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1455 OLIVER ROAD #130
FAIRFIELD CA, 94534

DESCRIPTION OF TORQUE DOWN 1275 PILES

TORQUE DOWN 1275 piles are Concrete-Filled Steel Pipe (CFSP) piles with a closed-end conical tip welded to the bottom of the pipe. The pipes typically consist of pipe with inside and outside diameters of 12 and 12.75 inches, respectively. The specially designed conical tip includes a single 1/2-inch-thick, 14-inch-diameter, steel-helix plate welded onto the tip along with various cutter teeth (See shop drawings). The piles are advanced (screwed) into the ground by application of torque and crowd (downward pressure) with a large drill rig. A specially designed hydraulic motor on the drill rig is capable of providing up to 200,000 ft-lbs of torque, enabling the piles to penetrate into very dense sands and weathered bedrock. A 30-ton main winch on the rig provides the necessary crowd. This method of pile installation results in little to no vibration and noise is limited to the engine on the drill rig. Several piles have been installed along side historic, unreinforced masonry (red brick) buildings with no adverse affects on the building or complaints from the inhabitants. After the piles are advanced to the specified tip elevation or to practical refusal, the pipes are filled with structural concrete (See installation procedures).

The Torque Down pile is a full-displacement pile that achieves its capacity through a combination of end bearing and skin friction. The pile capacities for each site will depend on the length of the piles, as well as the strength of the soil and/or rock along the shaft and at the tip of the piles. Higher capacities can be achieved by tipping the piles into dense to very dense sand or bedrock. TORQUE DOWN 1275 piles have been load tested in compression up to 1,000 kips without failure in optimum conditions. Depending on the specific site conditions, ultimate loads in axial compression, typically range between 300 to 700 kips.

Lateral load capacities for the piles will depend on the soil conditions to depths of about 15 to 20 feet below the bottom of the pile cap, as well as the pile-head “fixity”. Typical lateral capacities are similar to 14-inch-square concrete piles and range from about 10 to 25 kips for free-head conditions and ½ inch of pile-head horizontal deflection.

Pile to pile cap connections can be made in various ways depending on uplift and lateral restraint requirements (See pile cap connection options).

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TORQUE DOWN PILE INSTALLATION PROCEDURES

Torque Down piles are installed with a large drilling rig using a combination of torque and crowd (downward pressure). The specially designed pile tips allow the piles to be literally screwed into the ground. Torque, crowd and advancement rate are all monitored continuously during the installation.

A typical pile installation is as follows:

1. **Pile Hookup:** A pile is slid onto the driver tool and connected with three 2 ½ inch diameter steel pins at ground level.

2. **Loft:** The pile is then lofted by raising the drill motor (torque head) up the mast. Once the pile is lofted, a guide is clamped around the pile.

3. **Positioning:** The pile is then positioned over the designated layout. The drill rig mast and pile are plumbed by the operator to within .00 - .03 %. The pile is then lowered a few inches into the soil. Final adjustments are made so as to start the pile within the designated layout tolerances.

4. **Plumb:** As the pile begins advancing via rotation and crowd, the pile is checked for plumb visually, and with a hand level by one of the ground crew. This continues periodically throughout the installation. After installation is complete, the pile can be visually inspected using a strong flashlight or mirror. Additionally, a plumb bob can be lowered into the pile.

5. **Pile Depth:** Pile depth is monitored during installation via layout marks at 1 foot intervals painted on the piles. Once installation is complete, final depth verification can be done by lowering a weighted tap measure down the pile.

6. **Torque Monitoring:** Torque being applied to the pile is shown on pressure gauges mounted on the cab of the rig. Torque and pile depth are monitored and recorded by the Geotechnical Engineer during installation

7. **Advancement Rate:** Advancement rate per revolution is monitored by holding a marker at a fixed position on the pile as the pile rotates creating a spiral marking on the pile. This shows the operator how efficiently the pile is advancing. The operator can then adjust crowd as necessary to assure constant and efficient advancement. Additionally, the spacing between the spirals is an indication of the density or stiffness of the various subsurface soil layers as the pile advances through them.

8. **Early Refusal:** Under optimum conditions, the piles are advanced to the designated tip elevation or refusal in one continuous motion. If early refusal occurs, the pile is reversed (rotated counter clockwise) and withdrawn 1 to 2 feet. Another attempt is then made to advance the pile past the refusal point. Occasionally, it may take a few attempts to advance the pile past the early refusal point.

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9. **Criteria for Determining TDP Refusal:**

   A) Maximum output of drill rig approximately 300 bar or 200,000 ft-lbs. of torque.

   B) Pile refuses to advance under full crowd or advancement rate is reduced to less than ½ inch per revolution.

10. **Pile Termination:** Once the pile reaches the designated tip or top elevation, the installation is completed. The pile is then disconnected by removing the pins and withdrawing the driver tool from the pile top. Should a pile not reach the desired resistance at the established tip elevation; an evaluation will be made on an individual basis to determine whether the pile should be installed deeper or assigned a reduced capacity.

11. **Pile Splices:** For piles longer than approximately 60 feet, additional sections are welded on in the field. The additional section is hoisted and set atop the first length of pile once installed. The specified field weld is then performed by a welder with the proper certifications. By code, this weld must also be monitored and or inspected by a Third Party Special Inspector typically retained by the project Owner.

12. **Cut Offs:** Pile cut offs if needed are done by cutting the excess pipe off with a cutting torch prior to filling pile with concrete.

13. **Pre-drilling:** Occasionally, pre-drilling is necessary prior to pile installation due to obstructions or encountering extremely dense granular layers that may cause pre-mature or early pile refusal prior to reaching the desired pile depth. Pre- drilling is accomplished by attaching a continuous flight auger with a diameter slightly less than the diameter of the pile to the piling rig and drilling to the desired depth prior to installing piles. Drilling technique can vary from one single pass in and out to a few passes as conditions warrant.

14. **Concrete Placement:** Concrete is poured into the piles at some point after the piles are installed. The typical method for concrete placement is via concrete pump. Concrete can also be placed directly from the shoot (tail gaiting) when site conditions allow. Shortly after the pile is filled with concrete, it is vibrated by placing the vibrator into the pile approximately 10 feet and withdrawn quickly. The vibrator is then placed against the outside of the pipe for 10-15 seconds which causes the pipe to vibrate its full length. Note: Occasionally, concern arises over the issue of whether free falling concrete to the bottom of the piles causes concrete separation. It has been demonstrated that with the proper mix and slump, pouring concrete down a confined 12-inch diameter tube (the pile) and allowing it to drop to the bottom regardless of depth, does not induce separation of the various components of the concrete.

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1. **Rebar:** When rebar is specified as part of the pile cap connection for lateral shear resistance, it is usually installed as individual bars wet set into the pile top shortly after concrete is placed in the pile. The bars are initially set a few inches high of the specified elevation then adjusted as the concrete begins to stiffen. A short burst with the vibrator insures the concrete is well seated around the embedded bars.

   When a fabricated rebar cage is used, the cage is placed at the specified elevation and temporarily suspended from the top of the pile. Concrete is poured through the center of the rebar cage up to the pile top. A concrete vibrator is then used to consolidate the concrete around the rebar cage. Once the concrete has stiffened sufficiently the temporary supports for the rebar cage are removed and the cage is adjusted as needed.

2. **Uplift Connections:** For uplift and tension restraint connections, several methods are available depending on the tension restraint requirements. The various methods all require attachments to the pipe in some form where the pile is embedded into the pile cap. Various details can be provided by the Pile Contractor subject to review and approval of the Project Engineer of Record. All uplift connections are made after the pile is installed and just prior to rebar and concrete being placed in the pile caps. These connections are typically verified in the field by the Structural Engineer or Third Party Inspector.

3. **Corrosion Protection:** When required, corrosion protection can be applied to the top portions of the piles in the form of a coal tar epoxy or equivalent synthetic coating. This coating is usually applied during pile fabrication at the shop. The coatings can also be applied in the field after the piles are installed when conditions warrant. Application is typically done by hand with paint rollers and applied in multiple coats until the recommended mill thickness is achieved.