Piling Systems for
Deep Foundations

ductile iron technologies
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TIROLER ROHRE

Ductile iron piles

Safe and versatile foundation elements

The construction industry can benefit from simple, safe and universally usable prefabricated driven pile systems. Ductile iron piles (DIPs) are driven into the ground to effectively and reliably transmit the loads from the structure down to competent stratum.

With design working loads according to International Building Code standards (IBC 2009) up to 225 kips, the ductile pile is an economical solution for almost all deep foundation projects. The Plug & Drive® connection system ensures that connections are made quickly and variable pile lengths are achieved without requiring additional equipment, working time or costs.

Its easy set-up on the construction site makes Ductile Iron Piles an ideal solution for almost all sizes of construction project because the high productivity makes it an economical solution. The loads are transferred either in end-bearing, using the non-grouted piling method, or by skin friction using the grouted piling method.

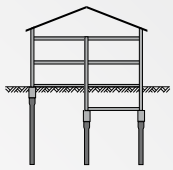
The benefits

- Cost-effective construction site set-up due to the use of lightweight and mobile standard excavator equipment.
- Substantially higher corrosion resistance than steel giving up to 100 years' service life.
- Safe and easy adjustment of the pile lengths to the naturally variable ground conditions.
- Pile load-bearing capacity proven during the pile driving process for every pile installed.
- Plug & Drive® jointing system: very fast forming of an inter-locked rigid connection between pile sections without any need for special tools, threading or welding.
- Virtually vibration-free driving process: pile installation as close as 16in distance from existing buildings.
- Excellent economy: reduced equipment and set-up costs, high productivity - up to 1350 linear feet per piling rig per day.
- No additional time or costs associated with site clean-up or disposal of debris, and no additional work or cost for trimming of pile heads.

Applications

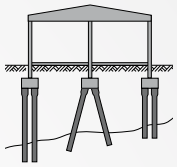
Building construction

Foundation of buildings: Advantages of using fast compact and mobile equipment giving short project execution time in inner city districts. The use of smaller diameter piles with high load capacity enables big savings of foundation concrete quantities in both piles and sub-structure elements.



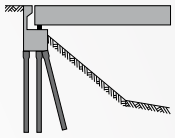
Industrial construction

Foundations of pre-fabricated buildings: reliable load transfer with piles integrated into small pre-cast concrete pilecaps. Highly suited for lightweight structures sensitive to total and differential settlement. Wind and other structural loads are efficiently transferred into the ground.



Bridge foundations construction

Foundations of bridge abutments and piers: simple and fast movement around building sites. Bending moments are transferred through pile supports and horizontal forces are transferred through raked piles.

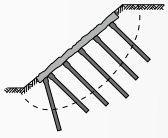


Pipeline supported on piles

Foundation of pipelines: piles control settlement to acceptable limits in pipeline and hydraulic construction where soils have limited load-bearing capability.

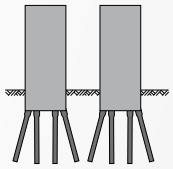
Slope reinforcement

Reinforcement of slopes which have a high risk of sliding. Piles can be inserted vertically or almost horizontally in accordance with design requirements in order to achieve slope stability.



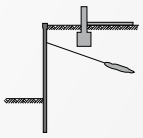
Silo foundation

Foundation of silos, tower cranes, pylons and transmission poles: piles can support compression and tensile loads where tall buildings exposed to cyclical wind loadings are founded on pile supports which include additional tensile reinforcement.



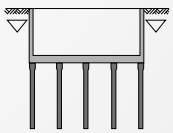
Construction pit reinforcement

Retaining walls in the vicinity of existing structures. The piles are installed to well below the construction pit base and form a perimeter wall with pile heads fully connected and supported, for instance with an anchored reinforced concrete capping beam or floor slabs.



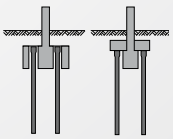
Buoyancy protection

Foundations of sedimentation tanks, subways and construction pits where the ground water level fluctuates. The reinforced concrete floor slab is protected against buoyancy by additional tensile reinforcement connected between the piles and the slab.



Retro-fit foundations

Underpinning of existing buildings: for industrial buildings where old foundations are reinforced or new foundations are retro-fitted to provide support for additional new loads with pile installation performed under restricted head room working space.



South Africa: CSP – Solar 100 MW

Austria: 14 units Vestas V90 – 28 MW

Austria : Spa "Grimming" with 500 Geothermal probes on 240,000 SF

Italy: Noise barrier for Railways - total length 2.8 miles

The alternative piling system

Pile tube length of 16.4 ft

The pile sections, made of ductile cast iron, feature a conical spigot at the bottom and a precise-fitting plug-in collar at the top. These are joined to form a continuous pile of any length.

- Efficient transport and simple building site logistics
- Safe handling
- Any pile length possible, virtually no limitation

Friction-locking plug-in connection Plug & Drive®

The high impact energy driving process forces the pile sections together producing a rigid, torsionally-stiff connection between the pile sections

- Fast connection of the individual elements through simple plug-in system
- No special connection tool, no welding and no threading
- Flexible adjustment of pile lengths to match the ground conditions: safe extension of the pile shaft

Fast and safe extension of the pile with longitudinal friction-locking system, Plug & Drive®

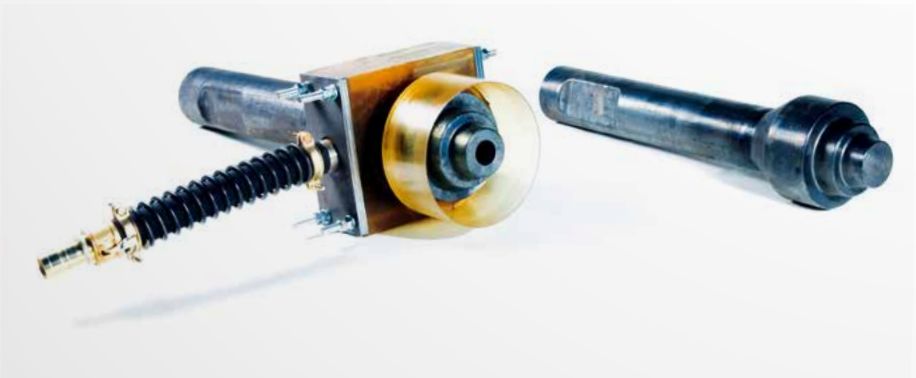
Complete product range

The pile system includes all accessories for the pile toe and pile head, as well as the driving adaptor enabling use of any hydraulic hammer for pile installation.

- Pipelines: Pipe tube saddles for pipelines with diameters ranging from 8 in to 20 in
- Pile shoes and pile tips for grouted and non-grouted piles
- Couplings to connect shortened pile sections when the working headroom space is restricted

Type	Wall thickness in	Mass lb/ft	Moment of inertia in^4	Section Modulus in^3	Bending moment kip-ft
118	0.30	14.1	9.59	4.15	16.0
118	0.35	16.4	11.08	4.76	18.4
118	0.42	18.8	12.52	5.37	20.8
170	0.35	25.0	35.56	10.62	41.1
170	0.42	28.6	40.67	12.14	47.0
170	0.51	34.9	47.79	14.28	55.2

Pile accessories according to the type of load transfer to the ground and superstructure



Grouted and non-grouted pile caps are available in stock for various hammer types

Made of modern materials

Corrosion resistance

Due to the high carbon and silicon content as well as the annealing process (oxide layer), the nodular ductile cast iron has a much higher corrosion resistance than steel.

The ecological cycle

Our piles are made of 100% recyclable material. The metal mix for the melted basic iron consists exclusively of raw materials from the recycling industry: stacks of sheets, sorted scrap steel and recycled materials.

High impact resistance

The addition of magnesium to the liquid iron immediately prior to centrifugal casting and the subsequent annealing treatment gives the ductile cast iron its high ductility and strength.

- Piles are driven efficiently into the ground using high-performance hydraulic hammers.
- The thicker pile collar is cast to avoid over-stressing the materials in the temporary condition during pile driving installation.

Made of recycled iron and fully recyclable

Piles manufactured from liquid iron by means of the centrifugal casting method

Industrial pre-fabrication

Pile production is subjected to strict full-time quality checks in accordance with the applicable standards. Quality assurance covers the chemical composition, the mechanical parameters and the dimensions.

- Quality tested to EN standards, ISO 9001 certification

Nodular cast iron	
Compressive strength	130 ksi
Tensile strength	60 ksi
Yield strength (0.2% elastic limit)	46 ksi
E-Modulus	24,656 ksi
Density	440 lb/ft^3

Each pipe is quality controlled

Economical solution

Use of standard construction equipment

Due to the concentrated ramming energy applied to the pile tubes, installation with a lightweight and mobile excavator mounted with a hydraulic hammer is possible even in restricted areas.

- Fast and simple set-up on site
- Low investment costs
- Minimal working platform requirements

Non-grouted and grouted piles

Depending on the soil condition, ductile piles can be installed with grouting (skin friction pile, grouted and filled) or without grouting (end-bearing pile, either filled or not filled with grout or concrete)

Proof of the load-bearing capacity during pile driving

The first pipe section receives a cut so that the concrete can flow out (only by using flat shoe)

Friction Ductile Iron Pile

The pile shoe forms the basis for the fully grouted friction DIP. The displacement driving process displaces soil laterally with either a flat or conical shoe while simultaneously pumping concrete, mortar or cement grout in the annular space created and continues until the final depth is reached. The excess length is cut off, eliminating any waste of pile material.

- No debris resulting in no disposal costs
- No reworking of the pile heads
- No trimming losses: the excess length is reused as a starter pile tube
- No change of the groundwater balance

Continuous grouting

The pile shoe forms an annular space along the entire pile. During ramming, it is continuously filled with concrete, mortar or cement grout by using a pump.

- Short construction times
- High production performance - 600 to 1350 ft per day
- Optimization of the pile lengths through efficient transfer of loads in friction.
- No post-grouting required

Grouting at the same time as the installation of the pile

The excess length is cut off at the right level and used as the first pile tube of the next pile

Tens of millions of feet successfully installed

Calculation of the pile load-bearing capacity

The pile tubes are offered in two diameters, 4 5/8 in and 6 5/8 in, with wall thicknesses of 0.30 in to 0.51 in. Filling with concrete or grout is usually carried out with a minimum 3,500 psi strength.

- Structural design according to national and international standards
- Additional corrosion proofing by grouting
- Allowable loads typically range from 50 to 200 kips

Low-vibration installation

Measurements on sensitive building sites repeatedly demonstrate the low-vibration installation. The measured vibration values as low as 0.1 in/sec are only a fraction of the permissible values.

- Pile installation is possible up to a distance of 16 in from existing structures

Calculation of the geotechnical load-bearing capacity

Ductile piles are rammed in to the final depth, which is determined on the basis of the penetration resistance. The measured penetration resistance is used as the criterion for the load-bearing capacity in the resisting soil layers.

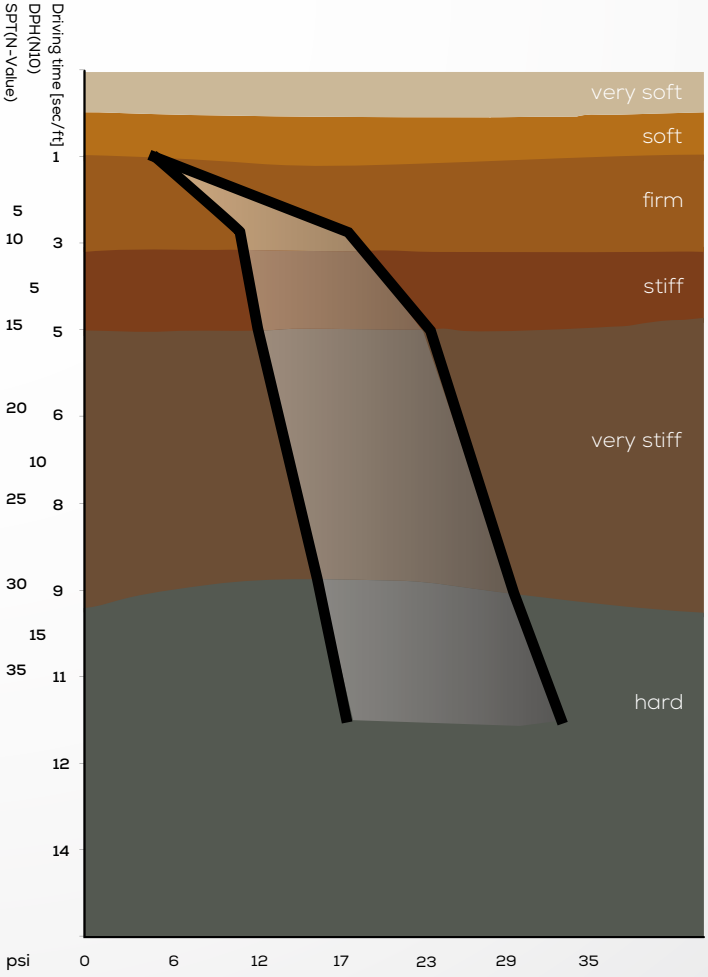
- Easy adjustments of the pile length to reflect the actual ground conditions encountered.
- Demonstration of the geotechnical load-bearing capacity during installation
- Allowable geotechnical skin friction capacities of up to 43 psi
- Correlation between driving times and design geotechnical skin friction values

Safety first

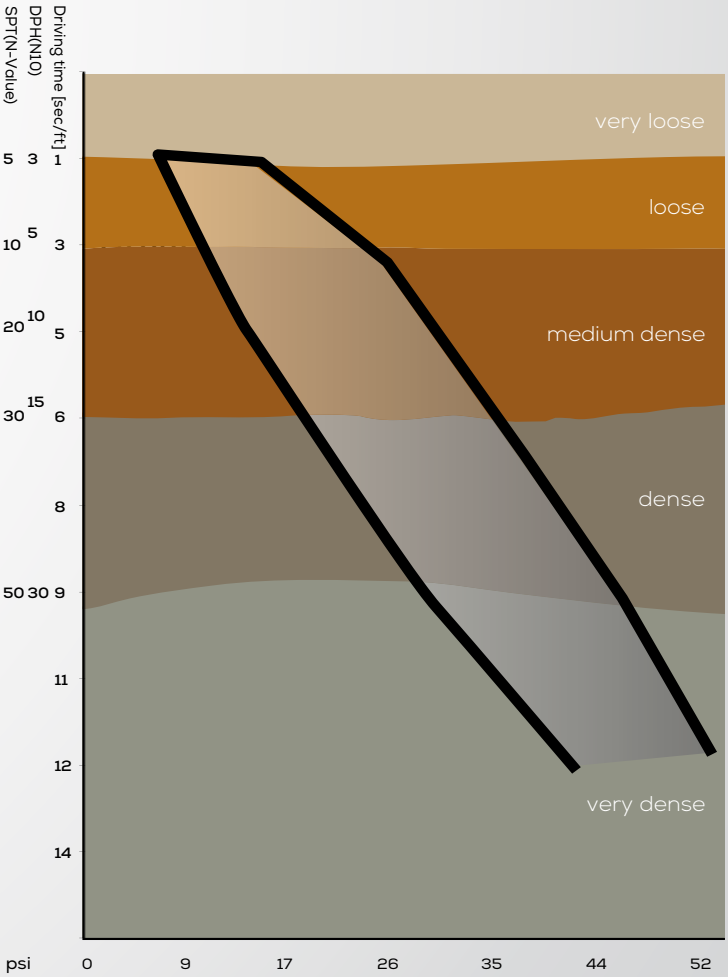
The soil is displaced laterally, therefore no debris is excavated. The manual activities are limited to minor physical work and safe interventions.

- Reduced accident risk and exposure to contaminated soils

Allowable skin friction values in cohesive soil conditions



Allowable skin friction values in non - cohesive soil conditions



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