EBS GEOSTRUCTURAL INC.

REFERENCE GUIDE

GEOTECHNICAL SOLUTIONS

www.ebsgeo.com

EBS GEOSTRUCTURAL

2025 v2

REFERENCE GUIDE NOTES

INTENDED USE:

It is our intention that this guide will provide a reference to evaluate the feasibility of the different geotechnical solutions.

LIMITATIONS:

This guide is provided for general information purposes only and should be used as a preliminary resource. The information contained herein is based on data and resources considered to be reliable, but the accuracy, completeness, or suitability of the information for any particular purpose is not guaranteed. Users of this guide are strongly advised to conduct site-specific investigations for their project. EBS Geostructural Inc. does not accept responsibility for any losses or damages arising from the use of this guide. Usage of this guide implies acceptance of these terms.

Please confirm this is the most up-to-date Reference Guide provided by EBS Geostructural Inc by the following:

1. Website www.ebsgeo.com
2. Contact Phone Number 519 - 648 - 3613

SQUARE SHAFT HELICAL PILE

SQUARE SHAFT HELICAL PILE NOTES:

1. Capacities are based on load testing completed by EBS Geostructural.
2. Actual pile capacities may vary based on soil conditions, access and pile depths.
3. Pile capacities to be verified during installation and/or load testing.

* Ability to install in tight access (3ft wide) and low headroom (6ft high)

SQUARE SHAFT CAPACITY

SOIL N VALUE		SHAFT SIZE		COMPRESSION				TENSION			
				SLS		ULS		SLS		ULS	
COHESIVE	NON - COHESIVE	mm	inches	kN	KIPS	kN	KIPS	kN	KIPS	kN	KIPS
25 - 35	25 - 30	* 38	1 1/2"	200	45	270	60	60	13	80	18
35 - 45	30 - 35	44	1 3/4"	370	83	500	113	115	26	150	34
50 - 60	40 -50	51	2"	500	113	670	150	205	46	270	61
65 - 100	55 - 100	57	2 1/4"	680	153	915	206	275	62	355	80

ROUND SHAFT HELICAL PILE

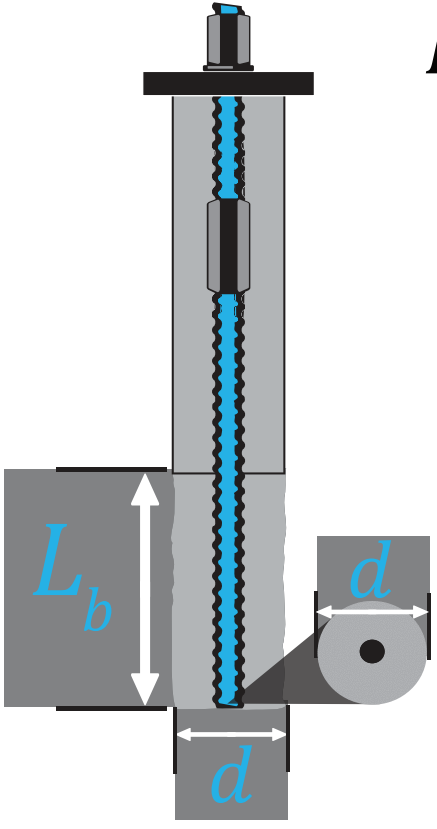
ROUND SHAFT HELICAL PILE NOTES:

1. Capacities of round shaft helical piles are calculated based on the shaft properties (diameter and wall thickness).
2. Helices are sized and spaced based on site and loading specifications.
3. Site factors influence the choice of Helical Pile size e.g. soil, access, etc.
4. Capacities stated in ranges are for varying shaft properties in that diameter.
5. EBS Geostructural recomends load testing of Helical Piles to confirm capacity.
6. Capacities provided are intended as a reference only, capacities can vary depending on the site soil conditions.
7. Larger diameter Helical Piles and custom configurations are available dependent on site specific conditions.
8. If desired, EBS Geostructural can provide design services for concrete pile caps and grade beams.

ROUND SHAFT CAPACITY

SHAFT DIA.		COMPRESSION				TENSION			
		SLS		ULS		SLS		ULS	
mm	Inches	kN	KIPS	kN	KIPS	kN	KIPS	kN	KIPS
73	2 7/8"	136	31	183	41	116	26	157	35
89	3 1/2"	198	45	268	60	170	38	230	52
114	4 1/2"	270 - 343	61 - 77	364 - 463	82 - 104	231 - 294	52 - 66	312 - 397	70 - 89
140	5 1/2"	376 - 524	85 - 118	507- 707	114 - 159	322 - 449	72 - 101	435 - 606	98 - 136
168	6 5/8"	478 - 688	108 - 155	645 -928	145 - 209	410 - 589	92 - 133	553 - 796	124 - 179
178	7"	509 - 704	114 - 158	687 - 950	155 - 214	436 - 603	98 - 136	589 - 815	132 - 183
219	8 5/8"	742 - 1082	167 - 243	1002 - 1461	225 - 329	636 - 927	143 - 209	859 - 1252	193 - 282
244	9 5/8"	822 - 1013	185 - 228	1109 - 1368	250 - 308	704 - 868	158 - 195	951 - 1172	214 - 264
273	10 3/4"	1078 - 1421	243 - 320	1455 - 1919	327 - 432	924 - 1218	208 - 274	1247 - 1645	281 - 370
324	12 3/4"	1350 - 1748	304 - 393	1823 - 2359	410 - 531	1157 - 1498	260 - 337	1562 - 2022	352 - 455

MICROPILE GEOTECHNICAL CAPACITY FORMULA



$$P_r = \varphi_q \cdot q_u \cdot (L_b \cdot \pi \cdot d)$$

φ_q = **Geotechnical Resistance Factor**
(0.6 Compression, 0.4 Tension)

q_u = **Ultimate Geotechnical Bond Stress**

d = **Nominal Drill hole Diameter**

L_b = **Effective Bond Length**

MICROPILE NOTES:

1. Grout-to-Ground or rock bond values taken from FWHA NHI-05-039 Micropile Design & Construction Reference Manual
2. Micropile Capacities are maximum values based on the following:
   a)Micropile Diameter **b)**Bond Length **c)**Bar Diameter **d)**Bar Capacity

ROCK BONDED MICROPILE

ROCK DESCRIPTION	GROUT-TO-ROCK TYPICAL BOND (kPA)	ULS CAPACITIES kN (KIPS)					
		DIAMETER OF MICROPILE INTO ROCK					
		108mm Ø		149mm Ø		209mm Ø	
		COMPRESSION	TENSION	COMPRESSION	TENSION	COMPRESSION	TENSION
Soft Shales (Fresh - moderate fracturing, little to no weathering)	375 (Range 205 to 550)	**560** (126)	**370** (83)	**1050** (236)	**700** (158)	**1470** (330)	**980** (220)
Slates and Hard Shales (Fresh - moderate fracturing, little to no weathering)	950 (Range 515 to 1380)	**630** (142)	**420** (95)	**1240** (279)	**820** (185)	**2900** (653)	**1900** (428)
Limestone (Fresh - moderate fracturing, little to no weathering)	1550 (Range 1035 to 2070)	**690** (155)	**460** (104)	**1440** (324)	**960** (216)	**3660** (824)	**2440** (549)
Granite and Basalt (Fresh - moderate fracturing, little to no weathering)	2800 (Range 1380 to 4200)	**720** (162)	**480** (108)	**1570** (353)	**1050** (236)	**3800** (855)	**2530** (569)

SOIL BONDED MICROPILE

SOIL DESCRIPTION	GROUT-TO-SOIL TYPICAL BOND (kPA)	ULS CAPACITIES kN (KIPS)					
		DIAMETER OF MICROPILE INTO SOIL					
		140mm Ø		178mm Ø		244mm Ø	
		COMPRESSION	TENSION	COMPRESSION	TENSION	COMPRESSION	TENSION
Silt and Clay (Stiff, dense to very dense)	80 (Range 45 to 120)	**250** (56)	**165** (37)	**320** (72)	**215** (48)	**440** (99)	**290** (65)
Glacial Till (Medium – very dense)	145 (Range 95 to 190)	**460** (104)	**305** (69)	**585** (132)	**390** (88)	**800** (180)	**535** (120)
Sand (Fine coarse, dense to very dense)	165 (Range 70 to 265)	**525** (118)	**350** (79)	**665** (150)	**440** (99)	**910** (205)	**605** (136)

OLIVIER DISPLACEMENT PILE

OLIVIER DISPLACEMENT PILE NOTES:

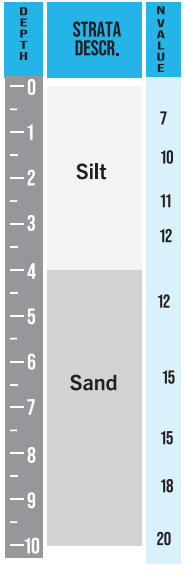
Theoretical capacities of Olivier Piles are calculated based on the cumulative Shaft Resistance over the depth of the pile. CPT (Cone Penetration Testing) data is preferred for these calculations.

In Compression: The Base Resistance (end bearing) of the pile is added to the cumulative Shaft Resistance.
In Tension: Only the cumulative Shaft Resistance (Friction) is used.

EXAMPLE:

Follow this example for guidance using the chart.

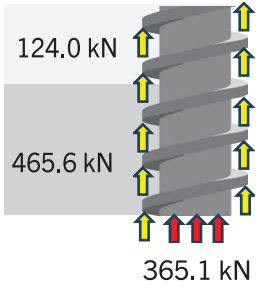
The sample N Values and chart below will be used to calculate an estimate of capacity for a 10.0 m long Olivier Displacement Pile



COMPRESSION:

Silt, N=10, (4.0 m x 31.0 kN/m) = 124.0 kN
Sand, N=15 (6.0 m x 77.6 kN/m) = 465.6 kN
End-bearing, Sand, N= 20 = 365.1 kN

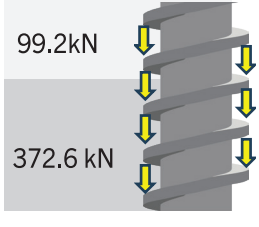
Total ULS in Compression = 954.7 kN



TENSION:

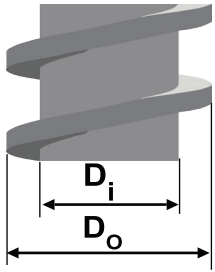
Silt, N=10, (4.0 m x 24.8 kN/m) = 99.2 kN
Sand, N=15, (6.0 m x 62.1 kN/m) = 372.6 kN

Total ULS in Tension = 471.8 kN



OLIVIER DISPLACEMENT PILE CHART

SOIL LAYER		ULS CAPACITIES D_i 360mm D_o 560mm		
		COMPRESSION		TENSION
TYPE	SPT(N)	END BEARING kN	SHAFT RESISTANCE kN/m	SHAFT RESISTANCE kN/m
Sand	5	114.1	25.9	20.7
	10	228.2	51.7	41.4
	15	342.3	77.6	62.1
	20	365.1	103.5	82.8
Silt	5	45.6	15.5	12.4
	10	91.3	31.0	24.8
	15	136.9	46.6	37.3
	20	182.6	62.1	49.7
Clay	5	22.8	15.5	12.4
	10	41.1	31.0	24.8
	15	61.6	46.6	37.3
	20	82.1	62.1	49.7



See the example above for guidance using the chart

GEOTECHNICAL GROUTING

Geotechnical Grouting is primarily used to modify the behaviour of existing soil or rock **without excavation**.

GEOTECHNICAL GROUTING IS USED WHEN:

- Not practical to excavate and replace
- Areas with limited access
- Contaminated materials present

BEHAVIOURS THAT CAN BE MODIFIED INCLUDE:

- Densification/Compaction
- Bonding (anchors and piles)
- Settlement reduction
- Permeability reduction
- Strengthening
- Reinforcement

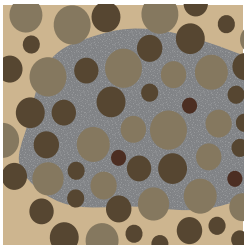
PURPOSES OF GEOTECHNICAL GROUTING:

- Temporary improvements in soil or rock to facilitate construction.
- Permanent improvements in soil or rock.

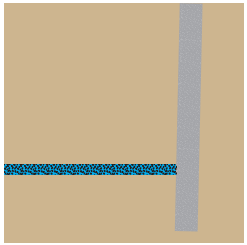
GROUTING METHODS

Compensation Grouting:
Injecting grout beneath structures to compensate for settlement or subsidence. Also used for mitigation of settlement in tunneling applications

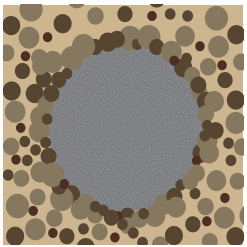
Hydraulic Fracture:
Deliberate injection of grout at sufficiently high pressures to produce fractures in a weak formation. Grout may move in fingers, sheets and or lenses.



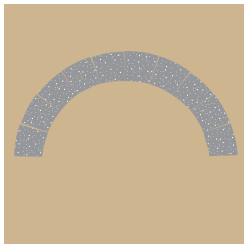
Permeation Grouting:
Filling voids in a soil or rock mass with a grout fluid at a low injection pressure to strengthen and/or reduce permeability



Curtain Grouting:
Injection of grout into a subsurface formation in such a way as to create a zone of grouted material perpendicular to the direction of the anticipated water flow.



Compaction Grouting:
The injection of a stiff (low mobility) grout that displaces and compacts the surrounding soil.



Umbrella Grouting:
An injection of grout to create a waterproof barrier or reinforcement canopy over tunnels or other underground structures by injecting grout into the ground above them

DEEP FOUNDATION SOLUTIONS

BUILD ON

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SITE FEASIBILITY EVALUATION:

Our purpose is to provide innovative geostructural solutions that overcome constructability challenges. We are ready to help you evaluate the feasibility of our solutions for your project. Scan the QR code to complete a form, email, or give us a call.
We look forward to discovering your solution.

REQUIRED FOR PRICING:

1. Geotechnical report including boreholes
2. Structural drawing(s) and loading

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