

# PILE FOUNDATION

**pile foundation** Abstract]

A [pile foundation](#) is a vertical structural element of a **deep foundation**, driven deep into the ground at the building site. a pile is a long slender foundation member, made either of timber, structural steel or concrete which might be cast-in-situ or driven and acts as a structural member to transfer the load of the structure to a required depth in deep foundations carrying a load which may be vertical or lateral or lateral plus vertical

**pile foundation** Video]

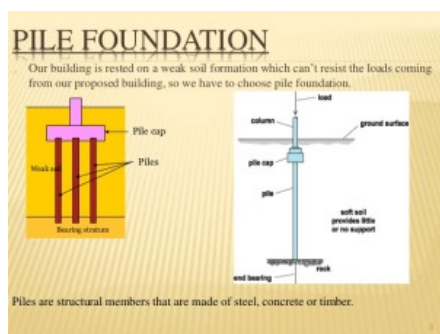
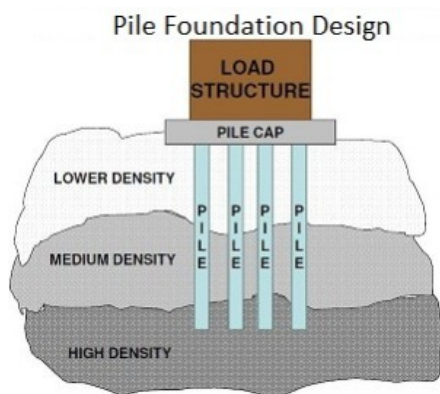
## What is pile foundation?

A pile is basically a long cylinder of a strong material such as concrete that is pushed into the ground to act as a steady support for structures built on top of it.

[pile foundations](#) are used in the following situations:

- When there is a layer of weak soil at the surface. This layer cannot support the weight of the building, so the loads of the building have to bypass this layer and be transferred to the layer of stronger soil or rock that is below the weak layer.
- When a building has very heavy, concentrated loads, such as in a high rise structure, bridge, or water tank.

Pile foundations are capable of taking higher loads than spread footings.



## Types of Pile Foundations

### End Bearing Piles

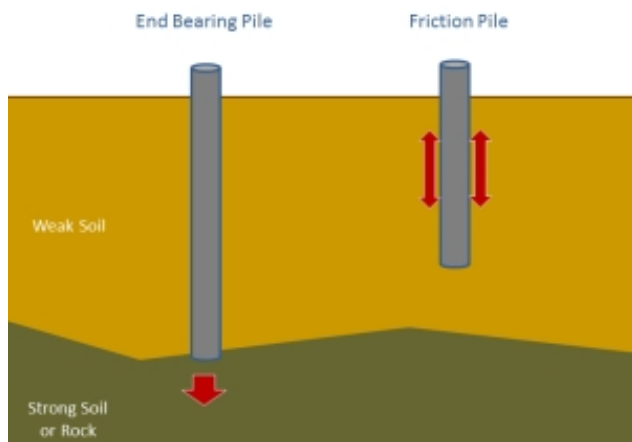
In end bearing piles, the **bottom end of the pile rests on a layer of especially strong soil or rock**. The load of the building is transferred through the pile onto the strong layer. In a sense, this pile acts like a column. The key principle is that the bottom end

rests on the surface which is the intersection of a weak and strong layer. The load therefore bypasses the weak layer and is safely transferred to the strong layer.

### Friction Piles

Friction piles work on a different principle. The pile transfers the load of the building to the soil across the full height of the pile, by friction. In other words, the entire surface of the pile, which is cylindrical in shape, works to transfer the forces to the soil.

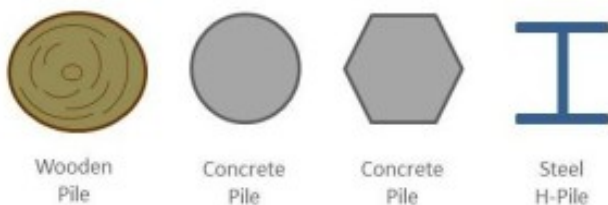
To visualize how this works, imagine you are pushing a solid metal rod of say 4mm diameter into a tub of frozen ice cream. Once you have pushed it in, it is strong enough to support some load. The greater the embedment depth in the ice cream, the more load it can support. This is very similar to how a friction pile works. In a friction pile, the amount of load a pile can support is directly proportionate to its length.



What are piles foundation Made of?

Piles can be made of wood, concrete, or steel.

In traditional construction, wooden piles were used to support buildings in areas with weak soil. Wood piles are still used to make jetties. For this one needs trees with exceptionally straight trunks. The pile length is limited to the length of a single tree, about 20m, since one cannot join together two tree trunks. The entire city of Venice in Italy is famous for being built on wooden piles over the sea water.

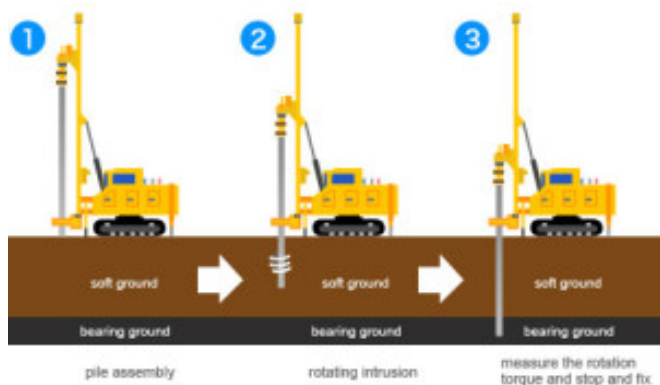


Concrete piles are pre cast, that is, made at ground level, and then driven into the ground by hammering - more on that later. Steel H-piles can also be driven into the ground. These can take very heavy loads, and save time during construction, as the pile casting process is eliminated. No protective coating is given to the steel, as during driving, this would be scraped away by the soil. In areas with corrosive soil, concrete piles should be used.

### How pile foundation Works?

Piles are first cast at ground level and then hammered or driven into the ground using a pile driver. This is a machine that holds the pile perfectly vertical, and then hammers it into the ground blow by blow. Each blow is struck by lifting a heavy weight and dropping it on the top of the pile - the pile is temporarily covered with a steel cap to prevent it from disintegrating. The pile driver thus performs two functions - first, it acts as a crane, and lifts the pile from a horizontal position on the ground and rotates it into the correct vertical position, and second, it hammers the pile down into the ground. Piles should be hammered into the ground till refusal, at which point they cannot be driven any further into the soil.

As pile foundations carry a lot of load, they must be designed very carefully. A good engineer will study the soil the piles are placed in to ensure that the soil is not overloaded beyond its bearing capacity.



Every pile has a zone of influence on the soil around it. Care must be taken to space the piles far enough apart so that loads are distributed evenly over the entire bulb of soil that carries them, and not concentrated into a few areas.

Engineers will usually group a few piles together, and top them with a pile cap. A pile cap is a very thick cap of concrete that extends over a small group of piles, and serves as a base on which a column can be constructed. The load of this column is then distributed to all the piles in the group.

#### Advantages]

As far as deep foundations are concerned there are no. of types of deep foundations and pile foundation is among one of them; uses of Pile Foundation depends on the type of pile used, the intended function for which the pile is used, the load which is to be applied on the pile and the type of material which is used for the construction of the pile;

The following are the uses of piles.

#### a) End Bearing or Compressive Strength

Sometimes we use the piles to achieve the required compressive strength in the soft soil; in that case we use the piles to transfer the load through that soft soil to a suitable bearing stratum by using the end bearing or toe bearing property of the pile

#### b) Scour Depth:

To build a structure within the water and on the water river or canal bed; we have to build the foundation through the river bed and within the scour depth. To learn more on what is scouring? What is scour depth and how to calculate scour click here.

#### c) Tension or Uplift:

Piles are usually used to carry compressive nature of load through tip bearing or end bearing; but in case of tall structures or like towers there might be tension that must be resisted by piles. For example for a tower carrying high power transmission lines the thrust of wind might produces over turning that must be resisted by the tension piles; other options include use of deep foundation or thick raft which is sometimes uneconomical.

#### d) Vibration Control

For foundation of buildings supporting vibrating equipments like Turbines and silos etc where the vibrations is significant and might cause failures as well; there are two options there you might go for the massive block to absorb the vibrations or you can use the deep foundations and same that the massive block is very uneconomical.

**e) Compaction Piles:**

Sometimes the piles are driven in a weaker strata of soil to increase the bearing capacity of the soil those piles are called compaction piles; and thus by using compaction piles we can increase the bearing capacity of the soil.

**f) Rapid Construction**

To tackle or to avoid any problem relating to soils deep foundations and specially piles are a very good option when the time schedule is very tough. They are rapid to construct and not difficult to design as well.