DUROTERRA™

DUCTILE IRON PILES

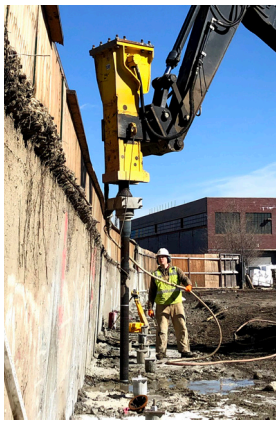
FAST.
SIMPLE.
SAFE.

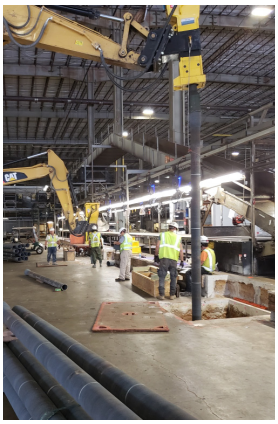
DUCTILE IRON PILES

MODULAR, FAST AND VERSATILE LOW-VIBRATION DRIVEN PILES

The Ductile Iron Pile system is a modular, low-vibration driven piling solution offering a high-value option for foundation support. Ductile Iron Piles are proven, fast and cost-effective for a variety of problematic soil and site conditions across all construction sectors.

- Achieve production rates of 500 to 1,200+ ft/day using TRM's proprietary Plug & Drive friction-locking connection.
- High value option for projects normally requiring micropiles, helical piles, or other deep foundation systems.
- Modular piling system installed with high-frequency percussion hammer mounted on medium-sized excavator.
- Perfect for projects with variable ground conditions, limited site access and constrained working conditions.
- Efficiently work adjacent to existing buildings and in low overhead conditions (within existing structures and near overhead utilities and obstructions).
- Allowable compression capacities range between 25 and 120 tons developed in end-bearing or friction.
- Low vibration levels typically between 0.25 and 1.0 ips to excel in congested urban areas or inside existing structures.
- Allowable tension capacity often range between 10 and 60 tons.





FAST. SIMPLE. SAFE.

A COST-EFFECTIVE SOLUTION TO ADDRESS A WIDE-RANGE OF GEOTECHNICAL AND CONSTRUCTION CHALLENGES

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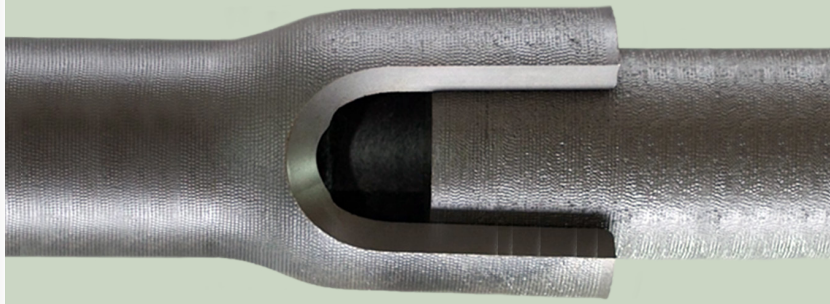
- COST EFFECTIVE
- RAPID INSTALLATION
- LOW VIBRATION
- HIGH CAPACITY
- ADAPTABLE
- EASY ACCESS
- MINIMAL WASTE
- CLEAN, NO SPOILS
- QUALITY INSTALLATION

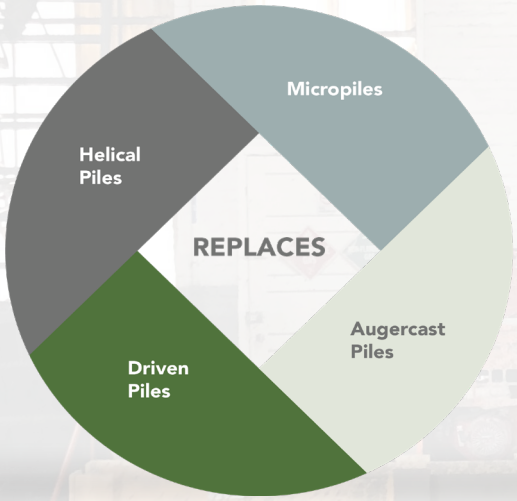
PLUG & DRIVE CONNECTION

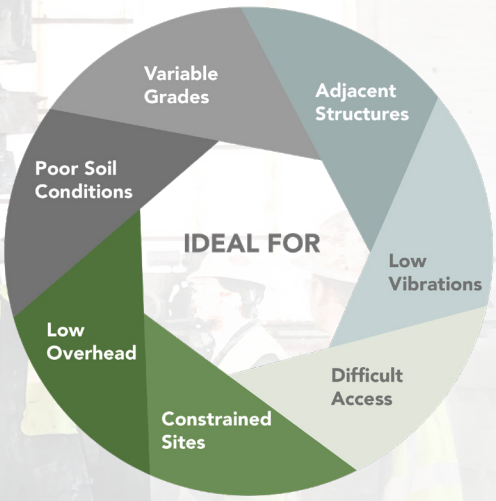


The proprietary Plug & Drive connection system is a key feature in the simplicity of Ductile Iron Piles. Each modular pile section is manufactured with a belled socket and a tapered spigot end. When connected during driving, the process forms a rigid, moment-resisting connection.

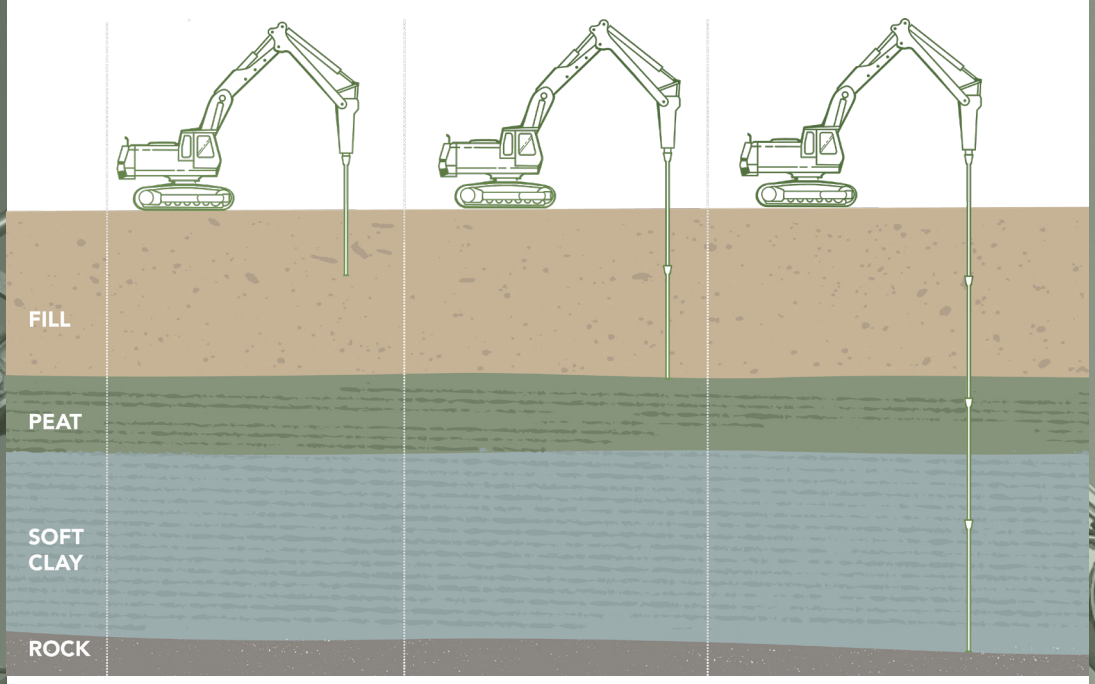
Plug & Drive technology benefits include:

- Rapid pile connections in the field.
- No costly and time-consuming field welding or splicing.
- Accelerated pile installation.
- Easy adjustments to pile lengths accommodate changing ground conditions.
- Significant reduction in material waste by re-using cut sections as starter pile sections.
- Modular 5-meter sections are easy to transport and handle on site.
- Modular sections simplify installations at sites with limited overhead.



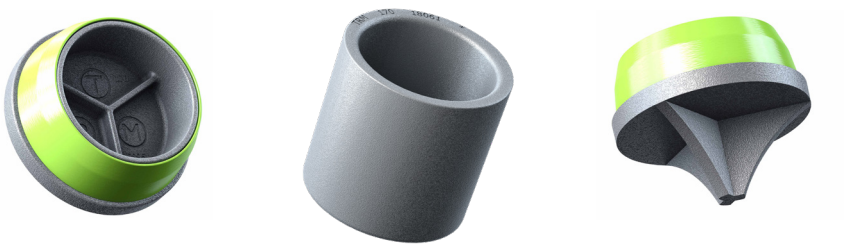


DRY INSTALLATION METHOD



Non-grouted ("dry") Ductile Iron Piles (DIPs) are installed by simply driving the pile sections into the ground and later filling the pile interior with cement grout. These piles develop capacity through end-bearing to achieve "set" on rock or very dense soil conditions. The dry installation method can also be used to develop frictional capacity through the interface between the roughened pile surface and the surrounding soil.

- The dry installation method begins by inserting a driving shoe over the end of the hollow pile.
- The pile is then driven into the ground using high-frequency impact energy until the belled Plug & Drive socket end is nearly at the working grade. The driving resistance is monitored during driving.
- The tapered end of the second DIP section is then inserted into the bell end of the installed pile.
- The driving process is repeated to advance the pile.
- This process continues until the pile terminates in the bearing layer by achieving a required driving criterion (typically 1 inch or less of movement in 50 seconds) for end-bearing piles or reaches the termination length within a design layer for friction piles.
- The pile is then cut at the proper elevation. The remaining pile section is then used as a starter pile section.
- If interior grout is being used, the grout is placed on the inside of the pile after the pile is driven and cut. A bearing plate is then placed on top of the pile to complete the process.



Drive shoe options for dry installation

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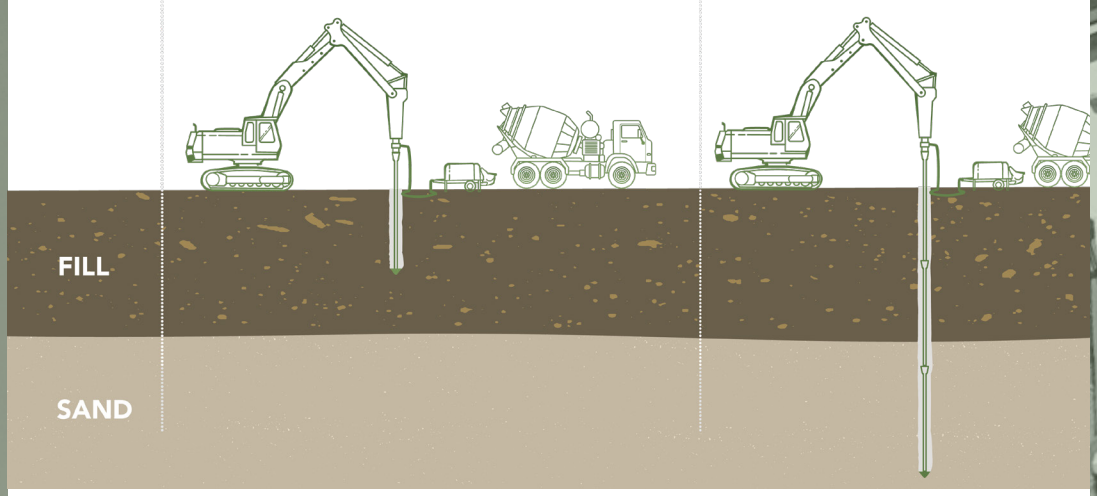
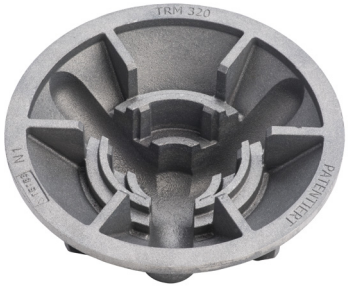
WET INSTALLATION METHOD



Grouted ("wet") Ductile Iron Piles are installed to develop high frictional capacity in competent soils through grout-to-ground bonding. Piles may also be installed with exterior grout to generate high tension capacity or enhanced corrosion protection or lateral resistance. Piles installed with the wet method may still terminate by "setting" the pile to achieve capacity in end-bearing.

- Grouted installations start by placing the specially-designed patented conical grouting shoe over the end of the pile. The conical grouting shoe is designed with ports for grouting and is available in oversized diameters of 180 mm (7 inch) to 370 mm (14.5 inches).
- The pile is then driven into the ground with a specially-designed grout driving shank that delivers cement grout through the center of the pile.
- The grout is pumped under pressure to fill the pile interior and then travels out the ports in the grout shoe at the pile tip. The pressurized grout encapsulates the pile by immediately filling the annular space created by driving the oversized shoe.
- The pile is driven and grout is pumped continuously until the Plug & Drive socket end is nearly at the working grade.
- The tapered end of the second DIP section is then inserted into the bell end of the existing pile and the driving / grouting process is repeated.
- This process continues until the pile reaches the design depth required to develop the frictional capacity or until the pile is "set" to develop end-bearing resistance.
- The pile is cut to the proper elevation. The remaining pile section is then used as a starter pile section. A bearing plate is placed on the top of the pile to complete the process.



Oversized conical grout shoe with grout ports

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EXPERIENCE

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INTERNATIONAL SHIPPING FACILITY
PHILADELPHIA, PA

- New mezzanine level renovation.
- Overhead clearance ranged from only 20 to 35 feet.
- Low vibration DIPs selected over micropiles and helical piles based on cost and speed of installation.
- Piles driven through soft alluvial deposits to terminate in dense sand and hard clay at depths of 67 to 103 feet.
- Allowable capacities ranged from 45 to 75 tons.
- Over 300 piles were installed in less than 4 weeks with 2 crews.

THE ADELE APARTMENTS
WASHINGTON, DC

- Construction of an 8-story apartment building.
- Installation on a 5,025 sq ft site surrounded by buildings.
- Historic building façade to remain in-place.
- Low vibration, driven Ductile Iron Pile solution replaced the original concept of augercast piles.
- DIPs provided greater mobility combined with vibration control on the tight urban site.
- Piles were driven 25 to 30 feet to terminate in end-bearing on rock.
- A total of 145 piles were installed with working capacities of 40 tons (compression) and 5 tons (tension).

ENTERGY SUBSTATION UPGRADES
ROLLING FORK, MS

- Existing substation upgrades required support for large mat foundations.
- Load testing of the specified helical piles failed.
- Exterior grouted Ductile Iron Piles were selected to provide foundation support.
- DIPs were installed through 45 feet of very soft clay and terminated in medium-dense sand.
- Working capacities of 33 tons (compression) and 19 tons (tension) were required.
- Following successful DIP load testing, 94 production piles were installed to 66 feet in less than 2 weeks.

FOR MORE INFORMATION VISIT WWW.DUROTERRA.COM