9 March 2022

COASTAL WALKWAY UPGRADE BRIDGE DESIGN ADVICE, GREY ROAD GULLY AND KURNABINNA GULLY, HALLETT COVE, SA 5158

TRIAL ANCHOR TEST REPORT

ASPECT STUDIOS

ADL2022-0050AC Rev0

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Date	Revision	Comments
9 March 2022	0	Factual Only

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1 INTRODUCTION

CMW Geosciences (CMW) was authorised by Aspect Studios to undertake a trial anchor assessment required to inform the geotechnical design development of a proposed walking trial Grey Gully and Kurnabinna Bridge designs, Hallett Cove, SA. This work was a part of the Coastal Walkway Upgrade Project.

This report outlines results of the trial anchor testing completed by RW Solutions at select locations of the bridge abutments.

2 METHODOLOGY

Assessments undertaken in this scope of works has included the collection of soil or rock conditions below the current ground surface within the zone of each bridge abutment structure.

Given the drilling method, at each borehole location typical soil and rock mass conditions have been collated into geotechnical units and representative data tabulated. Noting the recovery of composite 1m samples from a percussion drilling method, the tests are considered indicative of the gradual strength increase and defect number, weathering decrease away from the ground surface into the valley walls of both Grey Gully and Kurnabinna.

A limitation of the drilling method is the subtle changes in rock units was not able to be defined and the characteristics of the rock mass defects are unable to be inferred. Also, of the zones of weakness encountered during drilling process, their exact location, orientation and extent of these zones was unable to be recorded. But to supplement and assist in the assessment of the rock mass defects conditions, surficial mapping of rock outcrops was undertaken. As such there are many assumptions and limitations to this factual data and the engineering parameters assigned during design and in the interpretation of the pull test data below.

However, based on the data collated and the assumption of improvement in rock mass conditions with depth, access difficulties and time/budget constraints, additional boreholes were drilled for the installation of trial anchors.

The trial anchors were drilled vertically, with the first anchor aimed at testing the near surface material for annulus strength of the soil or weathered rock. A middle length anchor was installed to test the transition rock mass to competent rock bond strength and the longest length anchors were to test the bond strength of competent rock. Typically, the anchors were drilled between the ramp and anchor locations for each bridge abutment and on the eastern side of the valley slope for safe access and to limit vegetation damage.

The bar element tested during the trial was a 28mm GEWI with a minimum yield load of 308kN. Refer to the attached specification for additional properties of the element. The testing process was to incrementally jack the steel anchor out of the grout/ground at increments of this maximum yield stress and also the maximum of the jack that was available for the project (30t jack). With each test load the force was held for 5 minutes and if there was not change to the deflection, increments of force were increased. At the maximum load the force was held for 30 minutes. Refer to the attached test results for the details of specific tests.

A summary of the results is discussed below.

3 ANCHOR RESULTS

The table below for each bridge abutment record the upper limit test loads, whether the bar moved away from the ground during pull testing and the subsurface material and length of bar element embedded in the subsurface.

Overall, the results were as expected. With shallow anchors only suitable for light loads (e.g. retaining personnel for rope access) or at depth the anchors not exceeding bond strength and the steel elements yielding within tolerances.

Site: Grey Gully North			
Geotechnical Unit	Depth of anchor	Pull out movement	Highest test load (kN)
Clay (1)	1m fully grouted	Yes – grout failed	32
Residual Soil (2)	3m fully grouted	Within yield limits	285
Slate (3 and 4)	6m (3m debonded)	Within yield limits	295

Site: Grey Gully South			
Geotechnical Unit	Depth of anchor	Pull out movement	Highest test load (kN)
Residual Soil (2)	2m fully grouted	Yes – grout failed	24
Slate (4)	7m (5m debonded)	Within yield limits*	285

- Retested sample due to ground failure/movement under loading

Site: Kurnabinna North			
Geotechnical Unit	Depth of anchor	Pull out movement	Highest test load (kN)
Clay (1) and Residual Soil (2)	2m fully grouted	Yes – grout failed	42
Slate (3)	5m (3m debonded)	Within yield limits	290
Slate (4 and 5)	5m (3m debonded)	Within yield limits	290

Site: Kurnabinna South			
Geotechnical Unit	Depth of anchor	Pull out movement	Highest test load (kN)
Slate (2 and 3)	1m fully grouted	Yes – grout failed	132
Slate (4)	1.5m fully grouted	Within yield limits	290
Slate (4 and 5)	6m (4m debonded)	Within yield limits	290

4 LIMITATIONS

The findings contained within this report are the result of limited discrete investigations conducted in accordance with normal practices and standards. To the best of our knowledge, they represent a reasonable interpretation of the general surface condition of the site. Under no circumstances, can it be considered that these findings represent the actual state of subsurface ground conditions away from our investigation locations.

If the ground conditions encountered during construction are significantly different from those described in this report and on which the conclusions and recommendations were based, then we must be notified immediately.

This report has been prepared for use in the Coastal Walkway Project located in Hallett Cove SA, in accordance with generally accepted consulting practice. No other warranty, expressed or implied, is made as to the professional advice included in this report. Use of this report by parties other than City of Marion and their respective consultants and contractors is at their risk as it may not contain sufficient information for any other purposes.

5 CLOSURE

Should there be any questions in relation to this request for report, please contact the undersigned.

For and on behalf of CMW Geosciences

Prepared by:	Reviewed and authorised by:
Yan Wang	John Slade
Project Geotechnical Engineer	**Principal Geotechnical Engineer, CPEng**

Distribution: 1 electronic copy to Aspect Studio via email
Original held at CMW Geosciences

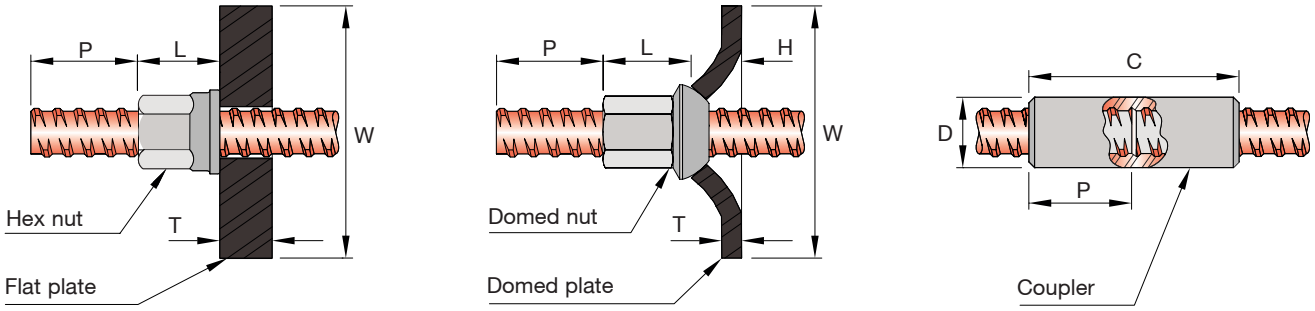
Appendix A
Anchor Trial Test Results

GEWI® Threadbar Anchor Properties: T Grade

Nominal Diameter (mm)	20	25	28	32	40	50	63.5
Minimum Ultimate Steel Grade (MPa)	600	550	550	550	550	550	700
Minimum Yield Steel Grade (MPa)	500	500	500	500	500	500	555
Minimum Breaking Load (kN)	188	270	339	442	691	1,080	2,217
Minimum Yield Load (kN)	157	245	308	402	628	982	1,758
Cross-Section Area (mm^2)	314	491	616	804	1,257	1,964	3,167
Minimum Thread Diameter (mm)	22.8	27.9	31.6	35.7	44.2	55.6	69.0
Unit Weight (kg/m)	2.47	3.85	4.83	6.31	9.86	15.41	24.86
Minimum Bar Protrusion P* (mm)	55	58	63	70	80	100	130

GEWI® Threadbar Anchor Hardware Dimensions

Nominal Diameter (mm)	20	25	28	32	40	50	63.5
Domed Nut L (mm)	35	40	46	51			
A/F** (mm)	36	38	43	46			
Hex Nut L (mm)	35	50	55	60	70	85	115
A/F** (mm)	36	41	46	55	65	80	100
Coupler C (mm)	110	115	125	140	160	200	260
D (mm)	37	42	48	55	68	84	106
Domed Plates W (mm)	150	150/200	200				
T (mm)	8/10	10/12	16				
Flat Plates W (mm)			200	200/250	250	250	200
T (mm)			16/20	20/25	20/25	20/25	25
Corrugated Sheathing Diameter (mm)	50	50	56	56	65	80	100



Notes:

*Minimum THREADBAR protrusion to accommodate tensioning or coupling: P=½C (mm).

**Width measured across flat of nut.

LOAD TEST RECORD SHEET

Client	
Location	Site #1 GN
Project	Grey North

Date:	25.2.2022
Time:	9:30
Soil Nail #	2m bolt. T1 (1m grouted)

Initial Seating to 15% Test Load	50.85
Seat nail to 15% of test load and release all load. Deflection during loading and unloading to be measured from this zero point	

Test Supervisor:	Jim Marrow
Client Engineer:	John
Proof Test Load (kN)	339

Nail Loading				Deflection (mm) - Upper reading							
	% Test Load	Load (kN)	Min Hold Time (min)	T = 0	T = 1	T = 2	T = 3	T = 4	T = 5	T = 10	T = 60
	0% Test Load	0	0	5.6m							
	15% Test Load	~~50.85~~	5	32kN	bolt Pulled.		trying to load jack at			50kN	
	25% Test Load	84.75	5	~~topped~~	~~at 46kN~~						
	50% Test Load	169.5	5								
	75% Test Load	254.25	10								

NOTES

LOAD TEST RECORD SHEET

Client	
Location	Site #1 GN
Project	Grey North

Date:	25-2-2022
Time:	10:00
Soil Nail #	T2 (3m fully grouted)

Initial Seating to 15% Test Load	50.85
Seat nail to 15% of test load and release all load. Deflection during loading and unloading to be measured from this zero point	

Test Supervisor:	JM Martin
Client Engineer:	John
Proof Test Load (kN)	~~330~~ 255kN

Nail Loading	% Test Load	Load (kN)	Min Hold Time (min)	Deflection (mm) - Upper reading T = 0	T = 1	T = 2	T = 3	T = 4	T = 5	T = 10	T = ~~30~~
	0% Test Load	0	0	12.6mm							
	15% Test Load	50.85	5	14.5	14.5	14.5	14.5	14.5	14.5		
	25% Test Load	84.75	5	15.2	15.2	15.2	15.2	15.2	15.2		
	50% Test Load	169.5	5	18.3	18.3	18.3	18.3	18.3	18.3		
	75% Test Load	254.25	10	19.1	19.1	19.1	19.1	19.1	19.1	19.1	
		285	30	19.4	19.4	19.4	19.4	19.4	19.4	19.4	

295 → 284kN

NOTES

15% 50.85 0 17.5

0419 954 244

LOAD TEST RECORD SHEET

Client	
Location	Site #1 GN
Project	Grey North

Date:	25-2-2022
Time:	12:00
Soil Nail #	T3 6m bar 3m Rebond (2m encap)

Initial Seating to 15% Test Load	50.85
Seat nail to 15% of test load and release all load. Deflection during loading and unloading to be measured from this zero point	

Test Supervisor:	Jai Marlow
Client Engineer:	John
Proof Test Load (kN)	300

Nail Loading	% Test Load	Load (kN)	Min Hold Time (min)	Deflection (mm) - Upper reading T = 0	T = 1	T = 2	T = 3	T = 4	T = 5	T = 10	T = 30
	0% Test Load	0	0	22.2							
	15% Test Load	50.85	5	25.9	25.9	25.9	25.9	25.9	25.9		
	25% Test Load	84.75	5	28.1	28.1	28.	28.1	28.1	28.1		
	50% Test Load	169.5	5	33.8	33.8	33.8	33.8	33.8	33.8		
	75% Test Load	254.25	10	39.7	39.7	39.7	39.7	39.7	39.7	39.7	
	100%	295	30	43.3	43.3	43.3	43.3	43.3	43.3	43.3	43.3

NOTES

15% 50.85 0 33.7mm

LOAD TEST RECORD SHEET

Client	
Location	Site #2 GB
Project	Grey South

Date:	28-2-2022
Time:	9:15
Soil Nail #	3m - 2m grouted.

Initial Seating to 15% Test Load	50.85
Seat nail to 15% of test load and release all load. Deflection during loading and unloading to be measured from this zero point	

Test Supervisor:	Ian Martin
Client Engineer:	John
Proof Test Load (kN)	339

				Deflection (mm) - Upper reading							
Nail Loading	% Test Load	Load (kN)	Min Hold Time (min)	T = 0	T = 1	T = 2	T = 3	T = 4	T = 5	T = 10	T = 60
	0% Test Load	0	0	15.1							
	15% Test Load	50.85	5	24kN	started	pulling	bolt				
	25% Test Load	84.75	5								
	50% Test Load	169.5	5								
	75% Test Load	254.25	10								

NOTES

LOAD TEST RECORD SHEET

Client	
Location	Site #2 GS
Project	Grey South

Date:	28-2-2022
Time:	10:30 - 12:00 (second test
Soil Nail #	7m bolt (5m debond - 2m encap)

Initial Seating to 15% Test Load	50.85
Seat nail to 15% of test load and release all load. Deflection during loading and unloading to be measured from this zero point	

Test Supervisor:	Jai Martin
Client Engineer:	John
Proof Test Load (kN)	339

Nail Loading	% Test Load	Load (kN)	Min Hold Time (min)	Deflection (mm) - Upper reading T = 0	T = 1	T = 2	T = 3	T = 4	T = 5	T = 10	T = 30
	0% Test Load	0	0	11.9							
	15% Test Load	50.85	5	15.9	15.9	15.9	15.9	15.9	15.9		
	25% Test Load	84.75	5	18.7	18.7	18.7	18.7	18.7	18.7		
	50% Test Load	169.5	5	24.1	24.1	24.1	24.1	24.1	24.1		
	75% Test Load	254.25	10	30.0	30.0	29.9	29.9	29.9	29.9	29.8	
		285	30	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5

NOTES

50kN 0 22.2

LOAD TEST RECORD SHEET

Client	
Location	Site # 2 GS
Project	Grey South

Date:	28.2.2022
Time:	9:45 - 10:30
Soil Nail #	7m bolt (5m bond - 2m encap)

Initial Seating to 15% Test Load	50.85
Seat nail to 15% of test load and release all load. Deflection during loading and unloading to be measured from this zero point	

Test Supervisor:	Jac Marrow
Client Engineer:	John
Proof Test Load (kN)	339

Nail Loading	% Test Load	Load (kN)	Min Hold Time (min)	Deflection (mm) - Upper reading T = 0	T = 1	T = 2	T = 3	T = 4	T = 5	T = 10	T = 60
	0% Test Load	0	0	15.4							
	15% Test Load	50.85	5	18.3	18.3	18.3	18.3	18.3	18.3		
	25% Test Load	84.75	5	20.5	20.5	20.5	20.5	20.5	20.5		
	50% Test Load	169.5	5	24.0	24.0	24.0	- Test Cancelled				
	75% Test Load	254.25	10	—	—	—	@ 255kN				

NOTES

Test Cancelled due to ground compression and frame moving to far off alignment.

Dis assemble + Re set frame.

LOAD TEST RECORD SHEET

Client	
Location	Site #3
Project	Kunnabinna North.

Date:	1-3-2022
Time:	9:00 - 9:15
Soil Nail #	3m bolt - 2m encapsulated.

Initial Seating to 15% Test Load	50.85
Seat nail to 15% of test load and release all load. Deflection during loading and unloading to be measured from this zero point	

Test Supervisor:	Jai Martin
Client Engineer:	John.
Proof Test Load (kN)	339

Nail Loading				Deflection (mm) - Upper reading							
	% Test Load	Load (kN)	Min Hold Time (min)	T = 0	T = 1	T = 2	T = 3	T = 4	T = 5	T = 10	T = 60
	0% Test Load	0	0	10.1							
	15% Test Load	50.85	5	42kN	bolt started to	Slip					
	25% Test Load	84.75	5								
	50% Test Load	169.5	5								
	75% Test Load	254.25	10								

NOTES

Held for 5mins @ 40kN (bolt holding @ 12.7mm)

@ 50kN - 13.7mm

Pressure increasing - bolt continued to slip.

LOAD TEST RECORD SHEET

Client	
Location	Site 3
Project	Kurnabinna North

Date:	1-3-2022
Time:	9:45
Soil Nail #	5m bolt # 4m encapsulation

Initial Seating to 15% Test Load	50.85
Seat nail to 15% of test load and release all load. Deflection during loading and unloading to be measured from this zero point	

Test Supervisor:	DAN MARROW
Client Engineer:	John
Proof Test Load (kN)	290 ~~330~~

				Deflection (mm) - Upper reading							
	% Test Load	Load (kN)	Min Hold Time (min)	T = 0	T = 1	T = 2	T = 3	T = 4	T = 5	T = 10	T = ~~30~~
Nail Loading	0% Test Load	0	0	7.9							
	15% Test Load	50.85	5	10.4	10.4	10.4	10.4	10.4	10.4		
	25% Test Load	84.75	5	12.2	12.2	12.2	12.2	12.2	12.2		
	50% Test Load	169.5	5	15.9	15.9	15.9	15.9	15.8	15.8		
	75% Test Load	254.25	10	19.8	19.8	19.8	19.8	19.7	19.7	19.6	
		290	30	21.3	21.3	21.3	21.3	21.3	21.3	21.4	21.2

NOTES

21.0 (@ 268 kN)
Pressure adjust. (@ 290 kN)

LOAD TEST RECORD SHEET

Client	
Location	Site 3
Project	Kurnabinna North

Date:	1-3-2022
Time:	11:17
Soil Nail #	7m bar @ 5m debond - 2m encap

Initial Seating to 15% Test Load	50.85
Seat nail to 15% of test load and release all load. Deflection during loading and unloading to be measured from this zero point	

Test Supervisor:	JAI MARTIN
Client Engineer:	John.
Proof Test Load (kN)	290 ~~355~~

				Deflection (mm) - Upper reading							
	% Test Load	Load (kN)	Min Hold Time (min)	T = 0	T = 1	T = 2	T = 3	T = 4	T = 5	T = 10	T = ~~30~~
Nail Loading	0% Test Load	0	0	15.8							
	15% Test Load	50.85	5	19.9	19.9	19.9	19.9	19.9	19.9		
	25% Test Load	84.75	5	23.8	23.8	23.8	23.8	23.8	23.8		
	50% Test Load	169.5	5	31.7	31.7	31.7	31.7	31.7	31.7		
	75% Test Load	254.25	10	42.1	42.1	42.1	42.1	42.1	42.1	42.1	
		290	30	43.4	43.4	43.4	43.4	43.4	43.4	43.4	43.4

NOTES

@ 50 kN 33.3 mm

LOAD TEST RECORD SHEET

Client	
Location	Site #4
Project	

Date:	3-3-2022
Time:	9:20
Soil Nail #	2.5m bolt @ 1.5m encap

Initial Seating to 15% Test Load	50.85
Seat nail to 15% of test load and release all load. Deflection during loading and unloading to be measured from this zero point	

Test Supervisor:	Jai Mahtw
Client Engineer:	John
Proof Test Load (kN)	290 ~~330~~

				Deflection (mm) - Upper reading							
	% Test Load	Load (kN)	Min Hold Time (min)	T = 0	T = 1	T = 2	T = 3	T = 4	T = 5	T = 10	T = ~~30~~
Nail Loading	0% Test Load	0	0	18.3							
	15% Test Load	50.85	5	19.1	19.1	19.1	19.1	19.1	19.1		
	25% Test Load	84.75	5	19.3	19.3	19.3	19.3	19.3	19.3		
	50% Test Load	169.5	5	20.6	20.6	20.6	20.6	20.6	20.6		
	75% Test Load	254.25	10	23.9	23.9	23.9	23.9	23.9	23.9	23.9	
		290	30	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7

NOTES

10kN

21.0

LOAD TEST RECORD SHEET

Client	
Location	Site #4
Project	

Date:	3-3-2022
Time:	10:55
Soil Nail #	6m bolt TZ 3m encap.

Initial Seating to 15% Test Load	50.85
Seat nail to 15% of test load and release all load. Deflection during loading and unloading to be measured from this zero point	

Test Supervisor:	Jan Marom
Client Engineer:	John
Proof Test Load (kN)	290

Nail Loading	% Test Load	Load (kN)	Min Hold Time (min)	Deflection (mm) - Upper reading T = 0	T = 1	T = 2	T = 3	T = 4	T = 5	T = 10	T = 60
	0% Test Load	0	0	11.2							
	15% Test Load	50.85	5	13.1	13.1	13.1	13.1	13.1	13.1		
	25% Test Load	84.75	5	15.5	15.5	15.5	15.5	15.5	15.5		
	50% Test Load	169.5	5	20.4					20.4		
	75% Test Load	254.25	10	Stopped Test							

NOTES

Stopped test. batteries died in recorder
Re set frame due to compaction.

LOAD TEST RECORD SHEET

Client	
Location	Site #4
Project	

Date:	3-3-2022
Time:	11:25
Soil Nail #	Gunbolt #2 in encap

Initial Seating to 15% Test Load	50.85
Seat nail to 15% of test load and release all load. Deflection during loading and unloading to be measured from this zero point	

Test Supervisor:	Jay Marrow
Client Engineer:	John
Proof Test Load (kN)	290 339

Nail Loading	% Test Load	Load (kN)	Min Hold Time (min)	Deflection (mm) - Upper reading T = 0	T = 1	T = 2	T = 3	T = 4	T = 5	T = 10	T = 60
	0% Test Load	0	0	19.9							
	15% Test Load	50.85	5	21.9	21.9	21.9	21.9	21.9	21.9		
	25% Test Load	84.75	5	23.0	23.0	23.0	23.0	23.0	23.0		
	50% Test Load	169.5	5	25.2	25.2	25.1	25.2	25.2	25.2		
	75% Test Load	254.25	10	25.7	25.7	25.7	25.7	25.7	25.5	25.5	
		290	30								

NOTES

stopped test due to mechanical failure
Hose "popped" while increasing to 290kN.

1-2-5
(1.5)

LOAD TEST RECORD SHEET

RWS-FIMS 0034
Page 1 of 1

Client	
Location	Site #4
Project	

Date:	3-3-2022
Time:	8:45
Soil Nail #	2m bolt ≡ 1m encapsulated.

Initial Seating to 15% Test Load	50.85
Seat nail to 15% of test load and release all load. Deflection during loading and unloading to be measured from this zero point	

Test Supervisor:	JM Martin
Client Engineer:	John
Proof Test Load (kN)	339

				Deflection (mm) - Upper reading							
Nail Loading	% Test Load	Load (kN)	Min Hold Time (min)	T = 0	T = 1	T = 2	T = 3	T = 4	T = 5	T = 10	T = 60
	0% Test Load	0	0	11.4							
	15% Test Load	50.85	5	13.0	13.0	13.0	13.0	13.0	13.0		
	25% Test Load	84.75	5	14.4	14.4				14.4		
	50% Test Load	169.5	5								
	75% Test Load	254.25	10								

NOTES

bolt pulled @ 132kN