Nomenclature

A_s, A	x-sectional area of pile shaft [in^2 (cm^2)]
A_h	projected helix area {ft^2 (m^2)}
B	footing width (base width) {ft (m)}
c	soil cohesion {lb/ft^2 (kN/m^2)}
C_a	adhesion (α x C) [lb/ft^2 (kN/m^2)]
D	vertical depth to helix plate [ft(m)]
D_h	helix diameter {ft^2 (m^2)}
D_p	grout column diameter [in(cm)]
D_r	relative density (%)
D_s	diameter of pile shaft [in^2 (cm^2)]
E	modulus of elasticity of pile shaft mat l [lb/in^2 (kN/m^2)]
E_s	secant modulus of the soil response curve
f'_c	concrete compressive strength [lb/in^2 (kN/m^2)]
f_s	sum of friction and adhesion between soil and pile shaft [lb/ft^2 (kN/m^2)]
FS	factor of safety (unitless)
GWT	ground water table, or phreatic surface [ft (m)]
HS	High Strength anchor — consisting of pipe shaft foundation elements
HPM	HELICAL PULLDOWN™ Micropile
HSF	Helical Screw Foundation
I	moment of inertia of pile shaft [in^4 (cm^4)]
I_L	liquidity index (%)
K	end condition parameter (unitless)
K_a	coefficient of active earth pressure
k_h	modulus of subgrade reaction [lb/in^3 (kN/m^3)]
K_o	coefficient of earth pressure at rest
K_p	coefficient of passive earth pressure
K_t	empirical torque factor [ft^{-1} (m^{-1})]
L	length of pile [in (cm)]
LL	liquid limit, (%)
N	blow count per ASTM D 1586 Standard Penetration Test (blows) (unitless)
N_c	bearing capacity factor, for cohesive component of soil = 9
N_q	bearing capacity factor, for non-cohesive component of soil
$N\gamma$	bearing capacity factor
O_{cr}	over consolidation ratio
P	axial load applied to helical screw foundation, either in tension or compression [lb(kN)]
P_a	active earth pressure
pH	hydrogen ion concentration

P_p passive earth pressure

PISA¤ **P**ower **I**nstalled **S**crew **A**nchor (registered trademark, Hubbell Power Systems)

PI plasticity index ($^o/_o$)

PL plastic limit ($^o/_o$)

P_o average overburden pressure for a given shaft element ΔL_F [lb/ft^2 (kN/m^2)]

Q axial compressive load [lb (kN)]

Q_F shaft resistance due to skin friction [lb (kN)]

Q_h individual helix capacity {lb (kN)} due to end-bearing

Q_s capacity upper limit, determined by helix strength {lb (kN)}

Q_t total multi-helix anchor capacity [lb (kN)] = $\Sigma Q_H + Q_F$

Q_u ultimate uplift capacity [ft-lb (kN-m)]

Q_{ult} ultimate capacity [lb (kN)]

R soil resistivity (Ω-cm)

RQD rock quality designation per ASTM D-5878

RR **R**ound **R**od anchor

S section modulus of pile shaft [in^3 (cm^3)]

SS **S**quare **S**haft — helical screw foundation type comprising a round-cornered-square solid steel central shaft.

δ_{net} total deflection minus the elastic movement of the helical screw foundation [in (mm)]

SPT Standard Penetration Test, per ASTM D-1586

δ_{TOTAL} axial deflection or movement of helical screw foundation [in (mm)]

$\delta_{ELASTIC}$ recoverable movement resulting from elastic shortening or lengthening of pile material defined as the axial load times the pile length divided by its axial stiffness (PL/AE) [in (mm)]

S_F average friction resistance on pile shaft [lb/ft^2 (kN/m^2)]

T installation torque [ft-lb (kN-m)]

T_{ave} average installation torque [ft-lb (kN-m)]

u pore water pressure in the soil pores in a cross section [lb/ft^2 (kN/m^2)]

w_n natural (in situ) water, or moisture content (%)

γ_{wet} total unit weight of the soil [lb/ft^3 (kN/m^3)]

γ_{dry} dry unit weight of the soil [lb/ft^3 (kN/m^3)]

γ effective (submerged) unit weight of the soil [lb/ft^3 (kN/m^3)]

τ_f the shearing stress at failure, or the shear strength [lb/ft^2 (kN/m^2)]

ϕ angle of internal friction (degrees)

σ total stress acting on the failure plane [lb/ft^2 (kN/m^2)]

σ effective stress acting on the failure plane [lb/ft^2 (kN/m^2)]

q overburden pressure on a helix plate, a.k.a. vertical stress [lb/ft^2 (kN/m^2)]

q effective overburden pressure on a helix plate a.k.a. effective vertical stress [lb/ft^2(kN/m^2)]

q_u unconfined compressive strength of soil sample [lb/ft^2 (kN/m^2)]

ΔLF incremental pile length over which pile diameter and skin friction are taken as a constant [ft (m)]

α adhesion factor (unitless)