Step 3 – Loads

Types of Loads

There are generally four common loads that may be resisted by a given foundation element. These are compression, tension, lateral and moment loads. It is anticipated that anyone reading this manual will know the meanings of these loads, but for completeness we will describe them for our purposes here. A compression load is one that will axially shorten a foundation and is typically considered to act vertically downward. The tension load tends to lengthen a foundation and is often taken to be acting vertically upward. A lateral load is one that acts parallel to the surface of the earth or perpendicular to a vertically installed foundation. The lateral load can also be referred to as a shear load. Moment load tends to bend the foundation about one of its transverse axis.

A fifth load is torsion. It tends to twist the foundation about its longitudinal axis. This is a load that is seldom applied except during installation of a helical screw foundation.

This design manual assumes the use of strength design, i.e. the entire factor of safety is applied to the ultimate strength of the helical screw foundation in the soil to determine a safe (or design) strength.

Design or Working Load

The design load or working load is typically considered to be the same load. This is a combination of dead loads and live loads. The dead loads are simply the gravity load of structure, equipment, etc. that will always be there to be resisted by the foundations.

The live load takes into account seismic events, wind load, snow load and occupancy activities. They are transient loads that are dynamic in nature.

Ultimate Load

The ultimate load is taken to be the combination of worst dead loads and live loads including safety factors. This load may or may not be the design or applied load for foundation design.

Factor of Safety

Before a foundation design is complete a safety factor must be selected and applied. The safety factor is the ratio between the ultimate capacity of the foundation and the design load. The safety factor of 2 is usual but can vary depending on the quality of the information available for the design process and if testing or reliable production control is used. NOTE: Ultimate load is not the same as ultimate capacity. Load is applied to a foundation. A foundation has some finite capacity to resist load.

Reversing Loads

Foundation design must allow for the possibility that a load may reverse or change direction. This may not be a frequent occurrence, but when wind changes course or during seismic events, certain loads may change direction. A foundation may undergo tension and compression loads at different times or a reversal in the direction of the applied shear load.

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Dynamic Loads

Dynamic or cyclic loads are encountered when supporting certain types of equipment or conditions involving repetitive impact loads. These loads can prove destructive in some soil conditions and inconsequential in others. The designer must take steps to account for these possibilities.

Codes – Standards

The minimum load conditions, especially live loads for buildings are usually specified in the building code that governs. There are municipal, state and regional as well as model codes that are proposed for general usage. The designer must adhere to the code for the project location.