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A Review on Construction Approach on Preliminary Stage at Best Location

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Abstract: ***The construction of high rise structures in developed and developing countries have been widely used in their urban areas and semi-urban areas. These tall structures include residential apartment, commercial and semi-commercial apartment. Since the provision of these buildings have a larger area of construction, but constructed over less area. In analysis stage of the structure, significant characteristics like vertical load, horizontal load, superstructure design, foundation design takes place. But before that the architecture planning over the larger area has proposed. The selection of area of construction in this preliminary stage has not sufficient on comparing with structural design configurations and soil parameters is an important part should takes place before the planning of the construction area. The paper consists of the study of the past research based on the above title and after that conclusions have drawn based on the inferences of reviews. The result shows that location parameter based on the soil investigation report should be determined first for the usage of best SBC of soil of the selection of construction area.***
Keywords: Vertical Load, Soil Bearing Capacity (SBC), Tall Buildings, Foundation, Building Design.

I. INTRODUCTION

The most important part of sub structure is “Foundation”. The types of foundation called footing that bears the load of the whole building and transfers it to the subsoil. Since soil directly deals with the settlement, it has important to design the footing as per its types and parameters of the building. The two major concerns in the design are the settlement of footing and the bearing capacity of the soil. For finding the settlement of the footing and the bearing capacity of soil, a lot of work from a long time is going on. Foundation acts as a medium through which loads are transmitted to the stiff soil and considered as an integral part of a building whose stability determines the stability of the entire structure.

The main factors depend on stability of a foundation are:

1) Structural loads.
2) Condition of the subsoil base.
3) Geology of the area.

The allowable bearing capacity may be calculated from consideration of shear failure with a factor of safety of three shown below shall be adopted.

a) Cohesion of soil
b) Density of soil
c) Angle of internal friction of soil

The foundation does not experience any shear failure under loading, the stability requirement ensures the same. On comparing with the deformation requirements confirms that settlement of a structure has within the superstructure’s acceptance limit.

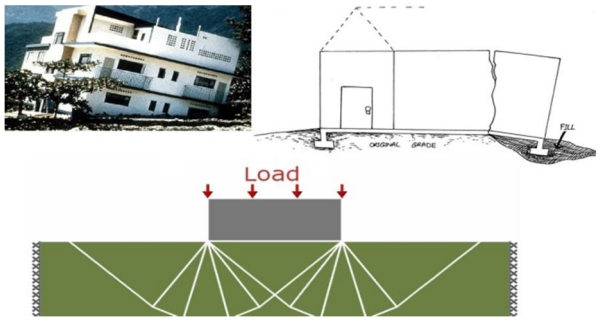

Fig. 1: Soil its failure phenomena

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The explanation of shallow foundations differs as per different. Foundations are classified as shallow and deep foundations subject to the depth of load-transfer from the structure to the ground. In the geotechnical engineering, the most important of all the aspects of parameters is bearing capacity. The two basic criteria to be gratified in the analysis along with the design of footing are deformation requirements with its stability. Loads from buildings are safely transmitted to the foundation that can be conducted by columns or by load bearing components such as load bearing walls.

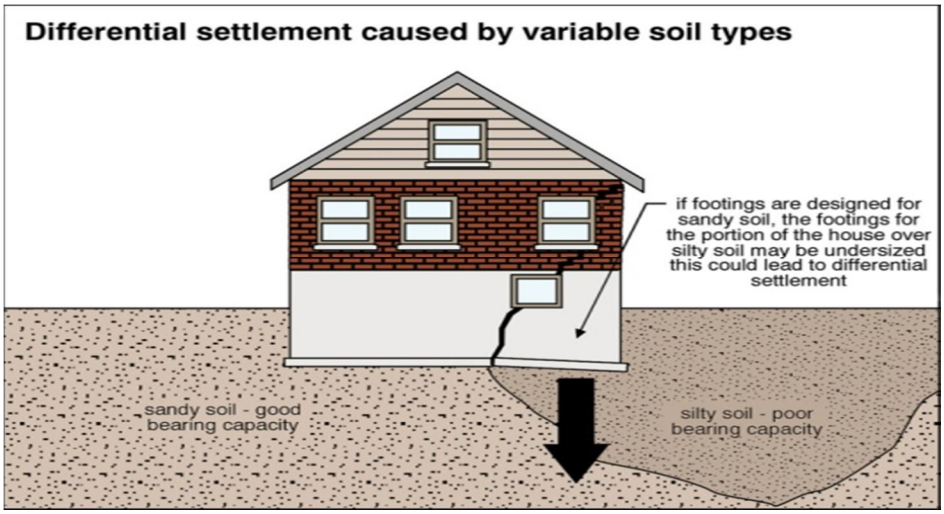

Fig. 2: Variation in soil strata causing settlement

II. REVIEW OF LITERATURE

The following literature articles has selected for the current research study based on soil conditions and construction over it. The individual summaries are as follows:

Magar J., Kudtarkar A. & et. al. (2020) To make more cost effective and cost efficient foundation, the analysis should be more accurate for providing the actual view. For this, the authors first consider foundation that withstands natural climate and durable substructure. Before the construction activities, the climate condition should be determined first. The collection of the information related to the different types of foundation with its suitability for a particular soil was conducted. Conclusion made in the research that major foundations were covered with its properties for the selection of different types of foundation.

Taie E.A., Ansari N.A. & et. al. (2014) The effect of the shallow foundation has been made in Iraq city. Total 79 samples were collected form twenty three bore holes from different areas. Depth of one to twenty four meter was selected and different test such as atterberg's limit, SBC calculation, water content, shear test, consolidation tests, etc. were conducted. The general equation of the bearing capacity used and with obtaining the results of bearing capacity parameters (c and ϕ). The software analysis then conducted over mat foundation with only two storey building. Different bearing capacity values has shown for different soil taken and the conclusion made for different location. Shallow footing was recommended for Basrah region and storey with 5 nos. was suitable as per conclusion.

Namdar A. , Xiong Feng X. (2014) The researchers in this paper wants to focus only on the mixed soil and structure over it with its behaviour. Various cases has made and footing dimensions have determined. They have constructed 15 soil foundation and place 180 footings over it with the assumption taken that no effect of the underground water will be applicable. The analysis has been made and the results found that when using the uniform soil, the actual strata configuration shows displacement and other parameters in uniform manner. The prediction of the actual soil analysis values only to be calculated after determining the SBC of soil in mixed form htat will require to control the footing dimensions.

Baker W.F., James B.C. & et. al. (2013) In this research, there are different types of towers were analysed and compared each other. The selected structures are Plaza rakyat, Trump tower and Burj khaifa. Main focus of the research has to analyse the foundation and design of the super structure. The influence of the foundation discussed briefly. The soil above the foundation and blow the foundation was compared by different analysis for successful design of tall buildings. Caissons are the controlling elements in trump tower and the main component that enable heavy concrete tower was the heavy bed rock strata. The bed rock of Plaza rakyat tower enables friction piles to stay over it without using the cast in situ piles.

Dev H., Ramana G.V. & et.al. (2012) The research gap was found by the researchers assessed the bearing capacity of soil using the field test. Various factors such as type of soil, compaction/interlocking of soil molecules and more prominently size of boulders beneath the footing that depends upon the load displacement characteristics of gravel boulder deposits. Load-settlement curve can also be utilized to determine the yield pressure and recommended allowable pressure for foundation design. The exact behaviour of a complex matrix does not represent the laboratory tests conducted on the tiny samples. For their proposed project, the results and its interpretation of the in-situ footing load tests was conducted. The ultimate bearing capacity was obtained with a value of 13.33t/m^2 was taken for their proposed site obtained from the test results of two footing load. The conclusion established by applying higher load, the failure had not occurred at the specified design load, the ultimate bearing capacity and safe bearing capacity of the formation may be selected which ever was higher.

Amornfa K., Phienwej N. & et.al. (2012) To explore the improvement techniques made on high-rise buildings in Bangkok, Thailand on the current practices with special attention to foundation design, the current research was done. The structural engineers control the current design practices found in an interview survey. The conventional method of analysis such as springs analysis and combined stress equations was commonly used in their research. In terms of cost efficiency, their current design practices does not encourage an optimal design outcome from the survey analysis, was the first part of the research gap. Coming on to the second part of the study analysis, they also explored the design concept of the adoption of the piled raft foundation that benefitted in their design concept. The third part of their research gap was to compare the 3D FEM analysis on various methods used. The pile springs method which neglects the raft-pile interaction and the pile-pile interaction was concluded in their 3D FEM analysis and results shows when raft is placed in the stiff clay layer, 70-80% of total building loads are carried by piles. When the true piled raft foundation concept has adopted, the number of piles in the piled raft foundation can be significantly reduced has been recommended with sightly increment of foundation settlement.

Dixit. M.S. and Patil K.A. (2009) For a particular bearing capacity of soil, this research paper deals with the study of effect depth of the footing along with the shape of footing. As depth or width of foundation increases as per their objectives, their parameters like bearing capacity of soil keep on increasing and the other parameters has not depending much so input parameters keep constant. Different shapes like square footing, circular footing, rectangular footing and strip footing was selected. IS code method and bearing capacity theories like Terzaghi was selected and analysis results has compared. Result analysis found that the bearing capacity of strip footing established to be with circular shaped footing, rectangular shaped footing and square shaped footing found to be lowest in comparison in case of local shear failure. Minimal effect on ultimate bearing capacity of increase in width of footing has suggested. On comparison with non-cohesive soil, the effect of water table correction on safe bearing capacity was found to be less compared to frictional and shear failure.

C.M. Martin (2003) For the calculation of the vertical bearing capacity of circular and strip foundations, ABC computer program was used in this paper. To find the characteristics of soil, the Mohr Coulomb's soil method was used. The boundary conditions that governs the equations have used for both smooth and rough footings in their research. The suggestion based on past research followed to obtain upper bound collapse load ($\psi = \varphi$) (for the classical case of related flow) and the stress field which was incomplete can be extended throughout the soil bulk in a statically permissible manner. A conclusion suggests that ABC computer program allowed fast calculations that conclude the solutions to a highly accurate benchmark.

III. CONCLUSIONS

The inferences of the above literature leads to the following conclusions are as follows:

1) The past famous derived theories like Mehrof's theory, Skempton theory, the famous Terzaghi's theory of soil and so on shows the load transferred to the soil in different forms in soil and states the status of soil failure. This can help to design the foundation and somehow decides the soil health to withstand the upcoming load.

2) Some inferences introduced different manual testing of soil such as core test, SPT test, soil investigations and so on to design foundation and obtain its failure Mechanism. Some researchers used different footing sizes by introducing the safe bearing capacity of soil.

3) Some inferences introduced x.y.z. types of software for finite element modeling of the soil to determine its properties before the design. This will enable the designers to use the corrected and enhanced properties of the same

4) The inferences of the literature also based on the past and historical buildings to determine its properties, geometry, design procedure and construction practices to use them in new approaches. Hybrid approaches are also considered by the past researchers.

5) Foundation depth is also a main and important point in the design of multistoried structure by manual way or by software approach. This can be also a great approach in seismic design of the structure.

To select the best location of construction area, it should be compulsory to determine the property of the soil first, analyze it and select the area based on the more enhanced property of the soil. This can be possible only when soil investigation takes place and then selection of the construction area should be based on it

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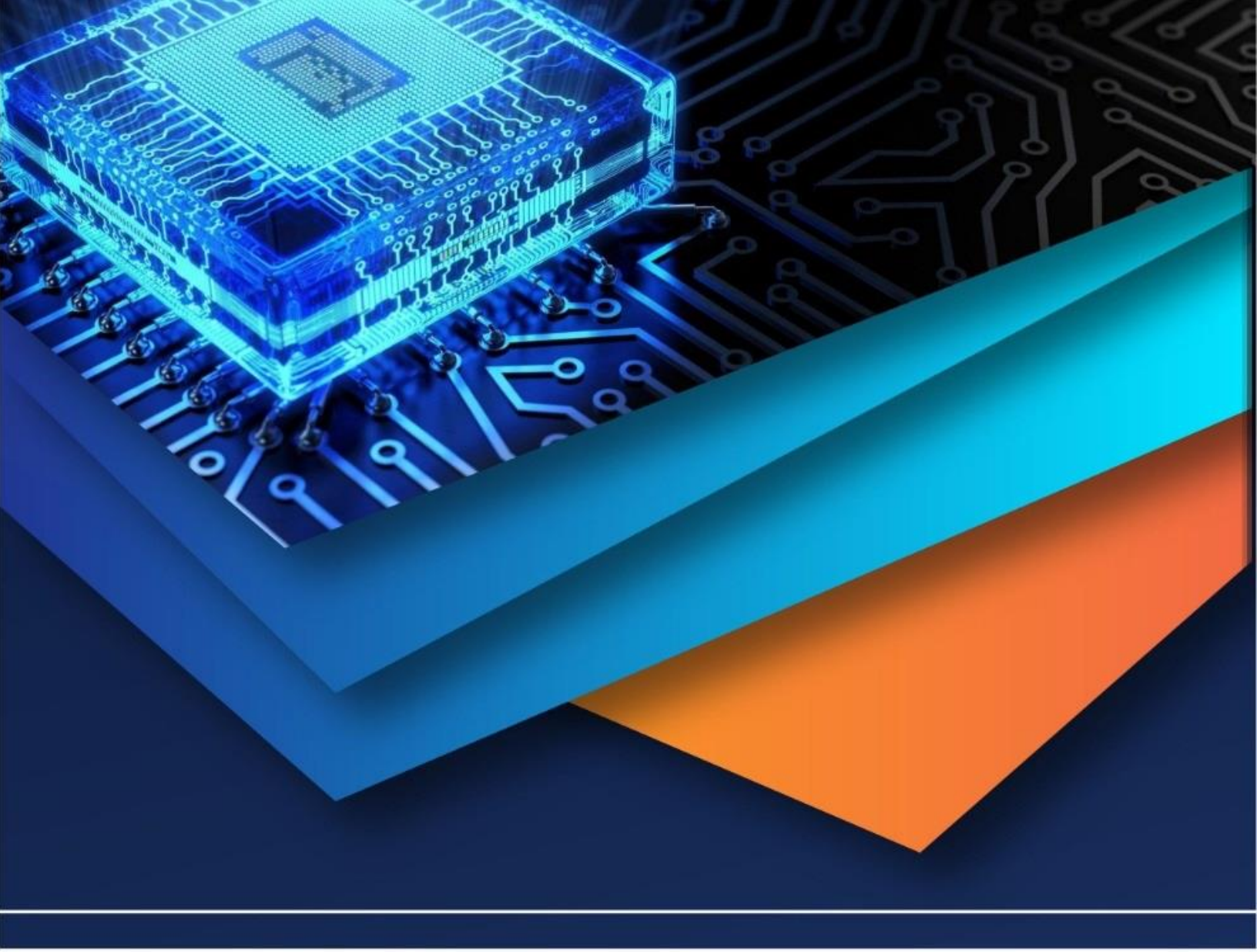

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