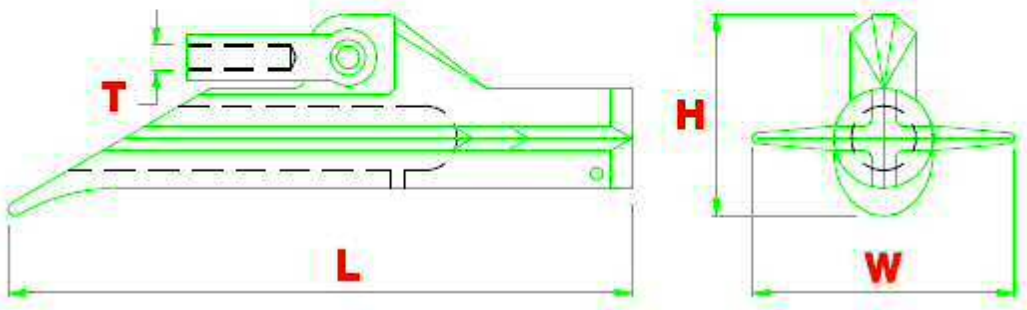
Anchor Systems (Europe) Ltd, Unit 45 Rowfant Business Centre, Rowfant, West Sussex, RH10 4NQ

DUCKBILL RETAINING WALL

Registered Office: North House 198 High Street, Tonbridge, Kent, TN9 1BE
Company Registration No. 04023935, VAT Registered No. 656490607

DUCKBILL ANCHOR SIZES



GROUND ANCHOR	Load Range kN	L mm	W mm	H mm	Surface Area mm^2	Bar Dia/Wire Dia. mm	Manufactured Material	Driven Depth Ave/week Ground (m)	Driving Equipment
AS-300	100-300	500	300	176	110,341	24 & 25	SG Iron/SS 316	9-12+	m/c DR
AS-200	90-200	500	172	150	73,200	24 & 25	SG Iron/SS 316	9-12	m/c DR
AS-140	60-140	500	258	140	96,111	16 & 20	SG Iron/SS 316	6	m/c DR
AS-120	70-140	500	300	134	110,456	20 & 25	SG Iron/SS 316	6-9	m/c DR
AS-100	50-100	422	180	139	57,384	16 & 20	SG Iron/SS 316	6-9	HH m/c
AS-50	30-50	375	98	110	32,525	16 & 20	SG Iron/SS 316	3-6	HH m/c
AS-30	15-30	293	88	107	24,579	12 & 16	SG Iron/SS 316	3	HH m/c
MR1	50-90	375	176	109	52,733	16 & 20	SG Iron/SS 316	6-9	HH m/c
MR2	30-50	375	98	110	32,525	16 & 20	SG Iron/SS 316	3-6	HH m/c
MR3	15-30	293	88	107	24,579	12 & 16	SG Iron/SS 316	3	HH m/c
MR4	10-20	200	88	95	10,625	12 & 16	SG Iron/SS 316	2-3	HH m/c
MR88	5-12	159	48	65	6,047	Wire/Paracore 4-6	SG Iron/SS 316	1.2-1.5	HDR
MR68	1-5	121	32	48	3,219	Wire/Paracore 4	SG Iron/ SS 316	1.2-1.5	HDR
DB88	5-10	159	48	65	6,047	Wire/Paracore 4-6	LM25	1.2-1.5	HDR
DB68	1-5	121	32	48	3,219	Wire/Paracore 4	Aluminium LM25	1.2-1.5	HDR

m/c DR - Machine Driven anchors (i.e. Using montebert 125SX Breaker or similar)
HH m/c - Hand Held Driving Equipment from Anchor Systems (Europe) Ltd
HDR - Hand Drive Rods to be used with a standard hand held hammer

Note: All Dimensions are in millimetres
All load values shown are SLS or Safe Working load recommended for the anchor
Anchor range available in Spheroidal Graphite, Grade 316 Stainless Steel or LM25 Aluminium

Duckbill Ground Anchor Holding Capacities (kN)

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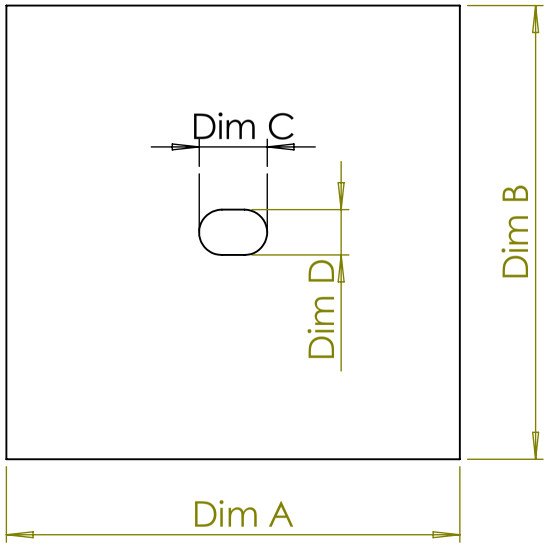
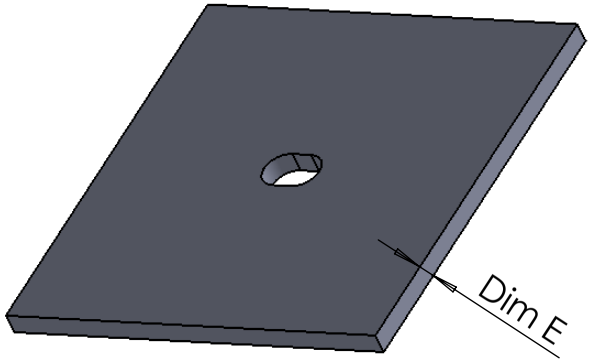
Common Soil Type Description	Geological Soil Classification	Blow Count or "SPT"	AS10	AS20	AS100	AS140	AS200	AS300
Very Dense and/or Cemented Sands; Course Gravel & Cobbles	Caliche, Nitrate Bearing Gravel	60 - 100+	10	20	100	140	200	300
Dense Fine Sand; Very Hard Silts & Clays	Basal Till; Boulder Clay Caliche;	45 - 60	10	20	90	140	200	285
Dense Clays, Sands & Gravel; Very Stiff to Hard Silts & Clays	Glacial Till; Weathered Shale's; Schist Gneiss Siltstone	35 - 50	10	20	90	140	200	270
Medium Dense Sandy Gravel; Very Stiff to Hard Silts & Clays	Glacial Till; Hardpan	25 - 40	8	18	70	110	150	220
Medium Dense Course Sand & Sandy Gravel; Stiff to Very Stiff Silts & clays	Saprolites Residual Soils	14 - 25	8	16	70	110	150	210
Loose to Medium Dense Fine to Course Sand; Firm to Stiff Clays & Silts	Dense Hydraulic Fill; Compacted Fill; Residual Soils	7 - 14	7	16	60	70	110	190
Loose Fine Sand; Alluvium;Soft-Firm Clays; Varied Clays; Fill	Flood Plain Soils; Lake Clays; Abode; Gumbo Fill	4 - 8	7	14	50	60	80	150
Peat, Organic Silts; Inundates Silts Fly Ash	Miscellaneous Fill; Swamp Marsh	0 - 5	5	12	40	50	20 - 50	20 - 80

N.B: For Guidance Purposes Only – True Capacity must be tested with an Anchor Systems Load Locker within the area of soil to be stabilized

In weak soil conditions tests have conclusively shown that grouted anchors can enhance loading capacity

Note: All underground work requires proper safety and location procedures. Do not install anchors without understanding below ground conditions. It is imperative that in all cases, ground anchors are fully locked before being put into service.





Anchor Systems Pattress Plate

REF	Dim A	Dim B	Dim C	Dim D	Dim E
Plate 75x75x8	75mm	75mm	45mm	22mm	8mm
Plate 150x150x8	150mm	150mm	45mm	22mm	8mm
Plate 200x200x8	200mm	200mm	45mm	22mm	8mm
Plate 350x350x8	350mm	350mm	45mm	30mm	8mm
Plate 200x200x10	200mm	200mm	45mm	22mm	10mm
Plate 250x250x10	250mm	250mm	45mm	22mm	10mm
Plate 300x300x15	300mm	300mm	45mm	30mm	15mm

Material SG Iron

Finish Galvanised

Revision

ANCHOR SYSTEMS (EUROPE) LTD

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www.anchorsystems.co.uk

Description Anchor Systems Pattress Plate

Drawing No. AS-PP-SG

Rev. 0

Drawn By	G Selvadurai	**Drawn Date**	21/10/2014
Approved By		**Approved Date**	

Tolerance - All Dimensions in mm
Whole Numbers: ±1
One Place Decimals: ±0.5
Angles : ±1°

THIRD ANGLE PROJECTION
DO NOT SCALE
IF IN DOUBT, ASK

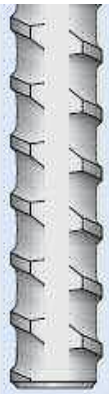
A4

Anchor Systems (Europe) Ltd, Unit 45 Rowfant Business Centre, Rowfant, West Sussex, RH10 4NQ

Galvanised Bar Sizes and Specifications

Standard Bar

Nominal Diameter mm	Steel Grade N/mm²	Ultimate Strength kN	Yield Strength kN	70% Ultimate Strength kN	Cross Sectional Area mm²	Diameter Over Threads mm	Thread Pitch mm	Weight Kg/m
16	500 / 600	121	101	85	201	18	8	1.58
20		188	157	132	314	23	10	2.47
25		295	246	206	491	28	12.5	3.85
28		370	308	259	616	32	14	4.83
32		482	402	337	804	36	16	6.31
40		754	629	528	1257	45	20	9.86
50		1178	982	825	1963	56	26	15.41
63.5	555 / 700	2217	1758	1552	3167	69	21	24.86

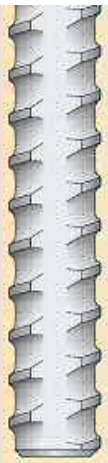


Key features of *GEWI*® Standard:

- Steel Grade: 500 / 600 N/mm² (except 63.5mm, 555 / 700 N/mm²)
- Coarse Pitch Threadform, d / 2 (except 63.5mm, d / 3)
- Left Hand Thread
- Standard Load Range

Standard Bar Plus

Nominal Diameter mm	Steel Grade N/mm²	Ultimate Strength kN	Yield Strength kN	70% Ultimate Strength kN	Cross Sectional Area mm²	Diameter Over Threads mm	Thread Pitch mm	Weight Kg/m
18	670 / 800	203	170	142	254	21	8	2.00
22		304	255	213	380	25	8	2.98
25		393	329	275	491	28	10	3.85
28		493	413	345	616	32	11	4.83
30		566	474	396	707	34	11	5.55
35		770	645	539	962	40	14	7.55
43		1162	973	813	1452	48	17	11.40
57.5		2078	1740	1455	2597	63	20	20.38
63.5		2534	2122	1774	3167	69	21	24.86
75		3534	2960	2474	4418	82	24	34.68



Key features of *GEWI*® *Plus*:

- Steel Grade: 670 / 800 N/mm²
- Reduced Pitch Threadform (d / 3)
- Right Hand Thread
- Increased Load Range Capacity

Technical Details:

Modulus of Elasticity: E = 205,000 N/mm2
Stock Length: 12m, Cutting Tolerance: +/–100mm
Standard Bar: Manufactured in accordance with German Approval Certificate
Standard Plus Bar: Manufactured in accordance with European CUAP

Corrosion Protection:

Sacrificial Corrosion Allowance: TRL 380 and CIRIA Soil Nailing Guide
Hot Dip Galvanising: BE EN ISO 1461 (zinc coating thickness of 85µm, bars remain fully threadable over entire length)

AS-300-SG-S- SG -BA-25- SG

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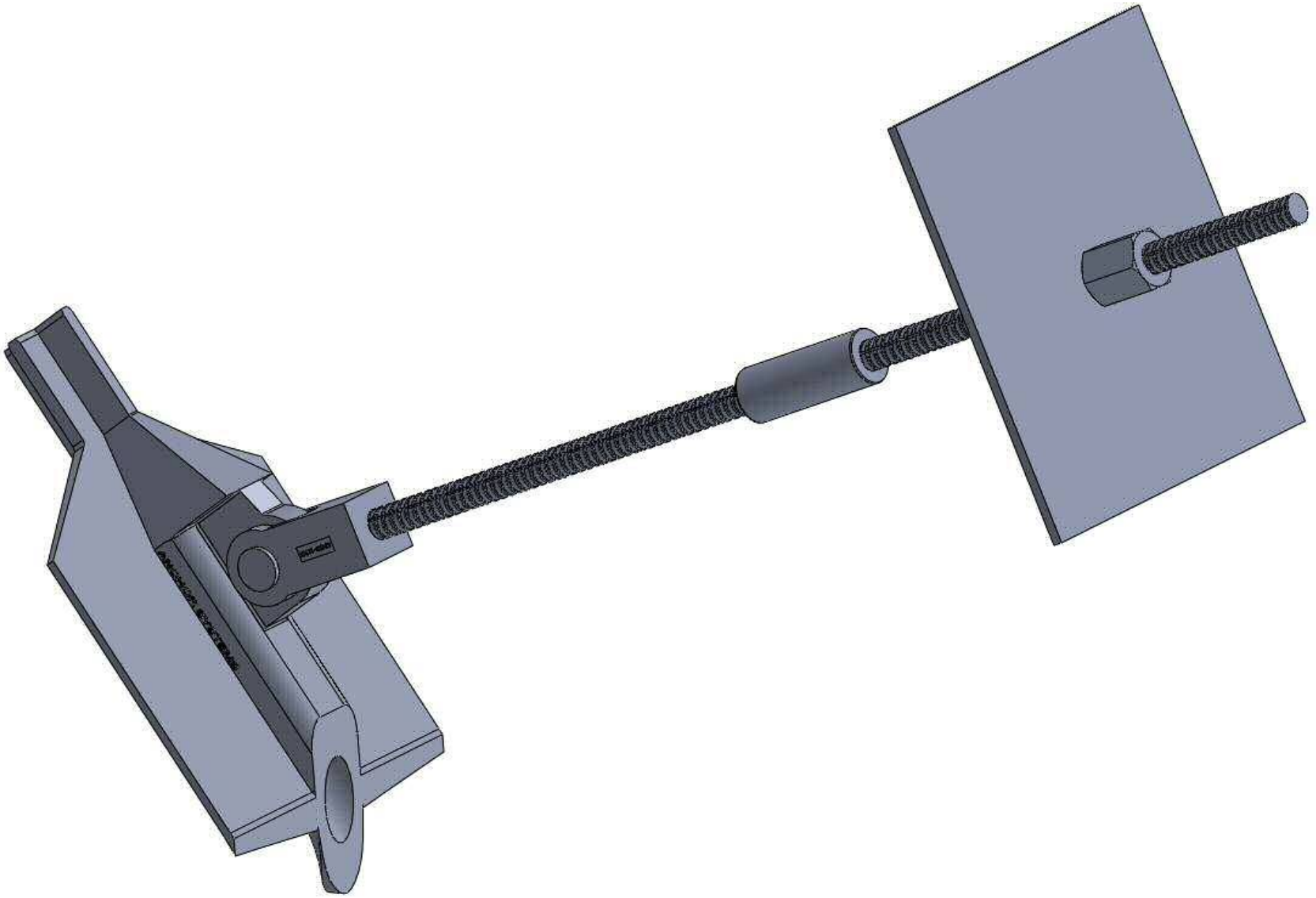

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AS-300-SG-S-SG-BA-25-SG with Wedge Boss

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AS-300-SG-S-SG-BA-25-SG with Wedge Boss

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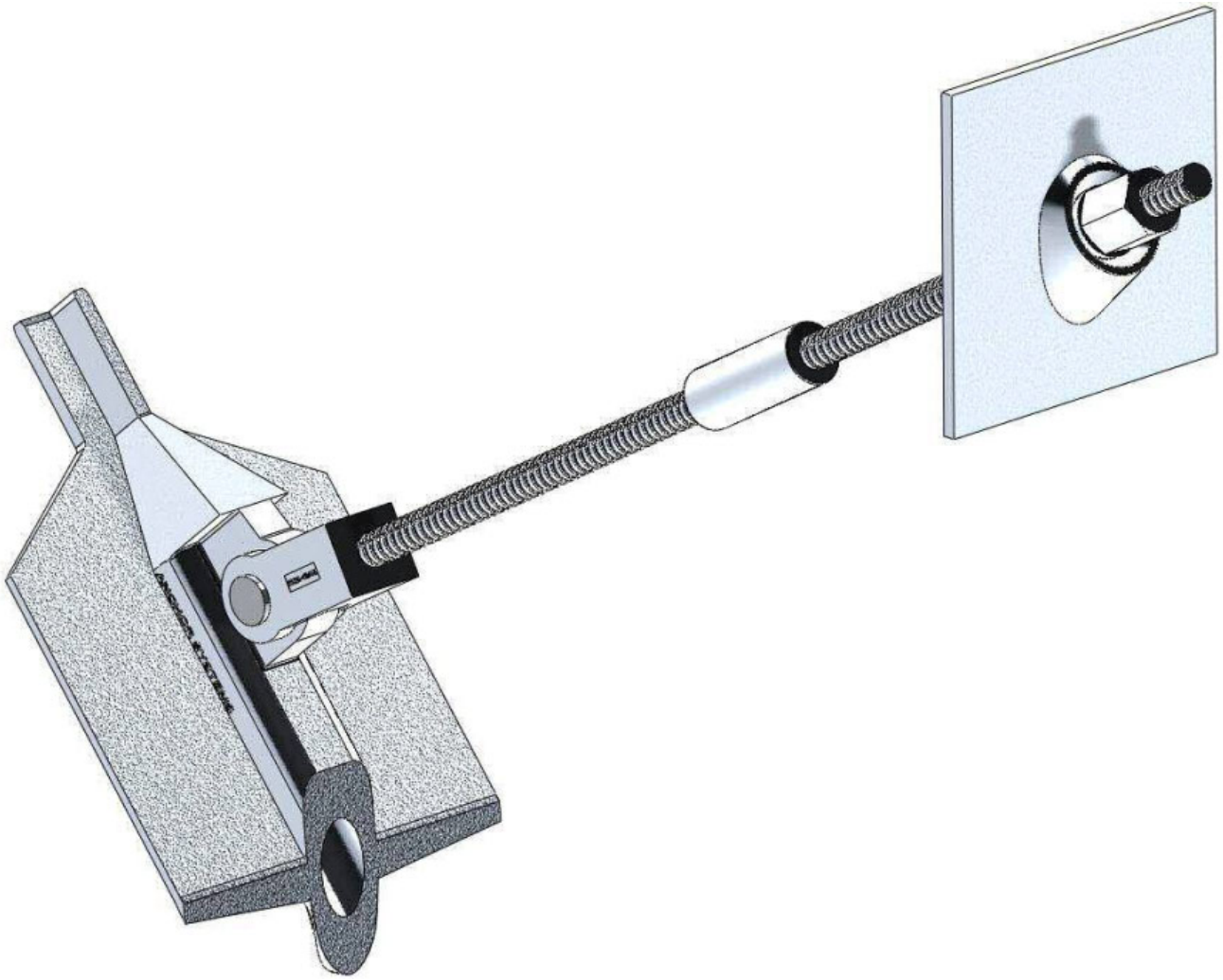

AS-300-SG-S-SG-BA-25-SG with Wedge Boss

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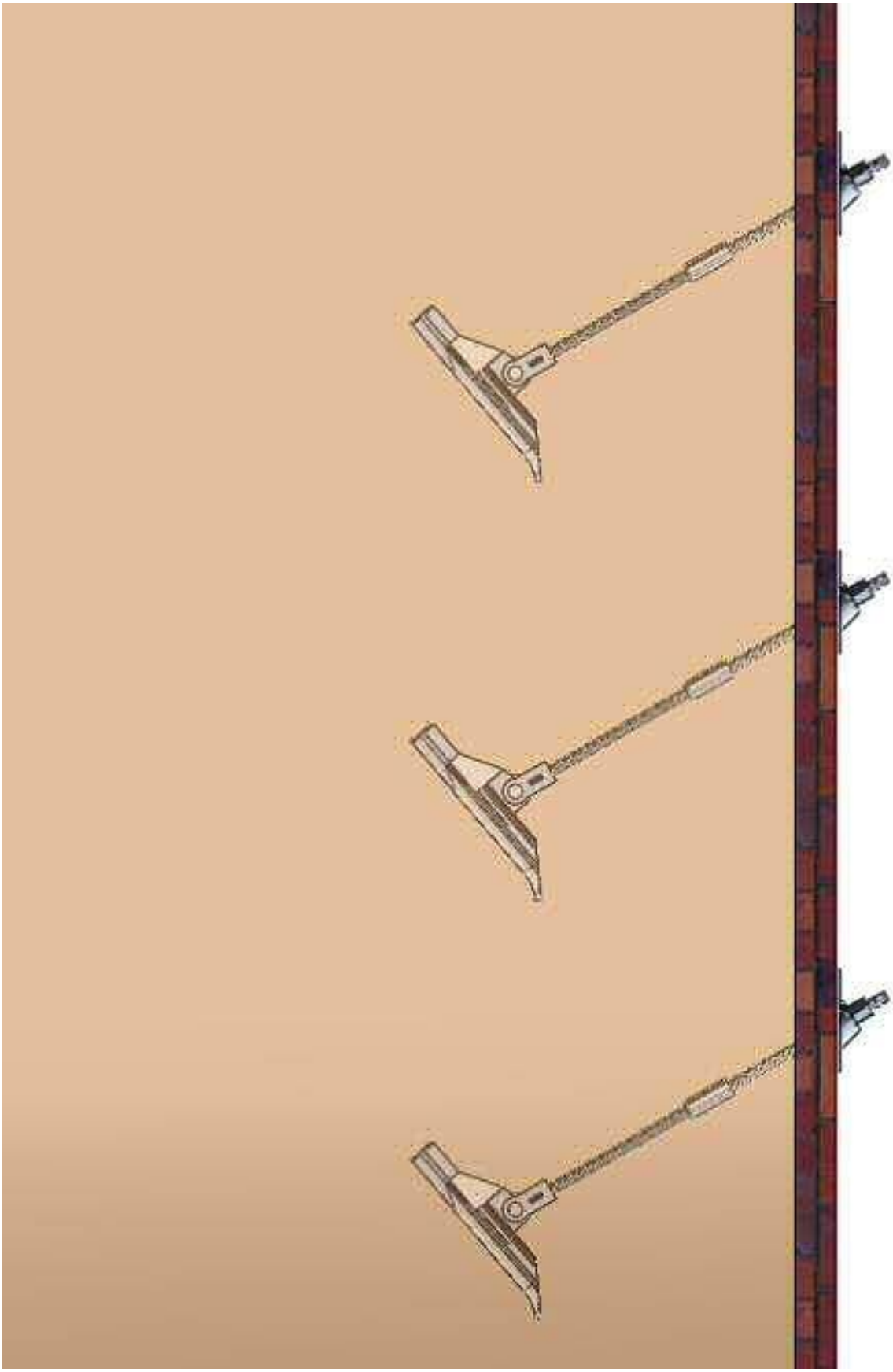

AS-300-SG-S-SG-BA-25-SG with Wedge Boss

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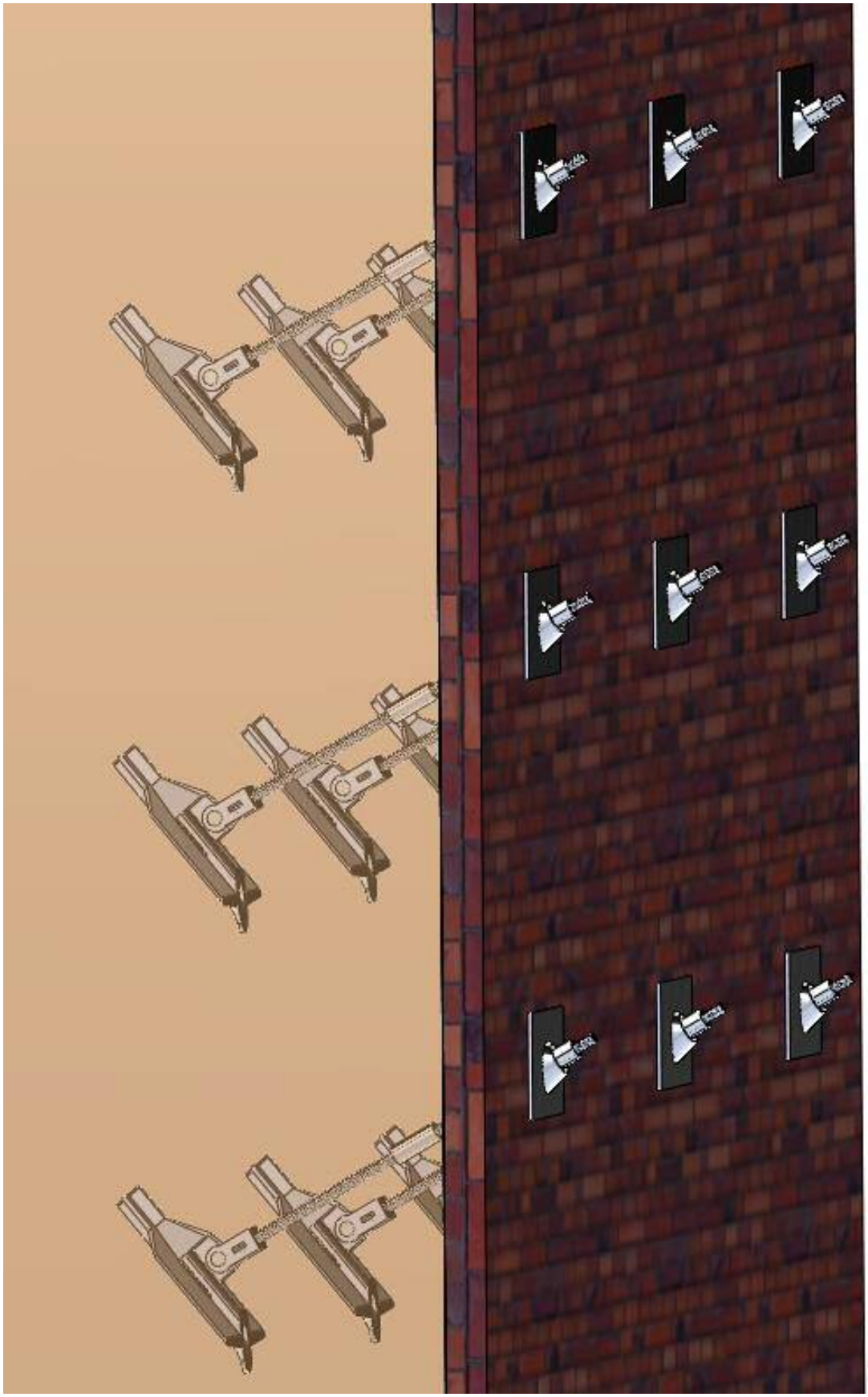

DUCKBILL®
Ground Anchor Systems

PROJECT REPORT

STABILISING WEAKENED AND BOWING RAIL BRIDGE MASONRY

Client: **Network Rail**
Engineers: **Richard Jackson Partnership**
Duckbill Installation: **Dyer & Butler**

Requirements

The supporting walls of Bridge 31/33 on the Reading Road in Basingstoke were becoming weak and beginning to bow as a result of age and weather erosion and needed to be quickly and effectively stabilised.

Richard Jackson Partnership specified the well proven MR1 stainless steel Duckbill mechanical ground anchors, having had previous good experience of the products.

After sound testing a design repair was finalised and undertaken

Installation

The Duckbill anchors, with 6m x 20mm stainless steel high yield bars, were rapidly driven into the made ground of clays, rubble and granular material. Installed in two rows on either side of the bridge arch walls, the anchors were terminated with 350mm x 350mm x 8mm stainless steel plates and nuts.

The anchors were proof loaded to 60kN and then set to a working load of 30kN.

Despite the difficult access and the restricted time frame for the project, all the Duckbill anchors were successfully installed and set within the allotted time and no grout was spilled over the footpaths which had to be kept open.

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PROJECT REPORT

RETAINING WALL STABILISATION
MANNINGTREE, ESSEX

Client: **Essex County Council**
Main Contractor: **Jackson Civil Engineering**
Project Engineers: **WS Atkins**
Installer: **WT Specialist Contracts**

Requirements

Where the busy Ipswich to London rail line crosses the main road at Manningtree, Essex, there is both a level crossing and an adjacent underpass to enable traffic to keep moving despite frequent trains.

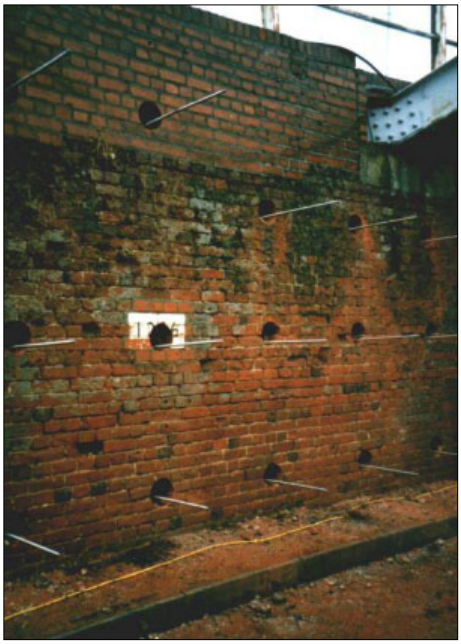
However, in order to avoid the possibility of any future structural problems it was necessary to secure the brick retaining wall between the two roads to ensure it was able to meet the latest EU weight loading regulations.

Solution

Project engineers WS Atkins, following previous good experience, specified the versatile and well proven Duckbill ground anchors as a rapid and efficient means of ensuring the retaining wall was fully strengthened and stabilised.

Duckbill MR2 anchors with 16mm grip bars were installed in rows into the retaining wall on both sides of the bridge by sister company WT Specialist Contracts.

Having cored through the brickwork, WT used a special installation rig to drive the stainless steel anchors 6m into ground conditions of fairly weak clays with sand present. Once in position the Duckbills were locked and set to a working load of 55kN.



To provide an aesthetic finish with no visible external plates, the brickwork had been over-cored to allow the Duckbill anchors to be fitted with recessed load plates. Once the 170mm diameter plates were fitted and the anchors locked, the cored bricks were replaced leaving the wall fully secured and with little visible evidence of the structural works which had taken place.

DUCKBILL®
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PROJECT REPORT

TRACKSIDE RETAINING WALL, MERTHYR VALE, SOUTH WALES

Client: **Railtrack**
Main Contractor: **John Mowlem & Co.**
Engineers: **Cass Hayward & Ptnrs.**
Installer: **WT Specialist Contracts**

REQUIREMENTS

A reliable and long-term solution was required to prevent the potential collapse of an old retaining wall onto the adjacent railway track at Merthyr Vale in South Wales.

The 2.5m high random stone wall was 140m long and in poor condition. It was being repaired and repointed by John Mowlem and Co. as one of seven structural renewals and it needed stabilising without involving any expensive and disruptive track possessions or night working.

SOLUTION

Duckbill mechanical ground anchors were specified by structural engineers, Cass Hayward & Partners, as they could be both supplied and installed by WT Group companies and would involve no disruption to rail services.

Working inside a narrow allocated green zone, which was just 2.7m wide, and using a specially designed rig, WT Specialist Contracts was able to undertake all work during normal working hours while trains continued to operate.

WT carefully diamond core-drilled through the wall, so as not to disrupt the weak material, before installing the anchors. In total, 82 stainless steel Duckbill MR2 anchors with 16mm Grip-Bars were driven 6m into the dense granular ash embankment.

Each anchor was tensioned to a 60kN proof load before being set at a 20kN working load and terminated with an external 250mm^2 plate to provide long term stabilisation of the retaining wall. (When circumstances demand, Duckbill anchors can be secured with a totally concealed top termination) The whole contract by WT companies was successfully and cost-effectively completed in just two weeks

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PROJECT REPORT

NEW GRAVITY WALL SAPCOTE, LEICESTERSHIRE

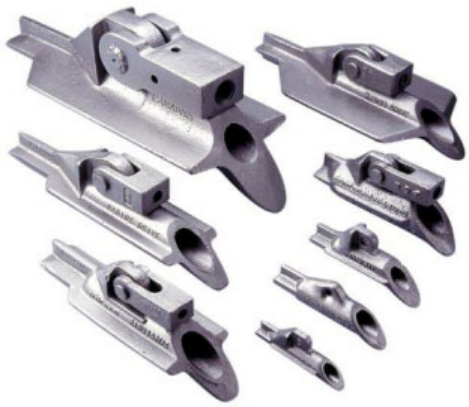
Client: **Stoney Cove Developments**
Project Engineers: **Terry Ingold Engineers**
Installer: **Stoney Cove Developments**

REQUIREMENTS

A busy access road serving a diving club in Sapcote, Leicestershire required widening and new footpaths. This involved cutting back the embankments either side of the road, making them both higher and steeper. Curving gravity walls were then constructed, some 200m long and up to 4m high, on both sides of the road to retain the ground and prevent erosion. The walls then needed to be secured without any visible plates.

SOLUTION

The gravity walls were constructed from solid geoblocks and secured to the embankments using the well proven Duckbill MR88 stainless steel mechanical ground anchors. Terry Ingold Engineers specified Duckbills because they were cost-effective, reliable and could be rapidly installed by Stoney Cove Developments own personnel after minimal training.



Some 400 Duckbills were driven 3m into the very stiff marl/clay substrate at an angle of 20^0 and concealed behind the walls. The anchors' 6mm stainless steel wire ropes were then secured to longitudinal bars, positioned inside the geoblocks as the walls were constructed, and tensioned to a working load of 10kN.

The new walls are now held securely to avoid the possibility of any danger to passing pedestrians and traffic.

The Duckbill range of mechanical ground anchors with the MR88 in the front row centre

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www.anchorsystems.co.uk

LA SAGESSE, JESMOND, NEWCASTLE-UPON-TYNE

DUCKBILL® GROUND ANCHORS FOR

RETAINING WALL STABILISATION,

DESIGN CALCULATIONS,

Revision 0

February 2015

Tellus Design Limited

SE008, e-Innovation Centre, Telford Campus, Priorslee, Telford, Shropshire, TF2 9FT, UK

Tel: 01952 288331 I Mobile: 07584 079553 I Email: info@tellusdesign.co.uk

1 Introduction

This report contains design calculations for stabilising an existing retaining wall using mechanical ground anchors (Duckbill® system). As part of this residential redevelopment of a former school site, an existing masonry retaining wall requires stabilisation over part of its length. The section of wall showing signs of distress is located directly in front of two mature trees. It is understood that the localised damage (bulging) to the wall may be due to root growth from these two trees. One of these trees (T82) will be removed during the works, but the other tree (T81) is to be protected and retained. Figure 1.1 below shows the proposed remedial measures for this section of retaining wall.

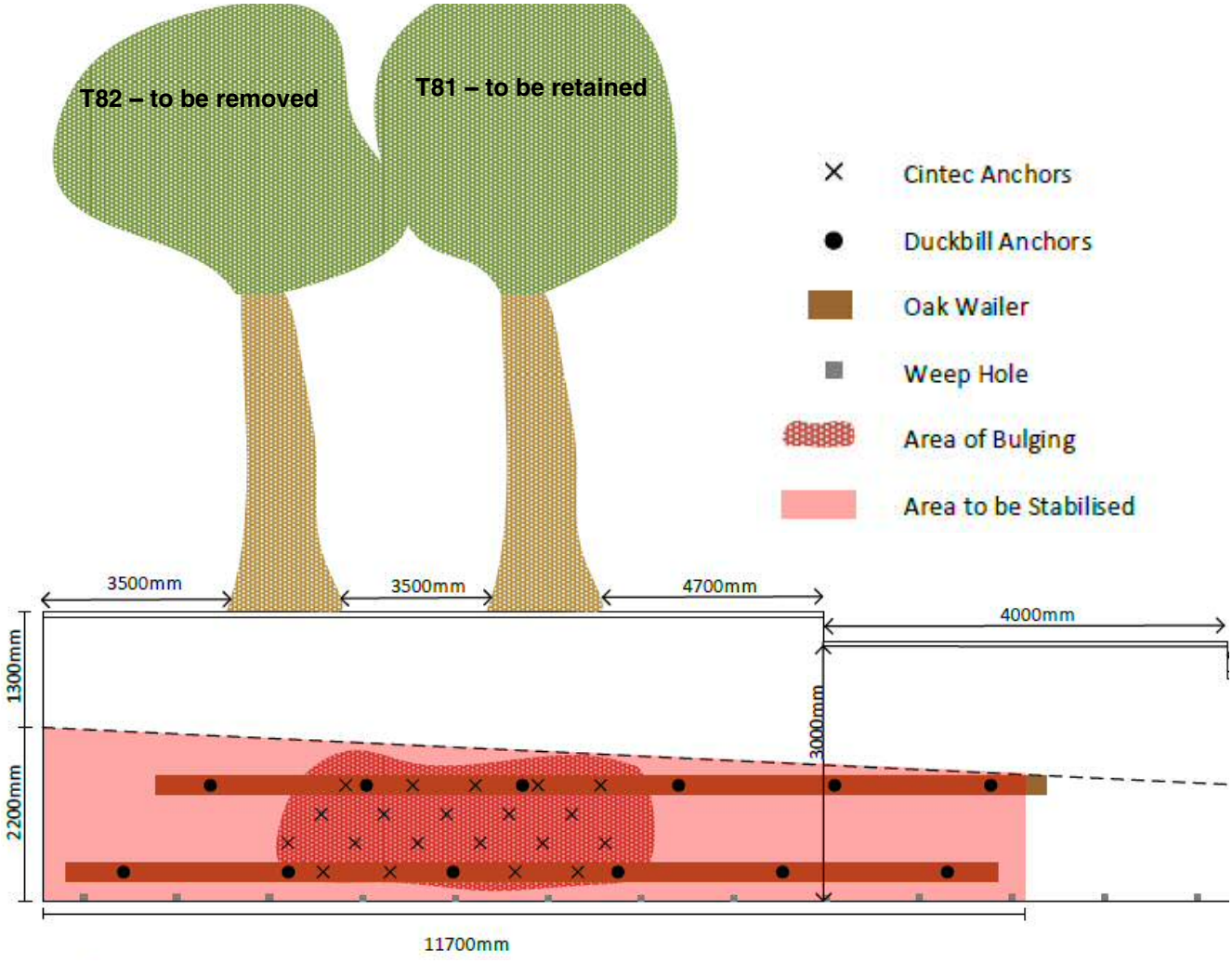


Figure 1.1. Part elevation of existing retaining wall length requiring stabilisation

The proposed remedial works to the wall comprise repairs to the masonry in the areas of bulging using Cintec anchors (by others). To ensure the global stability of the retaining wall, a number of mechanical ground anchors are to be installed over the stabilised length. Load from the anchors will be spread over the stabilised length using wailer beams (by others).

The scope of this design is limited to assessing the geotechnical stability of the critical section of the retaining wall structure. The objectives of these calculations are to determine the required design anchor forces to ensure the stability of the retaining wall and provide an anchor design indicating the layout in terms of anchor lengths and spacing.

- The vertical self-weight of the tree and design wind actions are dispersed over a length of wall, s, of 6.31m, derived in accordance with GEO Report No. 257
- The tree root foundation is modelled as a 'RIGID' element with a bulk density equal to the soil in which the roots are located. In this case, it is assumed the tree roots are within the Made Ground with a bulk density $\gamma = 18kN/m^3$.
- The tree root foundation is assumed to be 0.5m thick. This assumption has been based upon a review of available information on typical tree root systems which states that 90% of all roots and virtually all large structural supporting roots are to be found in the upper 0.6m of the soil (see Figure 3.1). Whilst acknowledging that the roots may be deeper, a shallower foundation should produce a more onerous load case when assessing the loads acting on the retaining wall and is therefore considered conservative.

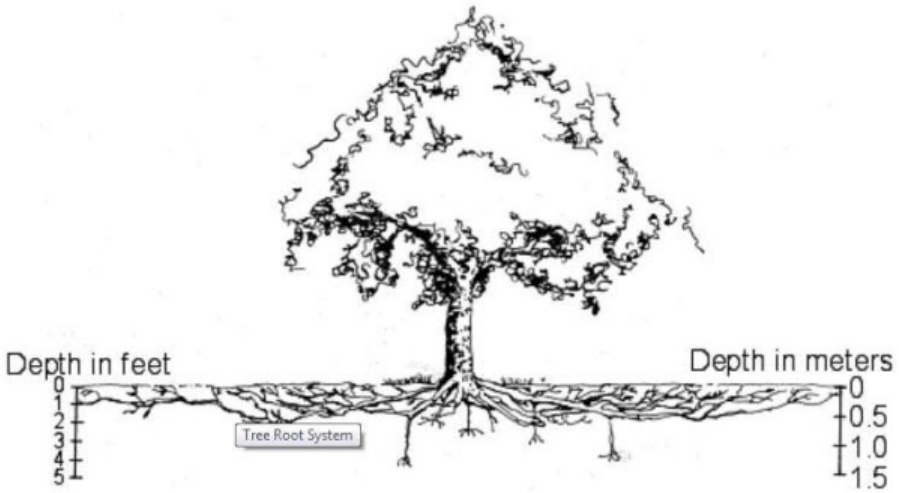


Figure 3.1 Diagram of a typical tree root system

- Long term effective stress conditions apply to the soils.
- The retaining wall is rigidly fixed and cannot move/rotate.

b) *Stabilised retaining wall – Restoring force applied to wall face*

Same assumptions as for a) above except:

- The retaining wall is not rigidly fixed and is free to move/rotate
- Minimum width of tree root foundation based upon results of analysis in a) above
- The masonry retaining wall has adequate structural strength to resist the restoring force applied to the face of the wall
- The restoring force must provide a minimum 'Adequacy Factor' of 1.0 on the disturbing wind forces with the partial load and material factors DA1-1 and DA1-2.
- The restoring force to be applied at two levels inclined at 15° below the horizontal. The top level is located 0.5m below retained ground level and assumes the first row of anchors are installed just below tree root depth. The bottom level is located at 1.5m below retained ground level.

c) *Stabilised retaining wall – With mechanical ground anchors installed*

- Same assumptions as for b) above
- The design anchor loads are transmitted into the ground at the base of the mechanical anchor.
- The anchor tendons are assumed to develop no bond with the ground along their length between the mechanical anchor and the anchor head at the facing.
- The anchors and tendons have a design service life of 50 years.

2 Reference Documents

The design has been based upon the following documents:

Drawings
- Cons-TPP-A – Tree Protection Plan – (AllAboutTrees Ltd)
- Plot 26 – Sketch plan of existing retaining wall and locations of affected trees (St. Astier)
- Plot 26 – Sketch elevation of existing retaining wall showing stabilising proposals (St. Astier)

Ground Investigation Reports
- La Sagesse School, Ground Investigation Interpretative Report, June 2013 (Shadbolt Environmental LLP)
- Ground anchor site test report, 03 February 2015 (ASEL)
- Extract from Tree Report for Trees T81 and T82 (AllABoutTrees Ltd)

Ground Anchor Technical Data
- Duckbill® Ground Anchor Systems – Products, Applications and Technical Information

Using data from the above drawings, the following cross sections defined in Figures 2.1 to 2.2 were used for design purposes.

Figure 2.1. Location of design cross sections

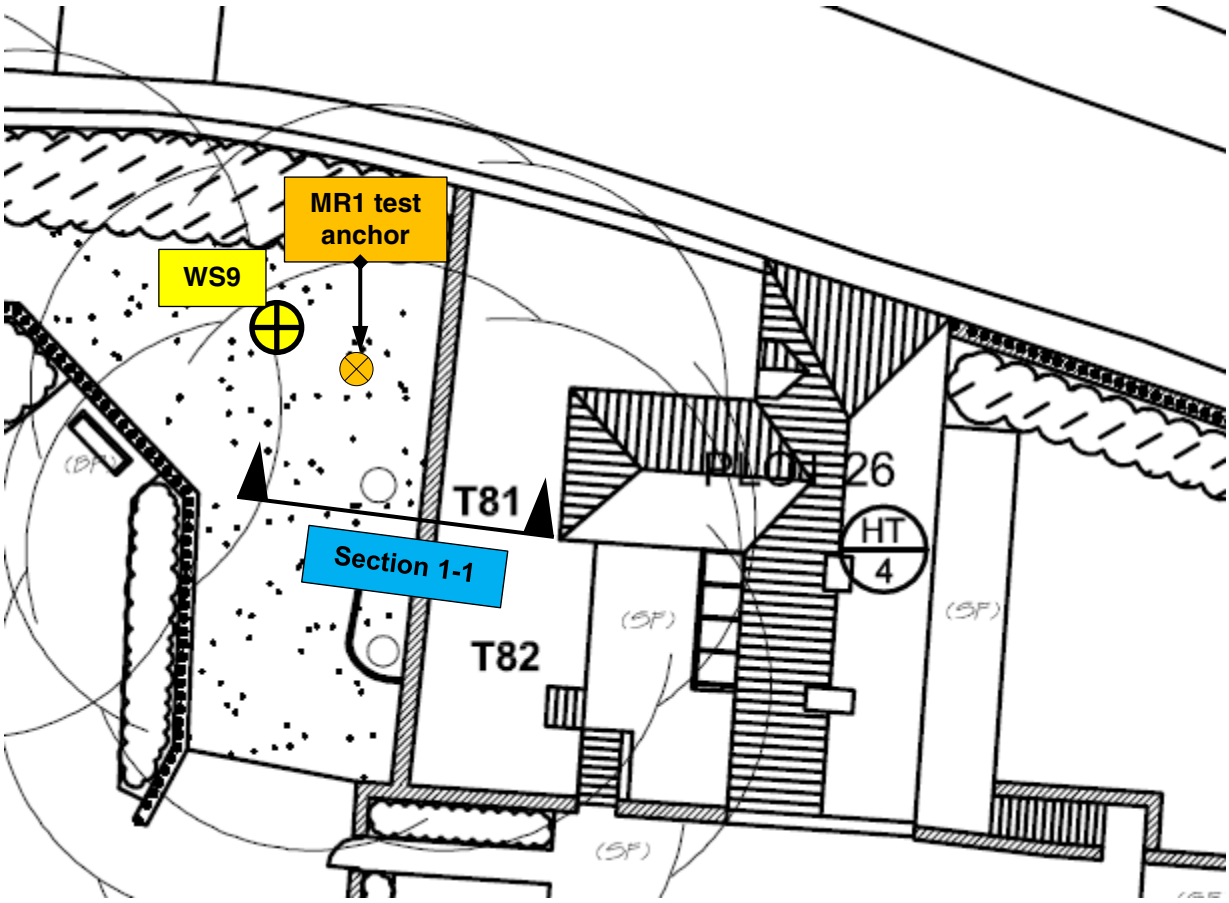
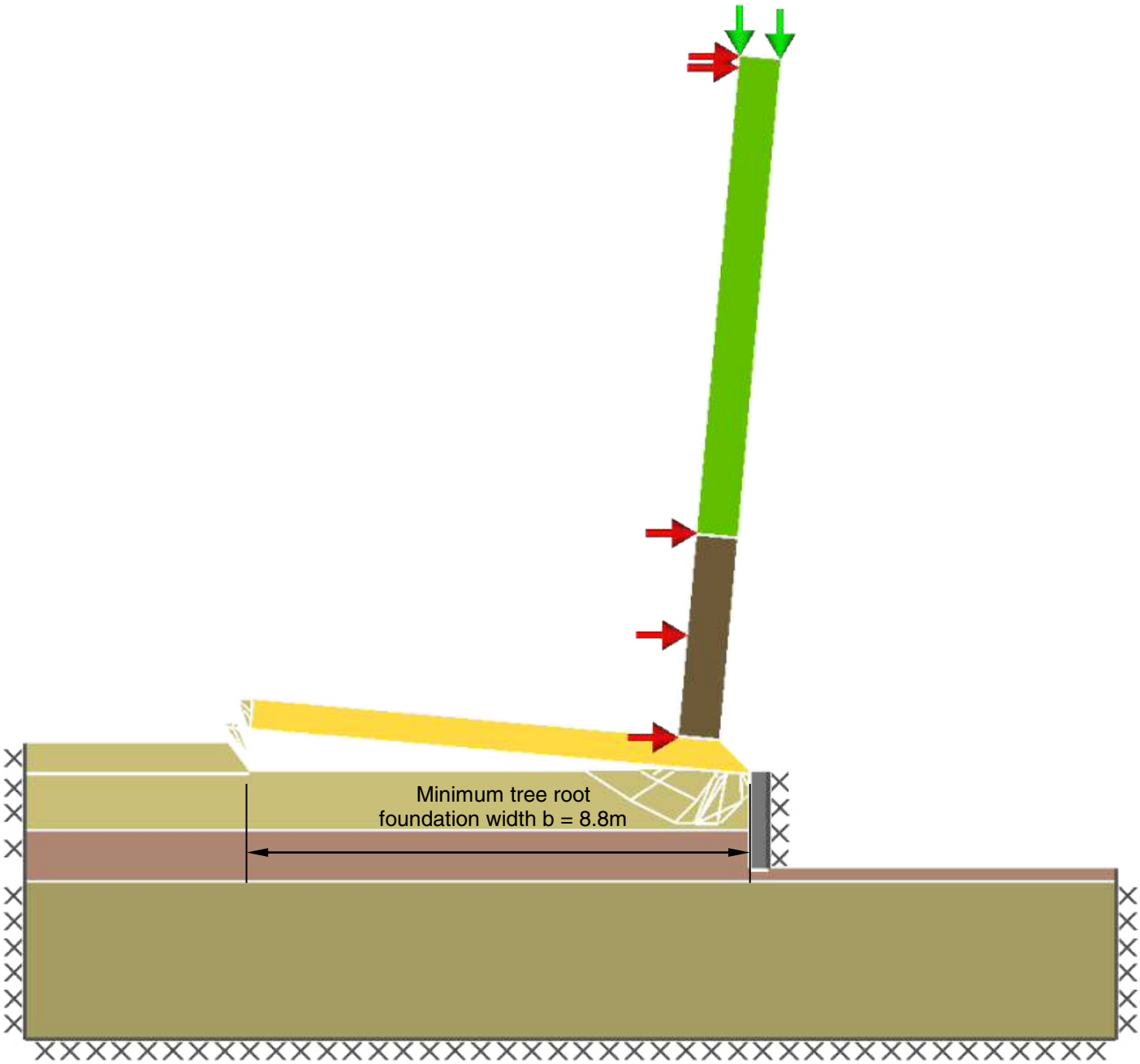


Figure 6.1.2 –Tree root foundation stability failure mode – Critical case DA1-1



7 Anchor Resistance

Based upon the results in Table 6.4.1, the retaining wall will require each row of anchors to provide a design resistance of 45kN/m. It is anticipated that the anchors will be installed within the medium dense SAND and/or the firm to stiff gravelly CLAY. For these types of materials with SPT 'N' values of 24 (SAND) and 14 (CLAY), the expected ultimate holding capacity of a 90kN MR-1 anchor would between 70kN and 80kN (see Table 7.2 below).

Table 7.2. Duckbill Ground Anchor Ultimate Holding Capacities

COMMON SOIL TYPE *Description*	GEOLOGICAL SOIL *Classification*	Typical Blow Count 'N'	MR-88	MR-4	MR-3	MR-2	MR-1	SR1
Very Dense and/or Cemented Sands; Coarse Gravel and Cobbles	Caliche; Nitrate-Bearing Gravel/Rock	60-100+	20	45	55	90	100	300
Dense Fine Sand; Very Hard Silts and Clays	Basal Till; Boulder Clay Caliche; Weathered Rock	40-60	20	40	50	80	100	250
Dense Clays; Sands and Gravels; Hard Silts and Clays	Glacial Till; Weathered Shales; Schist Gneiss; Siltstone	35-50	18	35	45	75	95	250
Medium Dense Sandy Gravel; Very Stiff to Hard Silts and Clays	Glacial Till; Hardpan	25-40	16	30	40	60	90	180
Medium Dense Course Sand and Sandy Gravel; Stiff to Very Stiff Silts and Clays	Saprolites; Residual Soils	14-25	14	25	35	60	80	180
Loose to Medium Dense Fine to Coarse Sand; Firm to Stiff Clays and Silts	Dense Hydraulic Fill; Compacted Fill; Residual Soils	7-14	12	20	30	50	70	150
Loose Fine Sand; Aluvium; Soft-Firm Clays; Varied Clays; Fill	Flood Plain Soils; Lake Clays; Adobe; Gumbo Fill	4-8	4-7	7-11	13-22	22-26	50	100
Peat; Organic Silts; Inundates; Silts; Fly Ash	Miscellaneous Fill; Swamp Marsh	0-5	0.9-4	1.3-7	3.5-13	9-22	13-37	20-60

The design value of the anchorage resistance, $R_{a,d}$, is derived from the characteristic value of pull-out resistance $R_{a,k}$ based on suitability tests. The design value, $R_{a,d}$, is obtained from the characteristic value by applying a partial factor, γ_a. In EN1997-1, the recommended value for the partial factor γ_a. is 1.1. A correlation factor ξ_a that accounts for the number of tests and variability of results is applied to the test results.

One site test was performed on a Type MR-1 anchor installed at 2.2m depth (see results in Appendix 1). The measured minimum holding capacity for the anchor was reported as follows:

$$R_{a.measured.min} = 95kN \text{ (Type MR-1)}$$

Allowing for a correlation factor of ξ_{a2} =1.20 based upon the results of less than three on-site tests, the characteristic values are:

$$R_{a,k} = R_{a.measured.min} / \xi_{a2} = 95 / 1.20 = 79.2kN \text{ per anchor (Type MR-1)}$$

Hence, the design resistance of the anchor is:

$$R_{a.d} = R_{a.k} / \gamma_a.$$

$$R_{a.d} = 79.2 / 1.10 = 72.0kN \text{ (Type MR-1)}$$

The design value of the anchorage resistance, $R_{a,d}$, represents a limit of the lock-off anchor load that can be applied to the installed anchors. To avoid creep deformation, it is advisable to select a lock-off load value, P_0, sufficiently lower than the characteristic resistance, $R_{a.k}$. EN1537 recommends that the lock-off force should not be greater than 0.65 times the characteristic resistance, $R_{a.k}$.

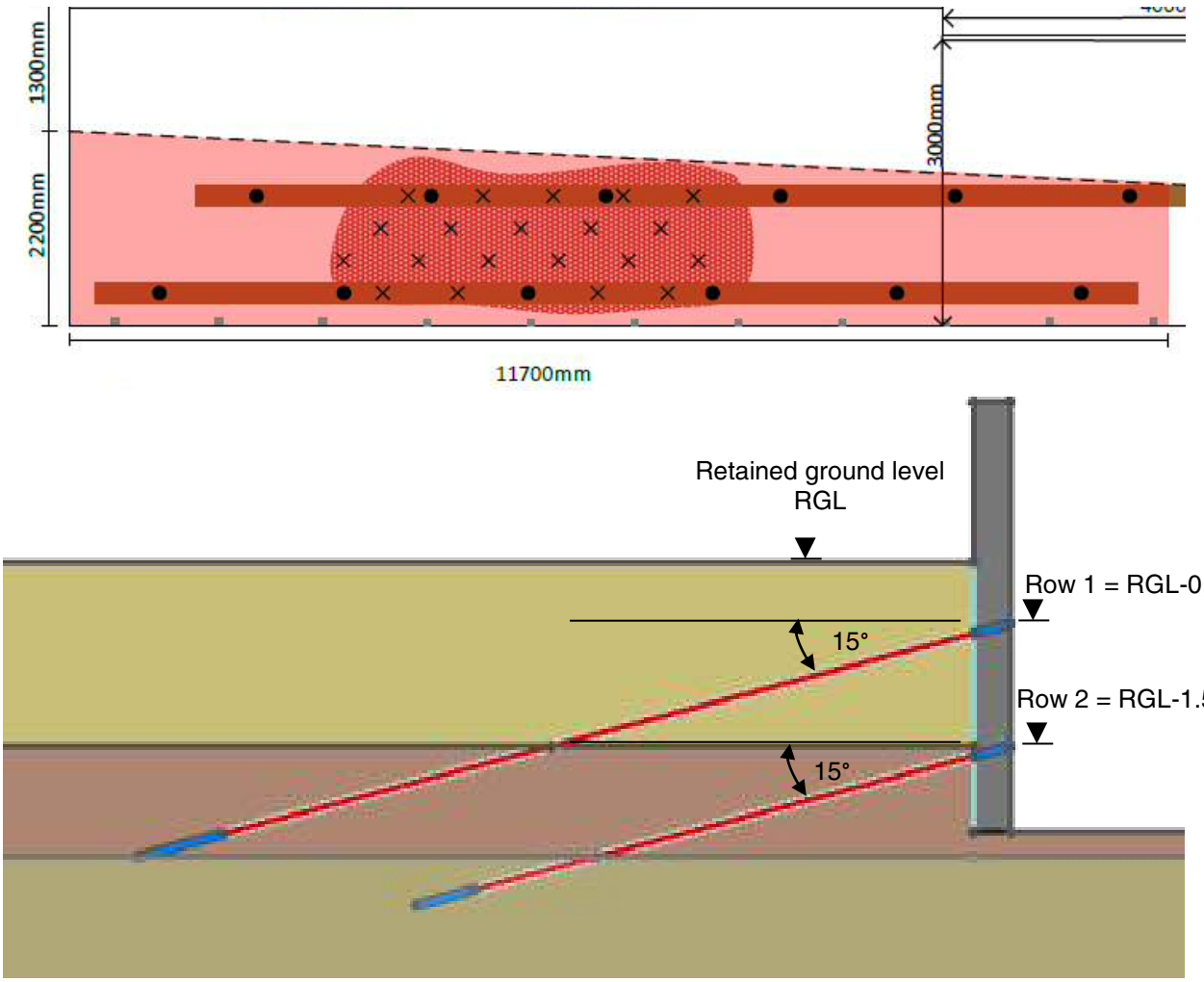
Hence, the lock-off load, P_0 of the anchors, taking account of creep deformation should not exceed:

$$P_0 \leq 79.2 \times 0.65 = 51.5kN \text{ (Type MR-1)}$$

8 Anchor Layout

Based upon the global stability analyses and the results of the site test, the following anchor layout is proposed:

8.1 Design Section 1-1



Row	*Min. anchor length (1) (m)*	*ULS anchor force per row (kN/m)*	*ULS anchor force per row (kN)*	*Minimum No. of anchors required*	*Proposed No. of anchors*	*Horizontal spacing (m)*
1	7.5	45.0	526.5	7.3	8	1.50
2	5.0	45.0	526.5	7.3	8	1.50

Note:

1) Minimum number of anchors based upon a design resistance $R_{a,d}$ = 72kN per anchor.
2) Anchors to be evenly distributed over 11.7m length of wall requiring stabilisation.
3) Minimum anchor length refers to the length of the installed anchor AFTER the anchor has been tensioned and rotated into the 'locked' position.
4) All anchors are Type MR-1 in stainless steel.
5) All anchors are installed inclined downwards from the horizontal at an angle of 15º
6) All anchors to be proof tested to 65kN and locked off at 52kN

ANCHOR SYSTEMS (EUROPE) LTD

St Astier Ltd
Former La Sagesse Scool
Site test carried out 03/02/2015
ASEI personel present,
Jordan Smith.

Anchor Type	MR-1	Anchor length 3m
Anchor max proof load	95kN	Anchor Inclination 90 deg
Site Location	Newcastle	Bar type Gewi
Test Anchor Ref:	MR-1	Bar diameter 16mm
Date Installed:	03/02/2015	
Date Tested:	03/02/2015	
Load required		90kN
Bar extraction during load		800mm

Test number	Installation times	Instalation Depth	Bar exstension	Plate loss	Finished anchor depth	Load Achived
1 - MR-1	8min approx	3m	800mm	0mm	2.2m	95kN

Notes
MR- 1 anchor installed into medium dense ground conditions vertically with approximate drive time of 8 minutes.
95kN load capacity acheived on vertical test of anchor with 800mm bar extension. Access to retaining wall limited with only hand held installation
equipment possible.

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Anchor Systems (Europe) Limited
Unit 45, Rowfant Business Centre
Wallage Lane, Rowfant
West Sussex
RH10 4NQ

Report No:	13010519
PO Number:	DB0013642
Date of Issue:	15/01/2013
Test Date :	14/01/2013
Tested in accordance with :	MTP 2 & Cust Req's

Testing Report

Description: Duckbill Anchor C/W Steel Pin, Shackle and all threaded bar

Method of Test:

The samples were tested in a universal testing machine serial number T49 calibrated to national standards.
The samples were held using fittings suitable for both the machine and the items under test.
Loading was applied uniformally in tension until no further load could be applied or failure occurred.

Results:

Test Number	Marks	Maximum Load kN	Maximum Load Ton	Remarks
--	MR1 II 90kN	195.3	19.60	Fracture occurred across both sides of the clevis

Issued By:

B Bullen

Assistant Manager Mechanical Testing

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Report No:	13080146
PO Number:	Hadley 001
Date of Issue:	14/08/2013
Test Date :	07/08/2013
Tested in accordance with :	MTP2 & Cust Req's

Testing Report

Description: AS-20 SG Iron anchor head complete with SG iron shackle fitted with 16mm diameter left hand thread gewi bar galvanised assembly. (Item marked 3)

Method of Test:

The samples were tested in a universal testing machine serial number T49 calibrated to national standards.

The samples were held using fittings suitable for both the machine and the items under test.

Loading was applied uniformally in tension until the required proof load had been achieved.

Items Marked	Max Load kN	Safe Working Load kN
3	70.74	20kN

Remarks:
Fracture occured at the pin hole locating lug of the anchor plate.

Issued By:

L Mangham

Operations Manager