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Evolution of Foundation Systems

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Foundation is that part of the structure which is in direct contact with the ground to transfer the load of super structure to the firm strata below. Purpose of foundation is to transmit the dead and live loads from the roof, floors, walls and columns in to the underlying supporting soil strata. There are basic three components for construction of foundation system.

1. Soil
2. Structure
3. Loads

It is invariably the type of soil; it's behavior, bearing capacity, qualitative analysis in respect of strength at various depths, which would help us arrive at the type of foundation to be adopted for various types of structure.

If it is sedimentary soil on the upper strata and there is history of soil erosion in and around the area, it will definitely reflect directly on the selection of type of foundation and suggestive type of structure. Basement floors are suggestive in sites with sedimentary soils, as the foundation needs to be laid on firm soil level with proper and adequate bearing capacity. The area around riverbeds i.e. Noida and East Delhi largely has sedimentary sandy soil on the upper strata. Hence, the structure cannot rest on the upper loose soil. Therefore either deep independent/ strip foundation on firms soil needs to be erected or engineering skill by way of under ream manual piling needs to be adopted to transfer the load effectively to the firm soil. A basement would also be effective to reach the firm soil and a raft foundation would accordingly be suitable. There are many such issues, which needs to be addressed while designing the structural aspects of a building. Similarly,

> The key players in the evolution of foundation system are the soil investigation and load of the structure

in sites with black cotton soil where there is uneven distribution of loads due to behavior of soil depending upon the water content etc. again one has to reach to a deeper level with firm ground grip having proper bearing capacity and evolution of plinth/ring beam, with under ream piling or isolated deep footing would be most effective structural system which would be adopted in most effective manner for such type of soil conditions.

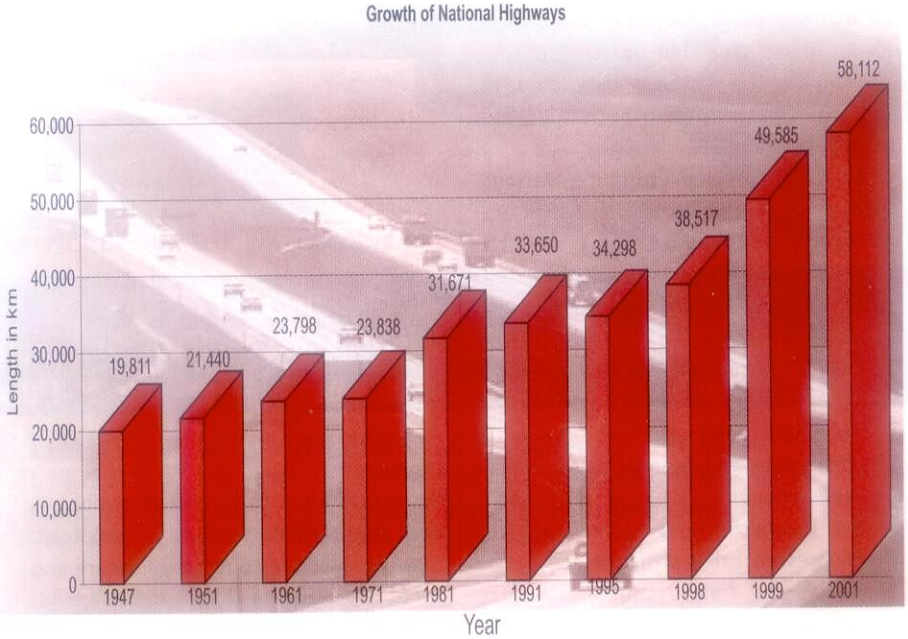
Other important factor to be considered is the type of structure for which we need to design the foundation system. Does it have some large spans or it is a residential masonry structure which only calls for load bearing strip foundation, if it has a good ordinary soil conditions with good bearing capacity or we need to develop some alternative system by application of simple understanding of science, technology, construction systems and appropriate use of construction materials like having an arch, curve foundation work in stone/brick masonry etc. large span structure would call for deeper & broader isolated footings adequately designed. Multiple isolated footings immerging into combined and ultimately into a raft foundation. Where there are multi-floors with large spans and heavy loads on various points, then we may adopt for pile foundation as is generally done in most of the multistoried buildings. There are many other complex issues in relation to foundation where in pre-stressing, cable structure, well foundation and other complex critical structural analysis are required to be carried out for a better and clear understanding of various elements.

We may therefore, now broadly discuss the three basic components of the foundation system, which have been referred earlier.

Soil

The general nature of the soils-including there structural properties and its behaviour-must be reasonably understood in the study of the site construction. A

Growth of National Highways



critical soil analysis would largely help in analyzing the foundation designs of the buildings.

We may classify the soils as under –

1. Ordinary Compact Soil
2. Loose/Sedimentary soil
3. Rocky Soil
4. Black Cotton Soil
5. Sandy Soil

Subsoil water level plays a vital role on the behavior of the soil. Moisture contents in soil also make a difference in the strength of soil. There is soil erosion due to moisture contents. The soil appears to look ordinary compact soil but due to heavy rains, it gets eroded and loosens up which reflect directly of the bearing capacity.

Structure

There are basically two types of structures

1) Load bearing structures
2) R.C.C. Framed structure

Load bearing structure consists of masonry walls either in brick or stone with mud, lime or cement mortar having linear continuous masonry walls with evenly distributed load through the wall to the desired foundation. The suggestive foundation for masonry walls is strip foundation with even distribution of load to the soil. The depth and width of foundation masonry, which generally comes out in stepped manner, depends ultimately on the bearing capacity of the soil. The concept of arch, vaults and its use in strip foundation can also be utilized by resting the foundation on an arch shape dug up trench. This is effective to increase the strength and wider base for distribution of load to the soil.

In R.C.C Framed structure, various type of footing and structure, which are generally adopted in R.C.C framed structure or otherwise for complicated and complex buildings are as under

1) Isolated footing
2) Combined footing
3) Raft footing
4) Pile foundation
5) Under ream pile foundation
6) Cable structure
7) Well foundation
8) Prestressed cable structure
9) Steel portal framed structure

Concrete Pavement Types

- Pre-cast concrete slab are available in wide range, create aesthetic bounding pattern and are suitable for pedestrian and vehicular movement.
- Pre-stressed concrete is better than pre-cast slab under continual compression conditions.
- Concrete blocks are available in various sizes. These are suitable for residential streets, roundabout,
- bus-stop, transport yards, etc.
- Insitu concrete can be used in low-cost paving but can br attractive if skillfully designed and laid.
- Asphalt concrete is suitable for vehicular paving.
- Interlocking concrete block gives better performance and is suitable for vehicular paving.
- Concrete broom finish is applied on insitu concrete with a wide strip of smooth finish. It is suitable for pedestrian paving.
- Concrete round is available in various sizes and is suitable for pedestrian paving.
- Concrete silt is laid on lime mortar bed and is suitable for pedestrian paving.
- Concrete Slab and Gravel incorporates coloured gravels are scattered around the slab and is also suitable for pedestrian paving.

It is very crucial to adopt for an appropriate and desirable technology and system of foundation, which should sustain the overall requirement of loads, soil and resistance to wind, earthequake and other climatic behaviours

Loads

The structure has to support primarily two kinds of loads: Static load and Dynamic load.

Static load are constant in nature and are of two kinds dead load and live load.

Dead loads are vertical static loads that results from the weight of the construction materials and from the permanent elements present within the building such as machine etc. dead load of a building vary according to there designing as to whether they are official, residential and commercial building etc. live loads also called superimposed loads are the static loads resulting from the weight of all the occupants, vehicles, or by the building, as well as materials and equipment's that are likely to be moved during the expected life of the building. Dynamic loads are applied to the structure