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Geotechnical review of shallow foundation

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Abstract
A shallow foundation is a kind of building foundation that exchanges building loads to the earth close to the surface, as opposed to a subsurface layer or a scope of profundities as completes a deep foundation. Shallow foundations incorporate spread balance foundations, mat-slab foundations, slab-on-grade foundations, pad foundations, rubble trench foundations and earthbag foundations.

Keywords: shallow foundation; building, footing

1. Introduction
Soils in the field or at recovered destinations usually contain approximately A shallow foundation is a kind of building foundation that exchanges building burdens to the earth exceptionally close to the surface, as opposed to a subsurface layer or a scope of depth as completes a deep foundation [2]
Shallow foundation exchange the loads to the prompt soil surface underneath the structure in this manner not transmitting it to extraordinary depth (or sub surface).
Footings are essentially shallow foundation. Types incorporate: Strap footing, Combined footing, Stepped footing, Raft footing etc.
At the point when the subsoil conditions are steady enough to hold a superstructure giving sufficient bearing limit, at that point we can go for shallow foundation. Important parameters to be considered while selecting Shallow Foundations are:

- Knowledge of the idea of superstructure and the loads to be transmitted to the foundation. (For substantial burdens, Pile foundation is ideal)
- Subsurface conditions. (For e.g. on the off chance that the heavy stratum is hard and steady, at that point shallow foundation is favored. For loamy soil (Bentonite or dark soil) heap foundation is favored)
- Existing conditions like the bearing limit of soil and potential outcomes of differential settlements must be considered. Since deep (pile) foundation settle on better decision at it.
- After evaluating the security parameters for the superstructure, one can consolidate the cost parameters in picking the sort of foundation.

2. Types of foundations

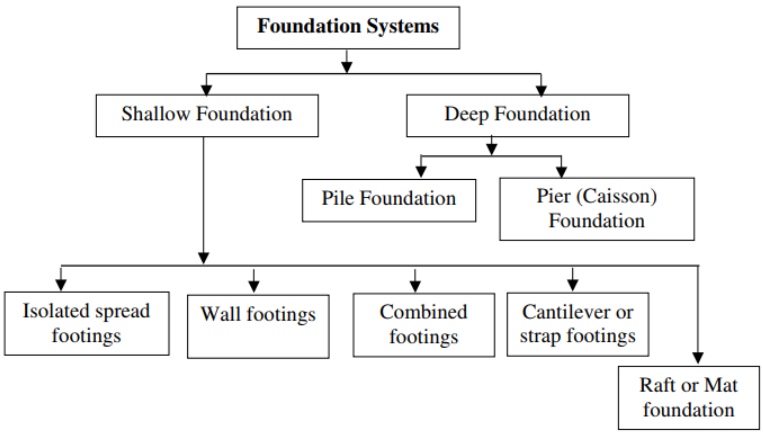

Fig 1: Types of foundation

Shallow Foundation v/s Deep Foundation [6]

Table 1

	Sources	Shallow Foundation	Deep Foundation
1.	Definition	Foundation which is placed near the surface of the earth or transfers the loads at a shallow depth is called shallow foundation.	Foundation which is placed at a greater depth or transfers the loads to deep strata is called deep foundation.
2.	The depth of foundation	The depth of shallow foundation is generally about 3 meters or the depth of foundation is less than the footing with.	Greater than shallow foundation.
3.	Cost	Shallow foundation is cheaper	Deep foundations are generally more expensive than shallow foundation.
4.	Feasibility	Shallow foundations are easier to construct.	The construction process of a deep foundation is more complex.
5.	Mechanism of load transfer	Shallow foundations transfer loads mostly by end bearing	Deep foundations rely both on end bearing and skin friction, with few exceptions like end bearing pile.
6.	Advantages	Construction materials are available, less labor is needed, construction procedure is simple at an affordable cost etc.	Foundation can be provided at a greater depth, Provides lateral support and resists uplift, effective when foundation at a shallow depth is not possible, can carry huge load etc.
7.	Disadvantages	Possibility of a settlement, usually applicable for lightweight structure, weak against lateral loads etc.	More expensive, needs skilled labors, complex construction procedure, can be time-consuming and some types of deep foundations are not very flexible etc.
8.	Types	Isolated foundation, strip foundation, mat foundation, combined foundation etc.	Pier foundation, pile foundation, caissons etc

The different types of shallow foundation are

1. Strip footing
2. Spread or isolated footing
3. Combined footing Strap or cantilever footing
4. Mat or raft Foundation

i) Strip Footing

A strip footing is accommodated a load bearing wall. A strip footing is likewise accommodated a line of segments which are so firmly dispersed that their spread footings cover or almost contact one another. In such a case, it is more affordable to give a strip footing than to give various spread footings in a single line. A strip footing is otherwise called continuous footing.

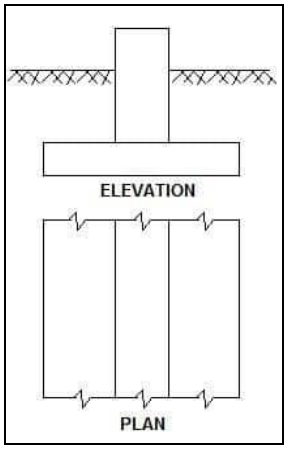

Fig 2: Strip Foundation

ii) Spread or Isolated Footing or Individual Footing

A spread footing additionally called as confined balance, cushion balance and individual balance is given to help an individual section. A spread balance is roundabout, square or rectangular slab of uniform thickness. Here and there, it is ventured or launched to spread the load over a substantial region.

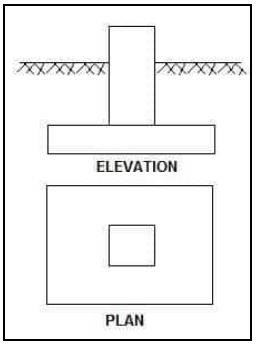

Fig 3: Spread footing

iii) Combined Footing

A combined footing underpins two sections. It is utilized when the two segments are so near one another that their individual footings would cover. A joined balance is likewise given when the property line is so near one section that a spread balance would be capriciously stacked when kept completely inside the property line. By consolidating it with that of an inside column, the load is uniformly conveyed. A joined footing might be rectangular or trapezoidal in plan.

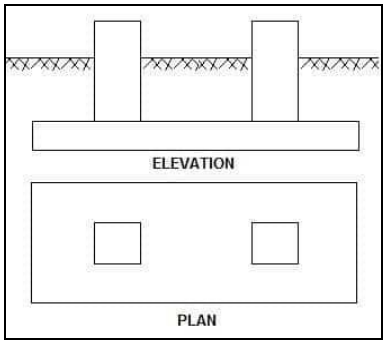

Fig 4: Combined footing

iv) Strap or Cantilever Footing

A strap (or cantilever) footing comprises of two disconnected

footings associated with a basic strap or a switch. The strap associates the two footings with the end goal that they carry on as one unit. The tie is planned as an unbending beam. The individual footings are designed to the point that their consolidated line of activity goes through the resultant of the complete load. a strap footing is more efficient than a joined footing when the reasonable soil pressure is generally high and the separation between the columns is extensive.

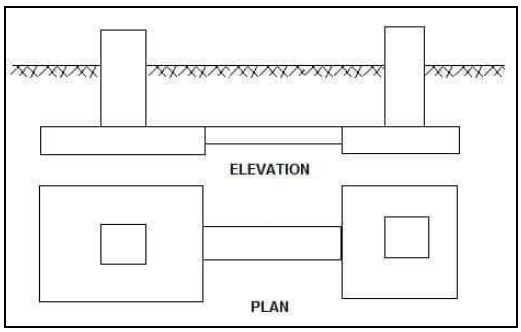

Fig 5: Strap footing

v) Mat or Raft Foundations

A mat or raft foundation is a substantial slab supporting various segments and walls under the whole structure or an expansive piece of the structure. A mat is required when the admissible soil pressure is low or where the segments and dividers are close to the point that singular footings would cover or almost contact one another.

Mat foundations are valuable in lessening the differential settlements on non-homogeneous soils or where there is an expansive variety in the loads on individual columns.

Table 1: Soil Types and Foundation Consideration

Soil Type	Foundation		Trouble Areas
	Type	Reason(s) for use	
SAND	Footings	Easy to construct and economical	• Bearing capacity may be a problem but in most cases it is sufficient. • Excessive settlement in wet and loose deposits • Confining pressure is usually low
	Retaining Structures	Must be used since sand can not support themselves	
	Deep Foundations (Piles)	Uses φ for friction resistance but low in bearing capacity	
CLAY	Footings	Economic but may have problem with bearing capacity in saturated clays	• Low bearing capacity. • Generally low shear strength when wet. • High consolidation in soft clays • Swelling is possible • Over-consolidated clays may contain cracks and fissures.
	Retaining Structures	Clays are self-supportive up to a certain height (critical). Must be used if height increases beyond the critical.	
	Deep Foundations (Piles)	If bearing capacity is low, piles may be driven to rock. May change formation of clay.	

Table 2: Problem and there solution

Soil Type	Nature of problem	Possible solution
SAND	Settlement	• Loose sands must be compacted • Lowering water table may result in sand densification.
	Bearing Capacity	• Compaction increases c and φ and thus bearing capacity • Use deep foundations
Clay	Consolidation	• Lowering water table • Pre-loading • Drive pile to rock
	Bearing Capacity	• Compaction • Use deep foundations
	Expansion or Swelling	• Treat or stabilize soil • Maintain constant water table • Alter soil nature (similar to stabilization) • Include swell pressure in design

3. Bearing capacity for shallow foundations

The bearing limit of a shallow foundation can be characterized as the most extreme estimation of the load connected, for which no point of the subsoil achieves failure point else for which failure reaches out to an extensive volume of soil.

Bearing limit is the intensity of foundation soil to hold the powers from the superstructure without experiencing shear failure or inordinate settlement. foundation soil is that part of ground which is exposed to extra stresses when foundation and superstructure are built on the ground. Coming up next are a couple of vital phrasings identified with bearing limit of soil.

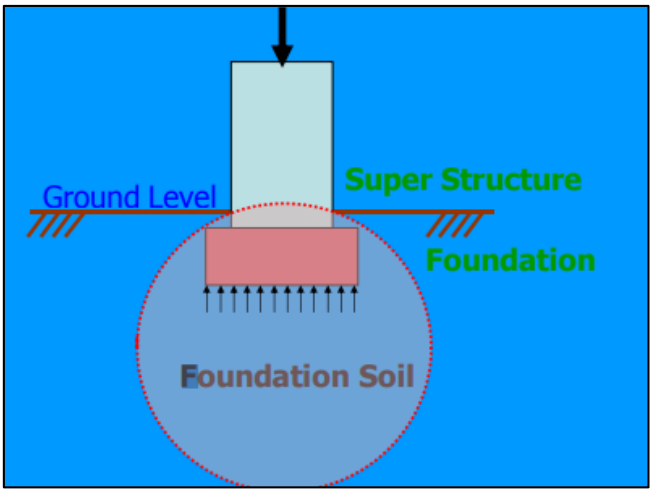

Fig 6: Bearing capacity

Ultimate Bearing Capacity (q_f) It is the greatest pressure that an foundation soil can withstand without experiencing shear failure.

Net ultimate Bearing Capacity (q_n): It is the greatest additional weight (in addition to introductory overburden pressure) that an foundation soil can withstand without experiencing shear failure [7].

4. Conclusion

A shallow foundation appropriates loads from the working into the upper layers of the ground. A shallow foundation is one in which the depth from the beginning to the underside of the foundation is under multiple times the width of the foundation. Every single other foundation are viewed as deep foundations. Shallow foundations perform great on locales with solid soils, adequately thick normal rock rafts overlying weaker soils or where powerful, built ground improvement is completed. For destinations with weaker soils, it might be progressively monetary to enhance the ground and utilize shallow foundations than to utilize deep pile foundations [4].

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