

 ROGER BULLIVANT	Project No: MG.18.7221	
Roger Bullivant Ltd. Walton Park, Hearthcote Road Swadlincote Derbyshire DE11 9DU	Reviewed by: DT	Date: 10/10/19
	Approved by:	Date:
Title: Phase 4, Green Park Village, Reading Berkley Homes (Western) Limited		

Design Calculations

Vibro Ground Improvement



We note that our respective representatives are continuing negotiations over contractual terms and conditions for the above project. The enclosed information is therefore provided without prejudice and subject to contract and must not be used for any purpose which has not been authorised by Roger Bullivant Limited.

Contents

1. Introduction
2. Design Methodology
3. Ground Conditions
4. Soil Parameters
5. Ground Improvement Specification
6. Ground Improvement Design
7. Ground Improvement Testing
8. Discussion & Recommendations

Appendix A – Site Investigation Extracts

Appendix B – VSC Design Calculations

Appendix B – Roger Bullivant Ltd – Ground Improvement Data Sheet

1. Introduction

This document summarises the design methodology, soil model and calculations for the Ground Improvement process of Vibro Stone Columns (VSC's) utilising equipment developed by Roger Bullivant Limited, to support the reinforced strip foundations.

The object of the ground treatment is to improve the density of the near surface soils thus providing a uniform bearing stratum beneath the building foundation lines to reducing total and differential settlement.

2. Design Methodology

The Roger Bullivant Limited design method is an iterative process based on standard methodologies:

- Load carrying capacity – Hughes & Withers, 1974
- Factor of Safety against bulging – Baumann and Bauer, 1974
- Settlement reduction factor – Priebe, 1995

The following information has been utilised in the generation of the Ground Improvement Design:

- Site Investigation Report Peter Brett Associates report 11321/300/SNK/KB/RP/LG
- Foundation Drawings 5361-2000 P1, 2010 P1, 2011 P1, 2012 P1, 2013 P1, 2014 P1
- Specification Ramboll document 1620000492/SP/002
- For VSC design a 500mm dia. column is assumed for calculation assessment.

3. Ground Conditions

The recorded ground conditions typically comprised soft to firm sandy occasionally gravelly clay (alluvium), overlying medium dense gravels (river terrace deposits), in turn overlying stiff clays overlying very dense sands (Lambeth group).

In addition to the recorded geology, the site has been up filled by up to 1.8m in accordance with Rambol specification 1620000492/SP/001. An additional 30kN/m² has been allowed for within the settlement analysis to make allowance for the change in stress profile with in existing soils due to surcharge from the new upfill.

Significant ground water inflows were not encountered, however some seepages were encountered. Standing water was not observed within the treatment zone.

One clay sample tested indicated a high PI > than 40%, however samples taken from the same borehole at different depths indicate PI of 25%. Given that the high PI occurs in an isolated sample only it is considered that the stone column performance will not be adversely effected. Berkley Group should confirm this with the NHBC.

4. Soil Parameters

The soil model (calcs section 6) has been developed in conjunction with the site investigation information provided and viewing additional trial pits prior to undertaking vibro ground improvement treatment.

To supplement the existing laboratory testing a worst case model was devised presenting typical values for a soft cohesive material accounting for both the fill material and the alluvium.

The unit weight values adopted in our VSC design (calcs section 2) are based on typical values specified within BS8004:1986 'Code of Practice for Foundations'.

Soil descriptions are in accordance with BS5930:1999 'Code of Practice for Site Investigations'.

5. Ground Improvement Specification

The ground improvement design has been prepared to conform with Ramboll specification document 1620000492/SP/002

Allowable Bearing Capacity	Strip Foundations	125kN/m ²
Settlement Requirements	Total Settlement	25mm
	Differential Settlement	1 in 500
VSC aggregate description	Type 6F Granular fill – coarse gravel (grading 75-40mm).	

6. Ground Improvement Design

The design calculations have been carried out using methodology developed by Roger Bullivant Limited and are presented on the VSC Design Spreadsheet

The design applies the previously discussed borehole and trial pit logs to simulate representative anticipated ground conditions present across the site.

6.1 Load Carrying Capacity

Refer to the attached VSC design sheet for carrying capacity of a single column.

Adopting the method proposed by Hughes & Withers, 1974 the ultimate bearing capacity of a single VSC in the soils present is **887 KN/m²**

6.2 VSC Length`

The design calculations highlight that a target depth of around **3.0m** will provide suitable settlement control against the loadings detailed in section 5.0. Due to ground conditions and working levels anticipated, column lengths in the range of 2.5m to 3.5m will be expected. Terminating upon refusal on natural competent strata.

6.3 Factor of Safety against Bulging

Refer to the attached VSC design sheet for FoS against bulging.

A FoS = **1.5 minimum** (1.5 is generally considered to be an acceptable factor of safety against bulging).

6.3 Predicted Settlement

Refer to the attached VSC design sheet for settlement analysis and improvement factor.

From calculation, the predicted total settlement for the foundation elements are expected to be limited to 25mm.

7. Ground Improvement Testing

To enable verification of the ground treatment, the following testing regime has been agreed with the Client's Engineer in advance of the works:

	Plate Load Test	Dummy Footing Test
Type	600mm dia. plate	1500mm x 0.6m plate
Test Location	Client to provide of RB's shall choose at random	Client to provide of RB's shall choose at random
Min. Frequency	1 per 100 VSC installed or 1 per rig per shift/day	1 per 500 VSC installed
Total Number Included	7	2

Testing shall generally be in accordance with the Ramboll Specification.

8. Discussion & Recommendation

It should be noted that prior to casting any foundation, the formation level should be inspected by a competent operative to ensure that no soft spots or localised deposits of compressible / organic material is present within the made ground that may not have been identified during the site investigation.

In the event of buried obstructions being encountered (e.g. old foundations), these should be grubbed out by the main contractor and replaced with wholly granular material to prevent the vibro scheme being compromised.

Appendix A

Site Investigation Extracts

Drilling Method Cable Percussion				Borehole Diameter 200mm to 8.00m 150mm to 10.00m		Casing Diameter 200mm to 3.50m 150mm to 9.50m		BOREHOLE No. BH103	
Equipment Dando 2000				Logged by JOK 26/03/2002		Compiled by pb 04/04/2002		Checked by <i>MB</i> <i>24/6</i>	
Dates Drilled Start 26/03/2002 End 27/03/2002				Coordinates (National Grid) 470094.6 E 170354.2 N Ground Level 37.93 m OD					

Date & Time	Casing Depth (m)	Depth to Water (m)	Sample Details			SPT Blows/N Dilva mm Test Result	U100 Blows/ Recovery mm Result	Description of Strata	Depth (Thickness) (m)	Level	Legend	
			Depth (m) From To	Type	No.							
26/03	nil	0.95	0.30-0.50	B	1	35/ 250		Turf and TOPSOIL (Drillers description) Soft pale brown and yellow brown mottled sandy CLAY/SILT. Sand is fine. With occasional roots. (ALLUVIUM)	(0.10) 0.10	37.83		
0.90-1.10			B	2	(1.20)							
0.95			W	5								
1.20-1.45			U	3								
			1.45	D	4	C10		Possibly medium dense dark grey, grey and brown clayey sandy GRAVEL. Grades with depth into silty sandy gravel. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse flint. (RIVER TERRACE DEPOSITS)	1.30	36.63		
2.20	1.00	2.20	B	6	(1.40)							
2.20	1.00	2.20-2.65										
2.70	1.60	2.70-3.00	B	7								
			3.10	2.70	3.10-3.50	U	8	50/ 400		2.70	35.23	
			3.50	D	9							
26/03	3.50	3.60										
27/03	3.50	3.90	3.90	W	16	S34						
	3.50	dry	4.10	D	10							
			4.10-4.55									
	3.10	dry	5.10-5.55	U	11			80	(4.80)			
			5.55	D	12	S41						
			6.50	D	13							
		dry	6.50-6.95									
			8.00-8.45	U	14							80
			8.45	D	15							
			8.60-8.90	B	17							
	8.60	3.90										
			9.50	D	18							S49/ 225
			9.50	3.60	9.50-9.88							
27/03	9.50	3.60						End of Borehole	10.00	27.93		

Remarks	1 On completion of boring a 50mm diameter standpipe was installed to 2.70m. See separate sheet for details.
(See notes & key sheets)	2 Groundwater was encountered at 7.50m during boring.
	3 Prior to boring a Cable Avoidance Tool (CAT) survey was carried out. An inspection pit was hand-dug to 1.20m depth and rescanned using the CAT to check for services. Services were not located.
	4 Groundwater was encountered at 1.10m during boring and rose to 0.95m after 20 mins.

Scale 1:60	Project GREEN PARK READING - PHASE III	Contract No. 801395
 FOUNDATION & EXPLORATION SERVICES	Figure No. FR3 (1 of 2)	301.02

Drilling Method Cable Percussion		Borehole Diameter 200mm to 6.70m 150mm to 18.30m	Casing Diameter 200mm to 3.00m 150mm to 18.00m	BOREHOLE No. BH104	
Equipment Dando 2000		Logged by JOK 28/03/2002		Coordinates (National Grid) 470216.9 E 170330.3 N Ground Level 37.90 m OD	
Dates Drilled Start 28/03/2002 End 02/04/2002		Compiled by pb 08/04/2002		Checked by <i>NAH</i> <i>24/4</i>	

Date & Time	Casing Depth (m)	Depth to Water (m)	Sample Details			SPT Blows/N Drive mm	U100 Blows/ Recovery mm	Description of Strata	Depth (Thickness) (m)	Level	Legend
			Depth (m) From To	Type	No.						
28/03	Nil	Dry	0.40-0.60	B	1	c13		Turf and TOPSOIL (Drillers description)	(0.10)	37.80	
		0.60	0.60	W	3			Soft to firm dark brown occasionally gravelly slightly sandy CLAY. Sand is mainly fine. Gravel is mainly subangular and subrounded fine and medium flint. Occasional roots. (ALLUVIUM)	0.10 (0.55)	37.25	
		0.60	0.90-1.10	B	2			Firm orange brown slightly sandy and gravelly CLAY. Sand is fine to coarse, gravel is mainly subangular and subrounded fine to coarse flint. (ALLUVIUM)	(0.55)		
	nil	dry	1.20	B	4			Medium dense brown and grey silty sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, subangular and subrounded flint. Occasional roots at top of unit. (RIVER TERRACE DEPOSITS)	1.20	36.70	
		1.30	1.20-1.65	W	13	c13					
			2.20	B	5				(1.50)		
	2.20	1.00	2.20-2.65	B	5	c13					
			2.70	B	6				2.70	35.20	
28/03	3.00	2.90	2.70-3.00	B	6	s34	60	Stiff becoming very stiff with depth, multicoloured (blue grey, red, yellow, brown) slightly sandy to sandy CLAY. Sand is fine. Occasional subrounded fine red mudstone gravel at top of unit. Locally friable. (LAMBETH GROUP)			
02/04	3.00	2.90									
		Dry	3.50-3.95	U	7						
			3.95	D	8	s34					
	3.00	dry	4.30	D	9				(4.00)		
			4.30-4.75			s50/195	70/300				
			5.40-5.70	U	10						
			5.70	D	11						
	6.73	1.30	6.70	D	12	s50/195		Very dense brown and blue grey mottled clayey SAND. Sand is fine. (LAMBETH GROUP)	6.70	31.20	
			6.70-7.05						(1.30)		
			8.10	D	14	s50/200			8.00	29.90	
			8.10-8.45					Very dense blue grey and green grey silty SAND with occasional lenses of clayey sand. Sand is fine. (LAMBETH GROUP)			
	9.50	3.20	9.50	D	15	s50/140					
			9.50-9.79								

Remarks (See notes & key sheets)

- Groundwater was encountered at 6.70m during boring.
- Prior to boring a Cable Avoidance Tool (CAT) survey was carried out. An inspection pit was hand-dug to 1.20m depth and rescanned using the CAT to check for services. Services were not located.
- Groundwater was encountered at 0.20m during boring and rose to 0.20m after 20 mins.

Scale 1:50



**FOUNDATION
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SERVICES**

Project
GREEN PARK
READING - PHASE III

Contract No. B01395

Figure No. FR4 (1 of 3)

30/03

Drilling Method Cable Percussion			Borehole Diameter 200mm to 6.50m 150mm to 25.00m		Casing Diameter 200mm to 6.50m 150mm to 27.70m		BOREHOLE No. BH105	
Equipment Dando 2000			Logged by JOK 27/03/2002		Compiled by pb 09/04/2002		Coordinates (National Grid) 470065.0 E 170191.7 N Ground Level 37.95 m OD	
Dates Drilled Start 27/03/2002 End 03/04/2002								

Date & Time	Casing Depth (m)	Depth to Water (m)	Sample Details			SPT Blows/m Drive mm	U100 Blows/ Recovery mm	Description of Strata	Depth (Thickness) (m)	Level	Legend
			Depth (m) From To	Type	No.						
27/03	1.20	0.60	0.10-0.15	D	1	C20	50	TOPSOIL (Drillers description)	(0.10)	37.85	
			0.10-0.35	B	2			Firm brown sandy occasionally gravelly CLAY. Sand is mainly fine. Gravel is subangular and subrounded fine and medium flint. Occasional roots. (ALLUVIUM)	(0.10)		
			0.35-0.40	D	3				(0.25)		
			0.35-0.65	B	4				(0.35)		
			0.65-0.65	W	5						
	2.20	0.50	1.20-1.65	B	6			C7	Medium dense grey and brown clayey sandy GRAVEL grading with depth into silty sandy GRAVEL. Sand is fine to coarse, gravel is angular to subrounded, fine to coarse flint. Contains roots at top of unit. (RIVER TERRACE DEPOSITS)	(2.75)	
			1.20-1.65								
			1.70-1.75	D	7						
	3.20	3.00	2.20-2.65	B	8						
			2.20-2.65								
	3.20	3.00	2.70-2.75	D	9						
			3.10-3.15	D	10						
3.20	3.00	3.10-3.60	B	11		Stiff blue grey and brown mottled CLAY. Slightly fissile and friable with depth. (LAMBETH GROUP)	3.10	34.85			
		3.20-3.65	U	12							
27/03	3.20	3.00	3.65-3.70	D	13			(1.00)			
28/03	3.20	Nil	4.10-4.15	D	14	S50/ 160	Very dense blue grey, brown and grey mottled silty SAND with occasional clay lenses. Locally grades into clayey sand. Sand is mainly fine. (LAMBETH GROUP)	4.10	33.85		
			4.10-4.50	B	15						
			4.20-4.51								
			4.20-4.50	D	16						
			4.20-4.50	D	17						
28/03	5.70	1.95	5.70-5.98	D	18	S50/ 95					
			5.70-5.95								
02/04	6.50	0.45	6.50-6.55	D	19	S50/ 60					
			7.20-7.45	D	20						
			7.20-7.37								
			8.00-8.05	D	21						
			8.70-9.15	D	22						
8.70	2.90		8.70-9.13			S50/ 275					
			9.60-9.65	D	23						

Remarks (See notes & lay sheets)

- Groundwater was encountered at 0.65m during boring and rose to 0.60m after 20 mins.
- Prior to boring a Cable Avoidance Tool (CAT) survey was carried out. An inspection pit was hand-dug to 1.20m depth and rescanned using the CAT to check for services. Services were not located.
- On completion a 50mm diameter standpipe was installed to 25.00m. See separate sheet for details.

Scale 1:50

 FOUNDATION & EXPLORATION SERVICES	Project GREEN PARK READING - PHASE III	Contract No. 801395
		Figure No. FR5 (1 of 4)

301/03

Appendix B

Ground Improvement Design – Vibro Stone Columns

VIBRO-STONE COLUMN DESIGN
COHESIVE SOILS



ROGER BULLIVANT

Project : Phase 4, Green Park Village, Reading

Job No : MG187221

File name : Foundation (600w)

Revision :

Based on : Peter Brett Associates report 11321/300/SNK/KB/RP/LG

Input by : DT

Revised by :

Chkd By :

Appr. For

Constr. :

Date : 10-Jan-19

Date :

Date :

Date :

1 Foundation/Floor Slab Details

Foundation/floor slab type Foundation

Found. Depth, F_s (m) = 0.60

Foundation length, L (m) = 6

Foundation breadth, B (m) = 0.6

Bearing pressure, q_o (kN/m^2) = 155

Load on soil surrounding columns,
 p (kN/m^2) = 0

Thickness of capping layer, t = 1.8

2 Soil Details

Description of Soil sandy gravelly clay fill

Cohesion, c_u (kN/m^2) = 35

Bulk unit weight, γ (kN/m^3) = 18

3 Stone Column Details

Description of Column Aggregate 75mm-40mm Aggregate

Angle of internal Friction, ϕ'_c = 40

Diameter of the Column, D , (m) = 0.5

Assumed Column Spacing, x (m) = 1

Area of influence of column, A_o = Square Grid = 1.00

Triangular Grid = 0.87

A_o for design = 1

VIBRO-STONE COLUMN DESIGN
COHESIVE SOILS



ROGER BULLIVANT

Project : Phase 4, Green Park Village, Reading

Job No : MG187221

File : Foundation (600w)

Revision : 0

6 Settlement Reduction Factor (Priebe, 1995)

Settlement reduction factor, (see notes for formula)

SRF = 2.19

Where: A_c = Area of column
 A_o = Area of influence of column
 K_{ac} = Coefficient of earth pressure for column
 F = Factor based on v (see notes)
 v = Poissons ratio for the soil

m^2
 m^2
 $\tan^2(45 - \phi_c/2)$

0.196
1
0.217
0.943
0.3

7 RB Method Correction Factor

RB method correction factor based upon foundation type

1

Therefore, the corrected settlement reduction factor for design

RB SRF = 2.19

**VIBRO-STONE COLUMN DESIGN
COHESIVE SOILS**



ROGER BULLIVANT

Project : Phase 4, Green Park Village, Reading

Job No : MG187221

File : Foundation (600w)

Revision :

Input by : DT

Revised by :

Chkd By :

Appr. For

Constr. :

Date : 08-May-17

Date :

Date :

Date :

8 Long Term Settlement (Consolidation)

Foundation / floor slab type Foundations

Foundation length, L (m) = 6

Foundation breadth, B (m) = 0.6

Applied Load, q_o (kN/m²) = 155

Layer Thickness, H (m) = 0.5

A_o = 1.0

Overall settlement reduction factor = 2.19
(Preibe x R.B Factor)

Treatment depth (m) = 3.0

Settlement, ρ = H x σ_v x m_v

Where σ_v = vertical stress at centre of layer, after Fadum 1941
 m_v = Coefficient of volume compressibility

LAYER	DEPTH TO BOTTOM OF LAYER (m)	STRESS AT CENTRE OF LAYER (kN/m ²)	m_v (m ² /MN)	SETTLEMENT IN LAYER WITHOUT TREATMENT (mm)	SETTLEMENT WITH REDUCTION FACTOR (mm)
1	0.50	134.971	0.109	7.34	3.35
2	1.00	71.469	0.109	3.88	1.77
3	1.50	45.227	0.109	2.46	1.12
4	2.00	32.291	0.167	2.70	1.23
5	2.50	24.538	0.167	2.05	0.94
6	3.00	19.331	0.167	1.61	0.74
7	3.50	15.596	0.167	1.30	1.30
8	4.00	12.809	0.167	1.07	1.07
9	4.50	10.675	0.167	0.89	0.89
10	5.00	9.008	0.167	0.75	0.75
11	5.50	7.685	0.167	0.64	0.64
12	6.00	6.621	0.043	0.14	0.14
13	6.50	5.755	0.043	0.12	0.12
14	7.00	5.042	0.043	0.11	0.11
15	7.50	4.449	0.043	0.10	0.10
16	8.00	3.952	0.043	0.08	0.08
17	8.50	3.532	0.043	0.08	0.08
18	9.00	3.173	0.043	0.07	0.07
19	9.50	2.866	0.043	0.06	0.06
20	10.00	2.599	0.043	0.06	0.06

Comments

$m_v = 1/(f_2 \cdot N)$
 $f_2 = 0.46$

TOTAL SETTLEMENT WITHOUT TREATMENT (mm)	TOTAL SETTLEMENT WITH TREATMENT (mm)
25.51	14.62

**VIBRO-STONE COLUMN DESIGN
COHESIVE SOILS**



ROGER BULLIVANT

Project : Phase 4, Green Park Village, Reading

Job No : MG187221

File : Foundation (600w)

Revision :

Input by : Revised by : Chkd By : Appr. For
Constr. :

Date : Date : Date : Date :

9 Short Term Settlement (Elastic Compression)

Foundation / floor slab type

Foundation length, L (m) = 6

Foundation breadth, B (m) = 0.6

Applied Load, q_o (kN/m²) = 100

Layer Thickness, H (m) = 0.5

A_o = 1.1

Overall settlement reduction factor = 2.00
(Preilbe x R.B Factor)

Treatment depth (m) = 6.0

Settlement, ρ = $H \times \sigma_v / E_o$

Where σ_v = vertical stress at centre of layer, after Fadum 1941
 E_o = Soil Modulus

LAYER	DEPTH TO BOTTOM OF LAYER (m)	STRESS AT CENTRE OF LAYER (kN/m ²)	SOIL MODULUS E_o (MN/m ²)	SETTLEMENT IN LAYER WITHOUT TREATMENT (mm)	SETTLEMENT WITH REDUCTION FACTOR (mm)
1	0.50	87.078			
2	1.00	46.109			
3	1.50	29.179			
4	2.00	20.833			
5	2.50	15.831			
6	3.00	12.472			
7	3.50	10.062			
8	4.00	8.264	10	0.41	0.21
9	4.50	6.887	10	0.34	0.17
10	5.00	5.811	10	0.29	0.15
11	5.50	4.958	10	0.25	0.12
12	6.00	4.271			
13	6.50	3.713			
14	7.00	3.253			
15	7.50	2.871			
16	8.00	2.550			
17	8.50	2.279			
18	9.00	2.047			
19	9.50	1.849			
20	10.00	1.677			

Comments

TOTAL SETTLEMENT WITHOUT TREATMENT (mm)	TOTAL SETTLEMENT WITH TREATMENT (mm)
1.30	0.65

Appendix C

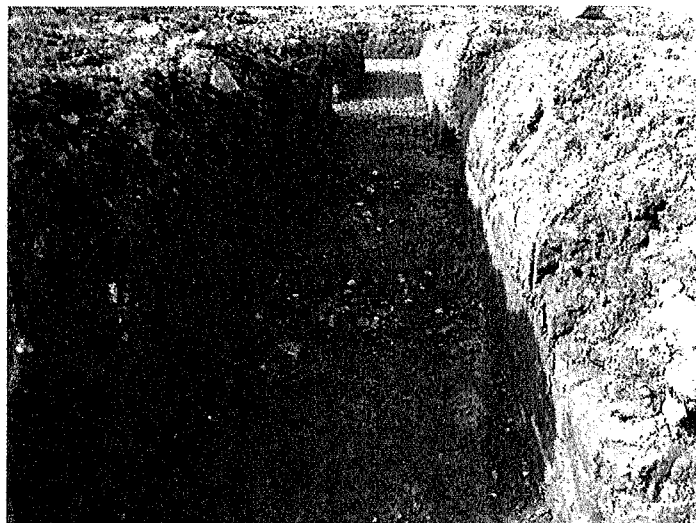
Roger Bullivant Ltd – Ground Improvement Brochure

Schedule of Piling Rig Component Weights, Dimensions, Forces and Pressures

Rig Manufacturer : ROGER BULLIVANT		Rig Type : 4007 / 4008 / 4009		
Operation mode:		Vibro		
Completed by: Neil Harris	03/11/2014	Checked by:	Chris Hibbert	
Item	Mass (kg)	Moment arm (m)	Moment (kNm)	
UPPER WORKS	12310	-0.58	-70.07	
LOWER WORKS	5025	-0.07	-3.45	
ROPE / KELLY / CHAIN SUSPENDED EQUIPMENT	4310	2.46	104.01	
COUNTERWEIGHT	0	0.00	0.00	
OTHER	750	0.05	0.37	
TOTAL	22395	0.14	30.86	
Tracks				
Track bearing length (m)	3.24			
Track pad width (m)	0.5			
Distance between centres of tracks (m)	2.35			
Front Foot Pads				
Pad Bearing Area (m ²)	0.00	Actual Dimensions	None	
Pad Maximum Loading (kN)	0.00	Actual Shape	None	
Pad Moment Arm (m)	0.00			
Rear Foot Pads				
Pad Bearing Area (m ²)	0.00	Actual Dimensions	None	
Pad Maximum Loading (kN)	0.00	Actual Shape	None	
Pad Moment Arm (m)	0.00			
Forces				
Maximum Extraction Force (kN)	97.00			
Maximum Penetration Force (kN)	97.00			
Maximum Auxiliary Force (kN)	0.00	Auxiliary Force Moment Arm (m)	0.00	
Pressure Summary for Platform Design (unfactored)				
MODE	BRE LOAD CASE (1 or 2)	Length (m)	Width (m)	UDL Pressure (kPa)
Standing	1	2.96	0.5	74
Travelling	1	2.96	0.5	74
Handling	1	2.96	0.5	74
Penetrating	2	0.99	0.5	143
Extracting	2	2.03	0.5	135
Other	NOT USED	N/A	0.5	N/A
MODE	WARNING MESSAGES	ERROR MESSAGES FOR FORCES		
Standing	None	Auxiliary Line Force OK	Extraction Force OK	Penetration Force OK
Travelling	None	Auxiliary Line Force OK	Extraction Force OK	Penetration Force OK
Handling	None	Auxiliary Line Force OK	Extraction Force OK	Penetration Force OK
Penetrating	None	Auxiliary Line Force OK	Extraction Force OK	Penetration Force OK
Extracting	None	Auxiliary Line Force OK	Extraction Force OK	Penetration Force OK
Other	None	Auxiliary Line Force OK	Extraction Force OK	Penetration Force OK
MODE	ERROR MESSAGES FOR FOOT PADS		Notes	
Standing	Front Foot Pad Force OK	Rear Foot Pad Force OK	Only for rig operation on level ground with a vertical mast, unless noted below !	
Travelling	Front Foot Pad Force OK	Rear Foot Pad Force OK	Only for use where the rig is working on a ground supported platform !	
Handling	Front Foot Pad Force OK	Rear Foot Pad Force OK	Foot pad pressures are adjusted to equalise with the track pressures !	
Penetrating	Front Foot Pad Force OK	Rear Foot Pad Force OK	Rigs to be operated in accordance with manufacturer's & employer's instructions	
Extracting	Front Foot Pad Force OK	Rear Foot Pad Force OK	This spreadsheet presents an "idealised" situation where the leader remains vertical at all times and left-to-right asymmetry is ignored. If in doubt contact Plant Design Department.	
Other	Front Foot Pad Force OK	Rear Foot Pad Force OK		
				



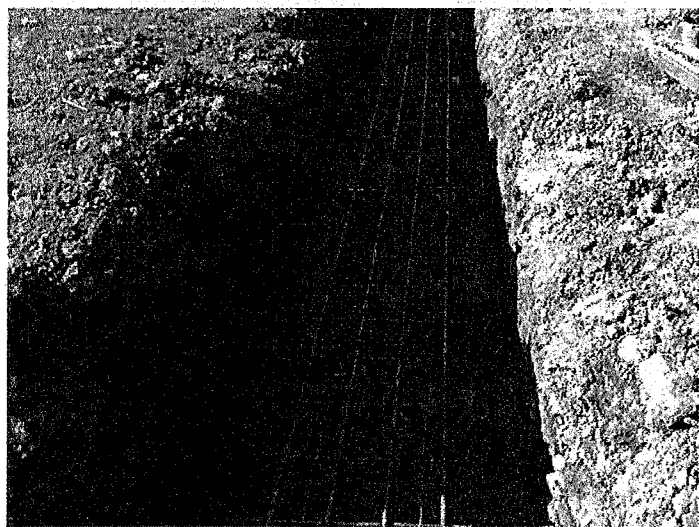
Typical Installation Process



- 1 Completed stone columns; trench to finished foundation level (foreground), with concrete blinding (background).



- 3 Finished strip footings; typically 600mm wide by 750mm deep.



- 2 Steel reinforcement (normally mesh), placed on spacer blocks on blinding layer.



- 4 Substructure blockwork (insulated trenchblock and drainage/service duct tails).

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Clackmananshire FK10 3LP
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No Harm to Anyone
A safety Initiative
by Roger Bullivant



FINALIST



PROJECT RISK APPRAISAL ASSESSMENT

RISK FACTORS	PROMPT	RATING
Site Investigation	No SI or Limited SI available. Ground Conditions may be difficult to install piles. Contamination existing on site.	
	Reasonable SI. Area well known from previous work. No apparent risk of contamination.	MED
	Good SI or preliminary tests carried out. Zero risk of contamination. Project on full re-measure.	LOW
Client	Commercial Client: Risk incurred by pile failure would be v. high. Factory or Retail complex where relocation costs/delay cost would be high.	
	Commercial Client where delays or disruption are unlikely to cause high claim costs.	MED
	Domestic or Residential Clients (Not including multiple occupancy e.g. Accommodation Blocks)	LOW
Terms & Conditions	Terms and Conditions supplied with enquiry, e-tenders, compliant tenders and past history of undue terms	
	Terms and Conditions supplied with enquiry but but subject to negotiation.	MED
	RBL Terms & Conditions likely to be accepted.	LOW
Specification	Onerous specification or outside normal RBL Product range or non-standard use of products. No testing and high Factor of Safety.	
	Any element of the specification which is unusual. Minimal testing	MED
	Standard RBL product with usual specification. Full testing requirements in accordance with ICE Specs	LOW
Operational	Restrictive access. Multi rig project. Sensitive Site or adjoining premises. Programme restraints	
	Potentially difficult aspects of the site	MED
	No onerous site issues.	LOW

	Risk Score Value	SI	Client	T&C	Spec	Operational	Total
High	3						0
Med	2			2			2
Low	1						4
		1	1	2	1	1	6

Enter Risk Score Value into corresponding column, only one score per column. Totals will automatically populate onto the Tender Appraisal Form within this workbook

Total Risk Score Approval Levels		Standard Functionary Tender Authority Levels (in accordance with GEN-WID 0316)	
Total Score	Authority Levels	Corresponding Level	
8 and Below	Level 1	Estimator & Discipline Manager	
9-10	Level 2	As Level 1 + Area Manager or Associate Director	
11	Level 3	As Level 2 + Operations Director or Nat. Commercial Manager	
12 and Above	Level 4	As Level 3 + Managing Director	

NOTES:



Indicate which of the following apply to the Project from the information provided :

		Description
1	☐	Land potentially affected by contamination
2	☐	Previously worked coal seams
3	☐	Undisturbed coal seams
4	☐	Aquifers
5	☐	Adjacent structures (state if basements)
6	☐	Publicly occupied buildings / spaces
7	☐	Controlled waters/site drainage
8	☐	Limited access / egress
9	☐	Enclosed spaces/lack of headroom
10	☐	Railways
		SITE WIDE REMEDIATION BY CLIENT
		NA
		NA
		NA
		>5M AWAY
		OCCUPIED PLOTS NOT IN VACINITY
		DRY PROCESS
		GOOD ACCESS THROUGH SITE HAUL ROAD
		NA
		NA

Indicate which of the following products are proposed :

		Potential Impact of Method													
		Noise	Vibration	Coal Authority Trespass	Pollution Rivers/Aquifers/Sie Drainage	Disturbing Ground Gases &/or leaving borehole	Exposure to soil contaminants	Displacement of Soils including Heave	Excessive Dust	Pollution from fuel / oil spill	Emissions to air	Hand Arm / Whole Body vibration	Excessive Transport Movements	None Standard Lifting Operations	
1	Driven Piling	<	<	<	<	<	<	<	<	<	<	<	<	<	
2	CFA Piling	<	<	<	<	<	<	<	<	<	<	<	<	<	
3	CHD Piling	<	<	<	<	<	<	<	<	<	<	<	<	<	
4	SFA Piling (hollow stem)	<	<	<	<	<	<	<	<	<	<	<	<	<	
5	SFA Piling (open hole)	<	<	<	<	<	<	<	<	<	<	<	<	<	
6	Odex / Symetrex Piling	<	<	<	<	<	<	<	<	<	<	<	<	<	
7	Pre-Cast Concrete Beams	<	<	<	<	<	<	<	<	<	<	<	<	<	
8	In-Situ Concrete Beams / Slabs	<	<	<	<	<	<	<	<	<	<	<	<	<	
9	Vibro Stone Columns	<	<	<	<	<	<	<	<	<	<	<	<	<	
10	Dynamic Compaction	<	<	<	<	<	<	<	<	<	<	<	<	<	
11	EcoSmart Foundations	<	<	<	<	<	<	<	<	<	<	<	<	<	
12	Site Investigation Boreholes/Geothermal	<	<	<	<	<	<	<	<	<	<	<	<	<	
13	Rotary Percussive Drilling	<	<	<	<	<	<	<	<	<	<	<	<	<	
14	Breaking out concrete / masonry	<	<	<	<	<	<	<	<	<	<	<	<	<	

CDM Design Considerations for Construction

(A brief statement works and particular design constraints using information from above assessment)

Compiled By(Print): D. TAYLOR Date: 2/1/19 Reviewed By(Initis): [Signature]

(Can be compiled by Estimator but be reviewed by a PII Authorised Engineer prior to entering into Contract)



Indicate which of the following apply to the Project from the information provided :

		Description
1	Land potentially affected by contamination	☐
2	Previously worked coal seams	☐
3	Undisturbed coal seams	☐
4	Aquifers	☐
5	Adjacent structures (state if basements)	☐
6	Publicly occupied buildings / spaces	☐
7	Controlled waters/site drainage	☐
8	Limited access / egress	☐
9	Enclosed spaces/lack of headroom	☐
10	Railways	☐

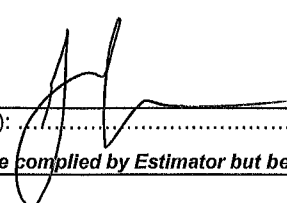
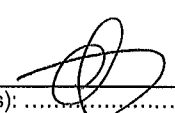
Indicate which of the following products are proposed :

		Potential Impact of Method												
		Noise	Vibration	Coal Authority Trespass	Pollution Rivers/Aquifers/Sie Drainage	Disturbing Ground Gases &/or leaving borehole	Exposure to soil contaminants	Displacement of Soils including Heave	Excessive Dust	Pollution from fuel / oil spill	Emissions to air	Hand Arm / Whole Body vibration	Excessive Transport Movements	None Standard Lifting Operations
1	Driven Piling	☹	☹	☹	☹	☹		☹		☹	☹	☹		
2	CFA Piling	☹		☹	☹	☹	☹	☹		☹	☹	☹		
3	CHD Piling	☹		☹	☹	☹		☹		☹	☹	☹		
4	SFA Piling (hollow stem)	☹		☹	☹	☹	☹	☹		☹	☹			
5	SFA Piling (open hole)	☹		☹	☹	☹	☹	☹		☹	☹			
6	Odex / Symetrex Piling	☹	☹	☹		☹	☹		☹	☹	☹			
7	Pre-Cast Concrete Beams	☹								☹	☹	☹		☹
8	In-Situ Concrete Beams / Slabs	☹								☹	☹	☹	☹	☹
9	Vibro Stone Columns	☹	☹	☹	☹	☹		☹	☹	☹	☹	☹		
10	Dynamic Compaction	☹	☹					☹	☹	☹	☹	☹		
11	EcoSmart Foundations	☹			☹		☹	☹	☹	☹	☹			
12	Site Investigation Boreholes/Geothermal	☹		☹	☹	☹	☹			☹	☹			
13	Rotary Percussive Drilling	☹	☹	☹	☹	☹	☹		☹	☹	☹			
14	Breaking out concrete / masonry	☹	☹				☹		☹	☹	☹	☹		☹

CDM Design Considerations for Construction

(A brief statement works and particular design constraints using information from above assessment)

Blank area for CDM Design Considerations for Construction.

Compiled By(Print):  Date: 10/1/19 Reviewed By(Initls): 

(Can be compiled by Estimator but be reviewed by a PII Authorised Engineer prior to entering into Contract)