RAMA UNIVERSITY

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FACULTY OF RNGINEERING AND TECHNOLOGY (DEPARTMENT OF CIVIL ENGINEERING)

BUILDING CONSTRUCTION

DIPLOMA (IInd YEAR/ IIIrd SEM)

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Lecture -08
TYPES OF PILES (Classification based on Function or Use)

END BEARING PILE

- These piles penetrate through the soft soil and their bottoms or tips rest on a hard stratum.
- These piles act as columns. The soft material surrounding the pile provides some lateral support. For end bearing pile Qu = Qp.

FRICTION PILE

- When loose Soil extends to a great depth, piles are driven up to such a depth that frictional resistance developed at the sides of the piles equals the load coming on the piles. Friction piles are used when a hard stratum is available at a greater depth.
- For friction pile Qu = Qs where Qu = ultimate load & Qs = skin friction

COMPACTION PILE

- When piles are driven in loose granular soil with the aim of increasing the bearing capacity of soil, the piles are termed as compaction piles.
- These piles themselves do not carry any load.

TENSION PILE

- These piles anchor down the structures subjected to uplift due to hydrostatic pressure or due to overturning moment. It is also called uplift pile.

FENDER PILE

- Fender piles are used to protect water structures against impact from ships or other floating objects.

TYPES OF PILES (Classification based on Materials)

Concrete Pile

Concrete Piles may be of:

I. Pre Cast Pile

II. Cast-in- situ Pile

III. Prestressed

1. Pre Cast concrete pile

- Precast concrete piles are those which are manufactured in a factory or at a place away from the construction site and then driven into the ground at the place required. These piles require heavy pile driving machinery.
- Precast piles may be square, octagonal or circular in cross section.
- The size of piles may vary from 30 cm to 50 cm in cross sectional dimension, and up to 20 m or more in length.
- The reinforcement may consist of longitudinal steel bars of 20 mm to 40 mm in diameter, 4 to 8 nos. with lateral ties of 6 to 10 mm diameter at 100 mm c/c spacing.
- A concrete cover of at least 50 mm is provided. The grade of concrete should be M20.

TYPES OF PILES (Classification based on Materials)

Procedure for forming precast concrete piles

- The formwork for the pile is prepared and it is coated with soap solution or oil to prevent adhesion.
- The cage of reinforcement is prepared as per design and this cage is then placed in the formwork. A concrete cover of at least 50mm is provided.
- A concrete of grade M20 is prepared with proportion 1:1.5:3. The size of coarse aggregate varies from 10 mm to 25 mm.
- The forms are removed after 3 days and the piles are kept in the same position for about 7 days or so.
- The piles are then shifted to a curing tank and after a period of about three or four weeks, they become ready for use.

2. Cast-in-situ Concrete Pile

Cased- Raymond pile, Mac Arthur Pile, Monotube Pile, BSP base driven piles, Swage piles

Uncased- Simplex pile, Franki Pile, Vibro pile, Pedestal pile, Pressure Pile

TYPES OF PILES (Classification based on Materials)

RAYMOND PILE

- The Raymond standard pile is used primarily as a friction pile. It is provided with uniform taper of 1 in 30 resulting in shorter piles.
- The lengths of piles vary from 6 to 12 m. The diameter of piles vary from 40 to 60 cm at the top and 20 to 30 cm at the bottom.
- Raymond piles have a high bearing capacity, because of the corrugated surface of the pile shaft and their conical pile shape. They are suitable for high pile loads and difficult driving conditions.

Raymond Pile installation

- In Raymond Pile installation shell is closed at bottom. The shell is driven in to ground with a collapsible steel mandrel or core in it having the same taper.
- When the pile is driven in to the desired depth, the mandrel is mechanically collapsed and withdrawn, leaving the shell inside the ground.
- The shell is inspected internally by using the light from a mirror of flash light or drop light. The shell is gradually filled with concrete up to the top.

TYPES OF PILES (Classification based on Materials)

MAC-ARTHUR PILES

- These pile is a pile of uniform diameter, using the corrugated steel shell which remain in place. However, the driving of the pile uses an additional steel casing of heavy gauge (thickness). The heavy steel casing with a central core is driven into the ground .
- After reaching the desired depth the central core is withdrawn and a corrugated shell is placed in the casing.
- Finally concrete is placed in the shell by gradually compacting it and withdrawing the steel casing.
- The compacted pile contains concrete core and the outer corrugated shell.

MONTUBE PILES

- Montube piles use tapered fluted steel shell without mandrel, and are suitable for wide variety of soil conditions, from end bearing to friction load carrying soils.
- The shell provide rigidity, and are watertight. The pile shells are driven to the required depth, and they are inspected after driving .
- Shells may be driven with hammer of comparable size to those used for wood piles.
- The shell, after inspection is filled with concrete and the excess length of shell is cut.

TYPES OF PILES (Classification based on Materials)

SWAGE PILES

- A pipe pile, having a thin wall; the bottom of the pipe is closed with a precast point. Swage Piles are used with advantage in some soils where the driving is very hard or where it is designed to leave water tight shell for some time before filling the concrete.

- The four stages of forming these piles are shown

I. In the first stage, a thin steel pile (known as Shell) is placed on a precast concrete plug, and a steel core, which is not long enough to reach the plug is inserted in the shell.

II. In the second stage, as the pipe is driven over the plug until the core reaches the plug, the pipe is swaged out by the taper of the plug, thus forming a water tight joint.

III. In the third stage, the pipe is driven to a specified depth. The driving force is practically all exerted by the core on the plug and the pipe pulled down rather than driven.

IV. In the froth stage, after the pipe has reached the desired depth, the core is removed, and the pipe left open until it is desired to fill it.

V. In the final stage, the pipe is filled with concrete.

TYPES OF PILES (Classification based on Materials)

BUTTON-BOTTOM PILE

- These piles are used in locations where increase in the end bearing area is desired. The pile uses a concreteplug,of the shape of a button. this button forms an enlarged hole in the soil during driving.

- The four stages in the pile driving are shown.

I. In the first stage a steel pipe with 12mm thick walls and reinforced base of cast steel, is set over the concrete button. the concrete button has a diameter about 25mm larger than the pipe.

II. In stage the second stage pipe and button are driven to a specified depth.

III. In the third stage a corrugated steel shell is inserted in the pipe, resting on the button. A steel plate with a bolt hole in it is welded on the bottom of the shell, before lowering it, so that hole may fit over the central bolt in button bottom.

IV. In the fourth stage the casing is withdrawn, leaving the button in place and the shell is filled with concrete.

TYPES OF PILES (Classification based on Materials)

UNCASED CAST IN SITU CONCRETE PILES:

These piles are comparatively cheap, as no casing will be left in the ground. But, great skill is required in this case to achieve the desired results. The common types of uncased cast in situ concrete piles are:

1. Simplex piles
2. Franki piles
3. Vibro piles
4. Pedestal piles
5. Pressure piles

SIMPLEX PILE

In this type of pile, a steel tube is fitted with cast-iron shoe is driven in to the ground up to the desired depth.

The Reinforcement, if necessary is placed in the tube. The concrete is poured into the tube and the tube is slowly withdrawn, leaving the shoe into the ground.

The concrete is not tamped and the pile is completed such a pile is known as simplex standard pile.

If tampering of concrete is done at regular intervals as the tube is withdrawn, it is known as simplex tamped pile.

TYPES OF PILES (Classification based on Materials)

FRANKI PILE

- The Franki pile, known and used world wide, It is a cast-in-situ concrete pile with an enlarged base and a cylindrical shaft which, due to its powerful driving method during installation, can penetrate stiff soils and reach large depths. By expulsion of a dry concrete plug, the soil surrounding the pile base is improved and thus the initial soil bearing capacity can be increased significantly. Although the application of the Franki system has decreased due to cost and environmental considerations, this system is still competitive and widely used when site conditions are suitable.

- This pile has an enlarged base of mush- room shape, which gives the effect of a spread footing. Also this type of pile is best suited to granular soil.

I. In the first stage a heavy removable pipe shell is set vertically on the ground with the help of leads and a charge of dry concrete or gravel is formed.

II. In the second stage a diesel operated drop hammer of 20 to 30 kN weight is driven on the concrete.

III. In the third stage when the tube has reached the desired depth, the tube is held in position by cables and the hammer is applied to the concrete, forcing it down and outward.

IV. In the fourth stage the shaft is formed by introducing successive charges of concrete, ramming each in turn and withdrawing gradually the casing. Finally it shows formed pile which has

TYPES OF PILES (Classification based on Materials)

VIBRO PILE

- The Vibro piles are formed by driving a steel tube and a casi iron shoe, filling with concrete and extracting the tube using upward extracting and downward tamping blows alternatively.
- Vibro-piles are extremely suitable for a large variety of soil conditions, for which the pile length can be adapted to the supporting capacity of the subsoil. This avoids risks of having piles too long or too short.
- A Vibro-pile is a closed off casing that is vibrated into the ground displacing and "densifying" all the material in its path. The casing is then filled with concrete and reinforcement and then extracted (or filled with concrete as it is extracted and the reinforcement is installed later.
- Vibro-pile is used as an alternative to pre-cast piles or drilled cast- in-situ piles in soft grounds especially when vibrating a can/probe is faster than drilling and casing or when vertical tie downs are necessary.

PEDESTAL PILES

- This type of piles are used where the bearing stratum is reached with reasonable depth. The pedestal of the pile gives the effect of spread footing on this comparatively thin bearing.
- The core and casing are driven together into the ground, till they reach the desired level.
- The core is taken out and a charge of concrete is placed in the tube.
- The core is again placed in the casing to rest on the top of poured concrete. Pressure is applied on the concrete through the core, and as the same time, the casing is withdrawn. The process is repeated till the casing is completely removed.

THANK YOU