Pile foundations essay sample

ASSIGN BUSTER

Introduction:

A deep foundation is a type of foundation distinguished from shallow foundations by the depth they are embedded into the ground. There are many reasons a geotechnical engineer would recommend a deep foundation over a shallow foundation, but some of the common reasons are very large design loads, a poor soil at shallow depth, or site constraints (like property lines). There are different terms used to describe different types of deep foundations including the pile (which is analogous to a pole), the pier (which is analogous to a column), drilled shafts, and caissons. Piles are generally driven into the ground in situ; other deep foundations are typically put in place using excavation and drilling. The naming conventions may vary between engineering disciplines and firms. Deep foundations can be made out of timber, steel, reinforced concrete and prestressed concrete.

Development:

I-When do we need pile foundations:

·Top layers of soil are highly compressible for it to support structural loads through shallow foundations.

·Lateral forces are relatively prominent.

·In presence of expansive and collapsible soils at the site. ·Offshore structures

·Strong uplift forces on shallow foundations due to shallow water table can be partly transmitted to Piles. ·For structures near flowing water (Bridge abutments, etc.) to avoid the problems due to erosion.

II-Why to use pile foundations:

·Inadequate Bearing Capacity of Shallow

Foundations

·To Prevent Uplift Forces

·To Reduce Excessive Settlement

III-How do they work:

·By Friction between the piles and the soil such as in Fig. 1 :

Fig. 1

·End bearing piles such as in Fig. 2 were the bed rock reaction force is important.

Fig. 2

IV-Types of piles:

1. Steel Piles

·Pipe piles, pipe piles are a type of steel driven pile foundation and are a good candidate for battered piles. Pipe piles can be driven either open end or closed end. When driven open end, soil is allowed to enter the bottom of the pipe or tube. If an empty pipe is required, a jet of water or an auger can be used to remove the soil inside following driving. Closed end pipe piles are constructed by covering the bottom of the pile with a steel plate or cast steel shoe. ·Rolled steel H-section piles, H-Piles are structural beams that are driven in the ground for deep foundation application. They can be easily cut off or joined by welding or mechanical drive-fit splicers. If the pile is driven into a soil with low pH value, then there is a risk of corrosion, coal-tar epoxy or cathodic protection can be applied to slow or eliminate the corrosion process. It is common to allow for an amount of corrosion in design by simply over dimensioning the cross-sectional area of the steel pile. In this way the corrosion process can be prolonged up to 50 years.

2. Concrete Piles

Concrete piles are typically made with steel reinforcing and prestressing tendons to obtain the tensile strength required, to survive handling and driving, and to provide sufficient bending resistance. Long piles can be difficult to handle and transport. Pile joints can be used to join two or more short piles to form one long pile. Pile joints can be used with both precast and prestressed concrete piles.

·Pre-cast Piles, These piles are molded and prepared to be transferred to the site, either to be immediately used or transferred as parts to be collected. ·Cast-in-situ Piles, These piles are molded in working site, molds are prepared then concrete is put in and waited for to mature. ·Bored-in-situ piles, These piles are drilled- bored- in situ, this process requires a “ male” and a “ female pile were one is drilled through the other. 3. Timber Piles , are simple designed piles. Main consideration regarding timber piles is that they should be protected from rotting above groundwater level. Timber will last for a long time below the groundwater level.

For timber to rot, two elements are needed: water and oxygen. Below the groundwater level, oxygen is lacking even though there is ample water. Hence, timber tends to last for a long time below groundwater level. It has been reported that some timber piles used during 16th century in Venice still survive since they were below groundwater level. 4. Composite Piles , are piles made of steel and concrete members that are fastened together, end to end, to form a single pile. It is a combination of different materials or different shaped materials such as pipe and H-beams or steel and concrete. V-Advantages and Disadvantages of Piles According to Type: 1. Steel Piles:

Usual length: 15 m – 60 m

Usual Load: 300 kN – 1200 kN

· Advantage:

i. Relatively less hassle during installation and easy to achieve cutoff level.

ii. High driving force may be used for fast installation

iii. Good to penetrate hard strata

iv. Load carrying capacity is high

· Disadvantage:

i. Relatively expensive

ii. Noise pollution during installation

iii. Corrosion

iv. Bend in piles while driving

2. Concrete piles:

- Pre-cast Piles:

1- Usual length: 10 m – 45 m

2- Usual Load: 7500 kN – 8500 kN

- Cast-in-situ Piles:

1- Usual length: 5 m – 15 m

2- Usual Load: 200 kN – 500 kN

· Advantage:

i. Relatively cheap

ii. It can be easily combined with concrete superstructure

iii. Corrosion resistant

iv. It can bear hard driving

· Disadvantage:

i. Difficult to transport

ii. Difficult to achieve desired cutoff

VI-Types of Piles Based on Their Functions and Effect of Installation: Effects of Installation of Piles.

·Displacement Piles

·Non-displacement Piles

1. Displacement Piles:

i. In loose cohesionless soils

Densifies the soil upto a distance of 3. 5 times the pile diameter (3. 5D) which increases the soil's resistance to shearing

The friction angle varies from the pile surface to the limit of compacted soil

ii. In dense cohesionless soils

The dilatancy effect decreases the friction angle within the zone of influence of displacement pile (3. 5D approx.).

Displacement piles are not effective in dense sands due to above reason.

iii. In cohesive soils

Soil is remolded near the displacement piles (2. 0 D approx.) leading to a decreased value of shearing resistance. Pore-pressure is generated during installation causing lower effective stress and consequently lower shearing resistance. Excess pore-pressure dissipates over the time and soil regains its strength. 2. Non-displacement Piles

i. Due to no displacement during installation, there is no heave in the ground.

ii. Cast in-situ piles may be cased or uncased (by removing casing as concreting progresses). They may be provided with reinforcement if economical with their reduced diameter.

iii. Enlarged bottom ends (three times pile diameter) may be provided in cohesive soils leading to much larger point bearing provided in cohesive soils leading to much larger point bearing capacity.

iv. Soil on the sides may soften due to contact with wet concrete or during boring itself. This may lead to loss of its shear strength.

v. Concreting under water may be challenging and may resulting in waisting or necking of concrete in squeezing ground.

vi. Example: Bored cast in-situ or pre-cast piles

Conclusion:

In conclusion, Piles are to solve the problem of the ground usually not fit to handle great loads from buildings above, and thus we create piles, of different measures, types and material used all to be adequate in what we need.

Reference list:

Garrison, P. (2005) Basics structures for engineers and architects. School of the Built Environment. Leeds Metropolitan University. Black Well published.

L. O. Anderson and O. C. Heyer ISO (2005) Certified Geotechnical Survey Services. Contact Us Now For Details .