well as ultimate failure of weld.





Figure 12: Close-up of weld failure on rod.

Sample resulted in peak load of 7012Kg (68.8KN) before catastrophic failure of helix at weld.

4 GSASM32X250X1880

4.1 Setup GSASM32X250X1880

Part Number GSASM32X250X1880. Photos of the configuration including sand bags for distributing the load to the helix:



Figure 13: GSASM32X250X1880 Setup within horizontal test bed.



4.2Results GSASM32X250X1880

The load was applied to the test sample until a peak load is established. Testing was stopped at greater than 16,000Kg.

Elongation(mm)

Tension Testing Report





Figure 14: Testing stopped at 16114Kg (158.0KN) Some elongation at approximately 90KN could account for the deformation of the helix. This could potentially be caused by non-uniform loading of the helix.





Figure 15: Subtle deformation of helix. No Ultimate failure at 16,114Kg.

Sample resulted in peak load of 16114Kg (158.0KN) No ultimate failure, testing stopped.

5 GSASM32X250X2000

5.1 Setup GSASM32X250X2000

Part Number GSASM32X250X2000 is the largest screw anchor for testing. Photos of the configuration including sand bags for distributing the load to the helix:



Figure 16: GSASM32X250X2000 Setup within horizontal test bed.



5.2 Results GSASM32X250X2000

The load was applied to the test sample until a peak load is established. Testing was stopped at greater than 16,000Kg.







Figure 17: Testing stopped at 17068Kg (167.4KN). No deformation of the screw anchor observed.





Figure 18: Screw anchor result. No deformation observed.

Sample resulted in peak load of 17068Kg (167.4KN) No ultimate failure, testing stopped.

6 Comments

The typical mode of failure in a lab scenario for Screw Anchors is the welded helix as these test samples demonstrate. In reality, the strength of the anchor is very much dependant on the soil type and depth it is installed. What can be determined is that the installed strength will not exceed the ultimate tensile strength of the screw anchor which is around 70KN for the M20 and M24 screw anchor and greater than 160KN for the M32 screw anchors.

A useful guide for the design use and application for screw anchors can be found in IEEE Std 691-2001 'IEEE Guide for Transmission Structure Foundation Design and Testing'.