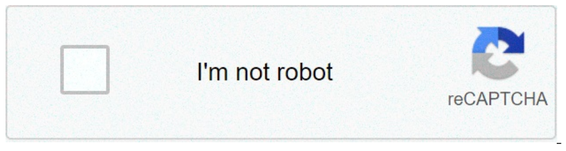

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Different kinds of foundations

Content of this article : Types of foundations, Spread footing foundation, Benching or stepped foundation, Pile foundation, classification of piles foundation, Piles can be classified according to material-wooden piles,concrete piles,RCC piles, sheet piles,classification is based on the mode of working of the piles,(i) Bearing pills, and (ii) Friction piles.Raft foundation,Well foundation,Cassion’s foundation,cantilever foundations,combined footing foundation,Inverted arch foundation,Grillage foundation. Types of Foundations The following are the different types of foundations, which are generally used for different structures : Spread footing foundation Benching or Stepped Foundation. Pile Foundation. Raft Foundation. Well Foundation. Caisson’s Foundation. Cantilever Foundation. Combined Footing Foundation. Inverted Arch Foundation. Grillage Foundation. Spread footing foundation Spread footing foundation This is the simplest type of foundation and is generally used for ordinary buildings on alluvial soils. This type of foundation can normally be used for three to four-storied buildings on common type of alluvial soils. The spread footing consists of a concrete base, generally lime concrete and a series of footings below the ground level. The depth and width of foundation depends on the bearing capacity of the soil and the intensity of load. The depth of foundation can be calculated by the Rankine’s formula The width of foundation should in no case be less than 2T+2J, where T is the thickness of wall and J is the concrete offset to be provided. If the width of foundation is taken as 2T + 2J, then the number of footings in this foundation will be equal to number of half bricks in the thickness of wall, excluding the concrete offsets. For example, for the foundation of 1 J brick thick wall, three offsets excluding concrete offset, will be provided. 2 Benching or Stepped Foundation. Benching or stepped foundation This type of foundation is provided on hilly places or in those situations where the ground is sloppy. In this foundations the excavation trenches are made in the form of steps. All the steps should be preferable of equal length and depth. The function of providing steps is. to avoid unnecessary cutting and filling. The plinth of the structure should start after the highest point of the ground. Sometimes R.C.C. pile is driven along the lowest base of the footing to avoid any slipping of the structure along with the foundations. 3 Pile Foundation. It is one of the important types of foundations which is used in the following situations: When it is not economical to provide spread foundations and hard soil is at a greater depth. When it is very expensive to provide raft or grillage foundations. When heavy concentrated loads are to be taken up by the foundations. When the top soil is of made up type and of compressible nature. When there are chances construction of irrigation canals in the nearby area. In case of bridges when the scouring is more in the river bed. In marshy places. Piles are vertical columns driven into the ground on which wooden or concrete platforms are supported. The piles are driven at regular distances. The size and distance apart, of the piles depends upon the bearing capacity and type of soil and the load of the structure. Classification of Piles. concrete pile,concrete pile with steel shell,precast RCC pile The piles can be classified according to (i) Material and (ii) Working. Material classification. The piles are classified as (a) Wooden Piles. (b) Concrete Piles. (c) R.C.C. Piles (d) Sheet Piles. (a) Wooden Piles. Wooden piles These are made from trunks of trees, such as Teak, Sal, Babul, Deodar etc. The wooden or timber piles are generally circular in shape, the diameter varying from 20 cm to 50 cm. The length of the pile is generally 20 times the diameter. The top of the pile is provided with an iron ring or cap and the bottom is sharpened and provided with iron shoe. Jf the soil is soft, blunt piles may be used, but if the ground Contains boulders, metal point should be Used. Timber piles should be driven below the permanent water table, otherwise they decay to fungi and insects. These piles are economical and can be driven rapidly without heavy machinery and much technical supervision. (b) Concrete Pile. Concrete piles are made cast-in-site. Holes of the specified diameter are made into the ground and filled with concrete. Sometimes, the shell driven for making the hole is left inside and the concrete is filled. The advantage of this is that there is the shell to protect the cement concrete of the pile from getting disturbed or eroded by the action of acidic water encountered in the sub-stratum. These piles are used when they are to be driven to a hard stratum passing through plastic soils. These are sound in construction as they have not to bear hammer blows. These are cast in exact lengths and there is no wastage like in precast piles. The main drawback of these piles is that they cannot constructed under water. (c) Reinforced Cement Concrete Piles. R.C.C. piles are generally precast and their feet are beveled like wooden piles. The R.C.C. piles can be octagonal, square or circular in shape with steel helmets on their top. After the piles are cured and seasoned, they are driven into the ground. These piles are 15 cm to 60 cm in diameter and can be 3 m to 30 m in length R.CC. piles should not contain more than 4% steel. These piles can be cast early before starting the foundation work and the execution of the work can be done very quickly. Unlike timber piles these can be used above the ground water table. But these piles are very heavy and cause difficulty in transpiration and there are changes of their being damaged m transit. (d) Sheet Piles. This class of pile is essentially used during the construction of foundation and not as foundation member of structure. Their main function is to enclose a certain area of the ground within which the foundations work can be carried and also to confine loose soil and prevent it from spreading. Sheet piles can be wooden, steel, concrete or R.C.C. Working classification. This classification is based on the mode of working of the piles. According to this classification piles are divided into two groups, (i) Bearing pills, and (ii) Friction piles. (i) Bearing Piles. These piles are used to bear vertical loads on their ends. Bearing piles are used in those places where the depth of hard stratum is not much. When piles are driven upto the hard stratum, they transfer the load of the structure to the hard stratum below, those piles virtually act as columns. (ii) Friction Piles. When the soil is very loose or soft to a considerable depth, friction piles are used. These piles balance the load of the structure by the friction offered by the surrounding soil on the sides of the piles. They are generally short in length and are not driven to the hard bed. The surface of the friction piles is made rough so as to increase skin friction. The problem of friction piles is controversial. In some of the soils, the soil become loose due to some reason or the other and reduce the friction, which may result in the failure of the structure. 4 Raft Foundation. Raft foundation Raft or mat foundation is used in those places where spread footing or pile foundation cannot be used advantageously. This type of foundation is also recommended in such situations where the bearing capacity of the soil is very poor, the load of the structure is distributed over the whole floor area, or where a structure is subjected to constant shocks or jerks. The raft foundation consists of a reinforced cement concrete Slab or R.C.C. T-beam slab placed over the entire area. The T-beam slab may consist of primary and secondary beams as shown in Fig. 1’8. The T-beam may be inverted also. The inverted T-beam raft foundation is most suited to columned structures, such as in factories •or work-shops. The beams and the slab should be constructed all at a time so as to act as monolithic. The R.C.C. work is laid at the required depth of foundation and then upto the plinth, the inside spaces are filled with dry sand and gravel. The R.C.C. slab and beams can be laid directly over the rammed ground surface or over a bed of lime concrete. 5 Well Foundation. Well foundation Wells are a convenient method of securing a trustworthy foundation in deep sandy and soft solid Well foundation is generally provided .for in the construction of bridge piers, ghats etc., where the depth of water is moderate and the foundations are to be carried out in deep sandy soils of soft soils. Detail of well curb For the construction of well foundation in running water as for the construction of a bridge pier, a temporary dam is constructed to exclude the water from the place of construction. This temporary structure is known as cofferdam. The water from the inside of the cofferdam is pumped out. Now a well curb made of steel, concrete or wood with steel cutting edges, is placed over the desired position where the well is to be sunk. A masonry or concrete staining wall is constructed up to a height of 1 m. It is then allowed to dry. 1 he earth from the inside of the well is scooped out either by manual labor or by draggers, and then the well is allowed to sink. Another height of staining is constructed and the material from the inside is dragged out. The well sinks due to its own weight. The process is repeated till the well sinks to the acquired depth or reaches some hard stratum as the case may be. Before descending the outer surfaces of the staining is plastered smooth so as to minimize the frictional resistances. The sinking is tested by putting the desired loads on the top of the well. Uses of well foundation for Bridge pier When the sinking in all respects is completed, the lower portion up to a depth of nearly 3 m is plugged with cement concrete, the middle portion with sand and gravel and the top portion with cement concrete. Now an R.C.C. well cup is constructed over the well. The top of the well cup should be below the bed level of the river. Over the well cap is now constructed the super structure of the bridge pier. 6 Caisson’s Foundation. Caisson’s foundation When the depth of water is considerable and the flow of water is such that cofferdam cannot be constructed easily and economically, then another method of well foundations is used which is called Caisson Foundations. A caisson is a box made of steel, double walled and water-tight, Laving a well curb with cutting edges attached to its bottom. The drum is carried to the site, i.e. the position where it is to be placed. The drum is made to sink with the help of steel rails or sand bags-and is kept in position upright by means of steel ropes. The double walled steel caisson is filled with cement concrete, and the water from the inside in purred out. Now the soil from the inside is scooped out with the help of draggers and the caisson is allowed to sink slowly. The length of the caisson is increased by attaching another length of the caisson, and filled with cement concrete (with some reinforcement it required), soil is dragged out and it is allowed So sink to the required depth or when it reaches the hard stratum.The sinking is tested by putting the designed loads over it. After the sinking is completed the bottom portion is plugged with cement concrete, middle portion with sand and gravel and •again the top portion with cement concrete. The steel caisson above She bed of the river is removed if possible and the remaining is allowed with the steining. In this case also R.C.C. well cup is constructed over the top of the caisson which the masonry pier is constructed. 7 Cantilever Foundation. Cantilever foundation This is a typical type of foundation, which is provided in such pleases where eccentric footings are to be provided for the external walls or columns due to restrictions of space or some other reasons. In this type of foundation separate footings are provided for the external and internal walls and they are simply connected with each other by a cantilever beam. The tendency of the exterior load to overturn, is balanced by whole or part of the downward pressure, acting at the other end of it. 8 Combined Footing Foundation. Combined footing foundation When two or more columns are supported by a single base area, the foundations to be provided in such cases are called combined footing foundations. The combined footings are also provided to establish the exterior columns along the boundary line, for white symmetrical footings are not possible. The exterior and the interior columns are constructed on the same base in such a way that the base area of the combined footing should be equal to the total load of the two columns, divided by the safe bearing capacity of the soil. The base area should be so shaped as to be symmetrical along the centre line of the columns. 9 Inverted Arch Foundation. Inverted arch foundation This is not a common type of foundation. This type of foundation is used in such places where the bearing capacity of the soil is very poor and load of the structure is concentrated over the pillars. The other conditions of the soil are such that deep excavation are also not possible. For this foundation an inverted arch is constructed below the foot of Pires etc. Generally segmental arches with a rise of l/5th to l/10th of the span are used. The span of arches will of course depend upon the arrangement of the pillars. The thickness of the arch ring, should not be less than 30 cm. 10. Grillage Foundation. Steel grillage foundation This is also a very important type of foundations and is suitable for those situations where the load of the structure is pretty heavy and the hearing capacity of the soil is very poor. This foundations is specially suited where deep excavations are not possible. Grillage foundations are usually provided for the construction of stanchions. It consists of a concrete base over which are placed one or two tiers of I-sections at right angle to each other. The area of the concrete base is calculated by dividing the total load of the structure by the bearing capacity of soil. A trench of the required dimensions, is excavated. Over this a cement concrete block generally 30 cm to 45 cm in thickness is spread and properly consolidated. When the contrite is partially dry, I-sections, i.e. Rolled Mild steel joists are placed at regular distances. (The size and the distance apart of the I-sections depends upon the load of the structure and the bearing; capacity of the soil). The lower flanges of the I-sections are connected to the concrete block by rich cement mortar. The I-sections are themselves connected to each other by pipes and bolts so as to form a rigid mass. Another tier of I-sections is placed at right angles to the previous one and connected by means of nuts and bolts. The whole unit is now embedded cement concrete so as to protect the steel from corrosion. Over this the structure is, constructed. Isometric view of Grillage foundation Save Save Save Save Save Save