

## HelicalPileWorld.com

### **Glossary of Terms**

**AASHTO** - American Association of State Highway and Transportation Officials. This group of government and private companies study methods and material applications and set performance standards for materials and procedures related to the construction of highways, bridges and related structures.

**ASTM** - American Society for Testing and Materials. Many of the raw materials, the manufacturing components, and the processes used to make and install helical piles are identified and controlled by ASTM specifications and standards. A partial list includes: grade and strength of steel, hot dip galvanizing, bolted connections, and field load test procedures.

**Batter Angle** – inclination angle other than vertical at which helical piles (used for compression) are installed. Battered piles are typically used for lateral stability and in areas where the top of the piles are constrained together so as to splay apart the bottom of the piles for more capacity when group effects are a concern.

**Compression** – a force or load pushing on a helical pile. A helical pile is said to be “*in compression*” when forces or loads applied to the pile tend to cause pile shortening or settlement.

**Corrosion** – the term used to define a force in nature that corrodes metal and attempts to return it to the natural mineral state from which it originated. The rate at which an installed helical pile will *corrode* is a function of the electrical resistivity of soil. A soil is more corrosive if it has moisture, dissolved salts, organics, and acidity.

**Deep Foundation** – a general term used to define various kinds of load transfer products embedded deeply in soil upon which foundations and/or structures are constructed. Examples include concrete caissons, driven piles, and helical piles.

**Derrick** – a truck with a boom mounted on it. Helical piles and anchors are installed with *derrick* systems. Also called a "cherry picker".

**Down Drag** – the phenomenon where soft soils surrounding a helical pile consolidate and produce a downward force on the pile tending to cause additional settlement. Consolidation can be triggered by soil self weight, periodic changes in ground water, placement of fill, or other surcharge loads on the ground surface.

**Extension** – helical *extensions* are the square bar or round shaft sections that get connected one after another to the helical lead section as required to form a continuous column of steel in the ground – an installed helical pile. *Extensions* too can have helical blades or bearing plates welded to the central shaft, which is often required in very soft soils or in soil nail applications.

**Factor of Safety** – a mathematical calculation used by engineers to develop a margin of safety when calculating capacities. With respect to helical piles, the most commonly specified factor of safety is 2.0. If a helical pile has a 100 KIP ultimate capacity, then applying a factor of safety of 2 would result in a working capacity of 50 KIPS.

**FHWA** - Federal Highway Administration. This is a division within the federal government that regulates and controls all aspects of federal highway construction, inspection and oversight.

**Foot Pounds** – the English unit of measure for measuring moment, torque, or torsional force; in the Metric system, torque is measured in Newton-meters. Helical piles are rotated into the ground with a torque (or gear) motor and the final measure of foot pounds of torque correlates to the axial compression or tensile capacity of the installed helical pile. See also Moment.

**Foundation** – typically a sub-structure made of concrete, block, steel or other substances built into or on top of soil. The purpose of a *foundation* is to transfer the load of a super structure to the soil for the purpose of stabilization and to prevent settlement and potential failure of structural integrity.

**Full Scale Load Test** – term used to define a procedure to determine the field capacity of a full-size helical pile in compression (e.g. ASTM D1143), tension (ASTM D3689), or both.

**Group Effects** – generally refers to the case where a group of helical piles has a lower capacity than the sum of individuals. This can occur when helical piles, or any deep foundation for that matter, are spaced too close together.

**Helical Blade** – Often referred to as a *bearing plate* – is formed in the shape of a helix and is welded to the central shaft of a helical lead section or a helical extension section. The most common sizes, but not all, of helical blades range from 8” to 14” in diameter. When embedded in firm soil, *helical blades* have bearing capacity for supporting compressive or tensile loads. When multiple *helical blades* are welded to a shaft, the blades are spaced in such a way so they track or follow one another through the soil to minimize soil disturbance.

**Helical Pile** – *A foundation element consisting of a central shaft with at least one helix plate located on the shaft with its axis positioned parallel to the shaft's length.*

Also referred to as a Helix Pier, Helical Pile, Helical Anchor, Screw Anchor, Screw Pile, Helical Pier, or simply Helical

Helical piles can be used as anchors to withstand tensile loads or as deep foundations to withstand compressive loads or both simultaneously. The terms helical pile, helix pier, helical pier, and screw pile are generally used when the device is to be used in compression. The terms helical anchor or screw anchor are generally used when the element is to be used in tension.

**Hot Dip Galvanizing** – the process of dipping a helical pile lead or extension into molten zinc to form a protective coating. A helical pile that has been *hot dip galvanized* has significantly improved protection against the forces of corrosion when compared to bare metal once the helical pile has been installed.

**ICC** – The International Code Council, a membership association dedicated to building safety and fire prevention, develops the codes used to construct residential and commercial buildings, including homes and schools. Most U.S. cities, counties and states that adopt codes choose the International Codes developed by the International Code Council.

**ICC-ES** – International Code Council Evaluation Services is a nonprofit, public-benefit corporation that does technical evaluations of building products, components, method, and materials. ICC-ES came into being on February 1, 2003, when America's four building-product evaluation services officially combined their operations. The four "legacy" evaluation services that came together to form ICC-ES were the National Evaluation Service, Inc.; BOCAI Evaluation Services; ICBO Evaluation Service, Inc.; and SBCCI Public Service Testing and Evaluation Services, Inc. Through the legacy evaluation services, ICC-ES has a history that goes back more than seventy years.

**In situ (Soil)** – the undisturbed or original soil at a construction site.

**KIP** – an industry designation for Kilo-pounds (1000 pounds). Engineers often specify in KIPS the design or working load that a helical pile must support. For example: 50 KIP Design Load equals 50,000 pounds.

**Lateral Load** – a force or load pushing or pulling on a helical pile where the force is acting in a direction that is transverse (perpendicular) to the longitudinal axis of a pile.

**Lead or Lead Section** – the first section of a helical pile is called the *lead*, and the *lead* always has one or more helical blades or bearing plates welded to the square bar or round pipe central shaft. *Leads* can be almost any length depending upon the project for which they are being installed. Typically, *Leads* are between 5 and 10 feet in length.

**Load Frame** – one of the parts or components used to conduct a full scale load test. A *load frame* is a custom designed configuration of structural steel members and other components configured in such a way to work in conjunction with a hydraulic pressure source with the objective being to apply a specified load or force (compression or tension) to one or more helical piles.

**LRD** – an acronym for *Lateral Resistance Device*. With respect to helical piles, it is a loosely defined term for a typical helical pile lead section with blades connected to larger diameter extension sections. For example, a 1.5" square bar lead section might have 1 or more 6" diameter round shaft extensions connected to it via a tapered or graduated connector system. Since the termination end of the pile is 6" in diameter, it has a higher lateral resistance capacity than if 1.5" square bar extensions were used to termination.

**LRFD** – an acronym for Load and Resistance Factor Design, which means both applied service loads and the capacity of a helical pile have a factor of safety applied.

**Lifting Bracket** – also referred to as foundation bracket or underpinning bracket, is a name given to a product used by foundation repair contractors to connect a helical pile to a foundation wall or footing. It is also used to form an underpinning system for lifting settled foundations or walls.

**Moment** – In theory, it is the same as torque. Although, moment is generally used for overturning (as in the case of wind tipping something over) and torque is used for rotation about the longitudinal axis of the helical shaft. Both are measured by taking the force required to turn something times the distance the force acts from the point of



rotation. Hence, 100 pounds applied to a 1 foot wrench equals 100 foot-pounds. The same force applied using a 2 foot wrench equals 200 foot-pounds.

**Mooring** – with reference to a helical pile, a marine anchoring system utilizing a helical pile embedded into the soil beneath a body of water with a line made of chain, cable or other material hooked to a floating buoy, to which a boat or other floating vessel is tethered.

**NEMA** - National Electrical Manufacturers Association, which sets the standards for manufacturers of electrical utility-type products.

**Overturning or Overturning Moment** – a term generally used when discussing wind or other lateral loads applied to the top of a pile that tend to cause a helical pile to exhibit translation (tip it over). *See also Moment.*

**PAPI and NAVID** - FAA (Federal Aviation Administration) acronyms for landing and navigational control systems.

**Pile Cap** – a term used to define a terminator or connection mechanism for connecting the top end of a helical pile to another object for the purpose of transferring a load or force. Examples include grade beam *pile caps*, wall caps, tieback caps, guy wire caps, etc.

**Pile** – In the building codes, the term pile refers to a foundation with a depth greater than ten times the diameter. Foundations not meeting this criterion are called piles. In some textbooks, a pier is a foundation element that extends above ground some distance, whereas a pile is fully embedded in the ground. In the Western United States, the term pier is used to mean a drilled foundation and a pile is a driven foundation. In the Eastern United States, the term pile is used generically to represent any deep foundation.

**Powder Coating** – a process that causes a resin powder to adhere (kind of an advanced paint) to a helical pile using spraying, electrostatics, heating, and curing.

**Refusal** – with respect to helical piles, it can mean rotation without forward advancement or achieving maximum installation torque.

**Resistance Bar** – also referred to as a Torsion Bar; used as a counter resistance to the torsional force of a portable, hand-operated, free-standing torque motor during helical pile installation. The *resistance bar* is attached to a torque motor at one end, and the

other end is braced against an immovable structure, thus serving as a counter force or resistance for the torque motor.

**Resistivity or Soil Resistivity** – is the opposite of electrical conductivity. Soil is generally given a *resistivity* rating, which is expressed in ohm-cm. A *resistivity* rating is then used to calculate the rate at which a helical pile will corrode – taking into consideration the thickness of the steel and any corrosion protection that has been applied.

**SBCCI** - The Southern Building Code Congress International also called the Standard Building Code. This group sets the minimum building codes for the southeast section of the USA from the Mississippi River east and north to the 36.5 degree parallel. Some states, Arkansas, Delaware, Indiana, Texas, and West Virginia, have two codes or different codes. Not all counties or municipalities adopt building codes.

**Shear** – with respect to a helical pile, it is basically the same as lateral load or transverse load. In structural engineering and mechanics, it is a force acting on a plane in that plane. A good example of a shear failure is caused by scissors or shears.

**Slender Shaft Pile** – a term sometimes used to define deep foundation piles with a shaft diameter or 6” or less. Most, but not all, helical piles installed around the world today are *slender shaft piles* except for light pole bases and the like.

**Slide** – a device that (usually) attaches to the boom of an excavator. The *slide* is used to hold and control the forward and backward movements of a torque motor during the process of installing a helical pile – usually in horizontal applications like tiebacks and retaining walls.

**Soil Nail** – another term for helical anchors when multiple anchors with multiple blades are being used to stabilize soils on a hillside or slope. *Soil nails* are also used to construct retaining walls. In a *soil nail* application, all extension sections, as well as the lead section, are configured with helix blades or bearing plates – typically all with the same diameter. The helical blades along the upper length of shaft resist movement of the soils within the active zone and the deeper helical blades prevent movement of the helical shaft.

**SPT** – Acronym for Standard Penetration Test; a commonly used soil density test. A split spoon sampler is hammered into the ground using a controlled weight and distance device. Each impact of the weight is called a “blow”, and the number of blows required

to move the split spoon sampler 12” in depth is called the “blow count”. Engineers who specify helical piles and contractors who install them refer to “blow counts” when determining the blade configurations for helical pile projects.

**Tension Load** – often referred to as Tensile Load, it is a force or load pulling on a helical pile. A helical pile is said to be “in tension”, when forces or loads applied to the pile tend to cause pile lengthening or pull-out. Forces that produce tension loads are wind, expansive soil, water buoyancy, frost, and earthquakes.

**Torque** – force x moment arm = torque; or the force applied to a helical pile by a gear motor that causes the pile to rotate and advance into the soil. *See also Moment.*

