International Journal of Current Engineering and Technology
E-ISSN 2277 – 4106, P-ISSN 2347 – 5161

Available at http://inpressco.com/category/ijcet

Review Article

A Review on Analysis of Foundation & its Super Structure under the SBC Condition of Soil

Mr. Piyush Kumar Tripathi[1], Dr. Yusuf[2], Mr. Arvind Vishwakarma[3]

[1] P. G. Student, Department of Civil Engineering, Oriental University, Indore (M.P.), India
[2] HOD & Associate Professor, Department of Civil Engineering, Oriental University, Indore (M.P.), India
[3] Assistant Professor, Department of Civil Engineering, Oriental University, Indore (M.P.), India

Received 15 Oct 2021, Accepted 10 Nov 2021, Available online 15 Nov 2021, **Vol.11, No.6 (Nov/Dec 2021)**

Abstract

A building never builds without foundation or any base. All the loads can be transfer through it. So it is required to design the sub structure for taken the load through it. The articles are deals with the analysis and summaries the various articles under the review to find out the impact of different depth and soil condition and other techniques. Based on summarized report the paper concluded that the foundation & super structure design the assessment of at different depth and approach are required. Different SBC method Prandt, Terzaghi, Meyerhoff, Hansen, Vesic and is adopted to get the ultimate value of carrying load of the particular soil. The software approach such ABACUS, PLAXIX etc also needed to quick check the structure under the soil and foundation behavior.

Keywords: *Foundation, Bearing Capacity, Super Structure, Settlement of Footing, Soil Parameters, Strip Footing, Depth of Foundation.*

1. Introduction

The foundation is the most important part of any structure. It receives a load on the whole building, so it is important to properly design the foundation of the building. The bearing capacity of the soil and the subsidence of the foundation are the two main design problems. Much work has been going on for a long time to find the bearing capacity of the soil and settle the foundation. The foundation is an integral part of the building, whose stability determines the stability of the entire structure. It acts as a vehicle for transferring the load to the ground or rock below. The stability of the foundation depends on its correct design, based on the structural loads of the building it carries, the geology of the territory and the condition of the soil foundation.

Depending on the depth of the load transfer from the building to the ground, the foundations are classified as shallow and deep. The definition of shallow foundations varies in different publications. The issue of carrying capacity is probably the most important in all aspects of geotechnical engineering. Many loads are carried to the foundation by columns, load-bearing walls, or other load-bearing components. The two main criteria that must be met when assessing and laying a shallow foundation are need and stability.

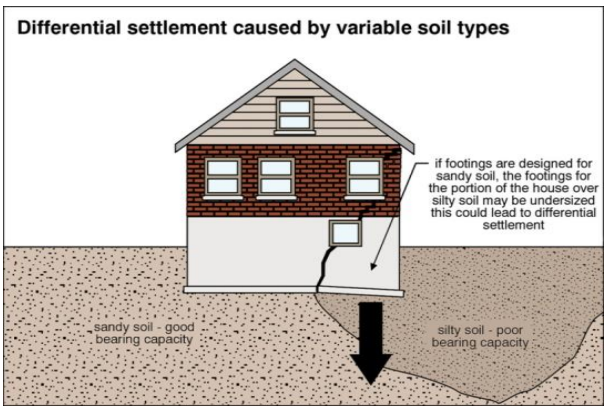

Fig 1: Settlement Due to Soil Strata Variation

Fig 2: Typical Foundation

Corresponding author's ORCID ID: 0000-0002-6890-6971
DOI: https://doi.org/10.14741/ijcet/v.11.6.2

Stability requirements ensure that the foundation does not shift during loading, while the deformation requirement ensures that the subsidence of the structure is within acceptable limits of the superstructure. If data on soil characteristics (adhesion, internal friction angle, density, etc.) are available, the allowable bearing capacity can be calculated taking into account shear failure. The safety factor must be taken in three.

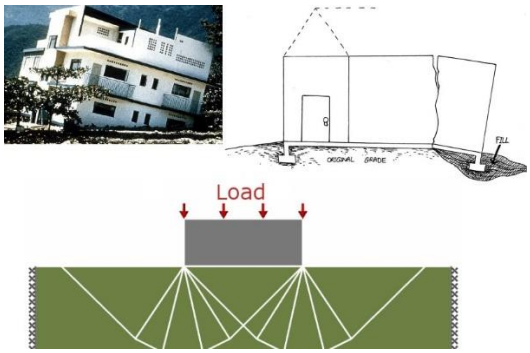

Fig 3: Load Transfer through Building on Soil and Failure Phenomena

The engineer considers the soil as a complex material obtained by weathering hard rock. Runt is the most important material used for building construction. Among all the parameters, the bearing capacity of the soil to withstand the load per unit area is very important. There are various methods of calculating the bearing capacity of the soil, proposed by such scientists as Prandtl, Terzagi, Meyerhoff, Hansen, Vesic and others. The main factors influencing the ultimate bearing capacity are the type of soil, the width of the foundation, the mass of the soil in the landslide zone and the allowance. Structural stiffness and distribution of contact stresses do not greatly affect the bearing capacity. Load-bearing capacity analysis assumes uniform contact pressure between the foundation and the soil underlying it. With other constant factors, the type of soil destruction, the depth of occurrence and the impact of soil cover also affect the bearing capacity of the soil. The results of laboratory soil mechanics help in the accurate design of the soil foundation and improve the mitigation of destruction. Mixing soil design has been used in many geotechnical engineering to improve soil. The bearing capacity of the foundation is a primary problem in the field of foundation design. The load at which the soil shifts is called the ultimate bearing capacity of the foundation.

2. Review of Literature

It is presented the summarise report of the various outcomes of different researcher which are as follows:

Przewlockia J., Zielinskab M. (2016)

A case study is taken by the researcher for the behaviour of the foundations of historic buildings. The analysis is taken under the techniques, materials, other basic parameters. The analysis is based on the properties such as Cohesion less soils, high, moderate & compacted loose etc,

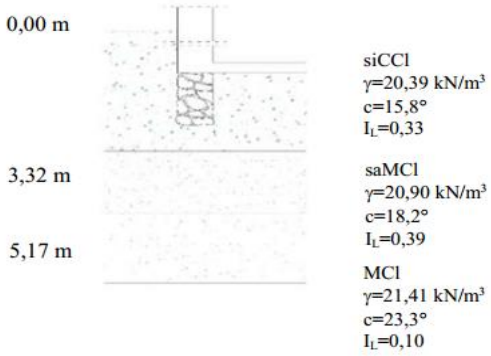

Fig 4: Use of different parameters at various depths (Ref. Przewlockia J., Zielinskab M. (2016))

Several different approaches and methods of analysis of the foundations of historic buildings are presented. The special analysis focused on the example of a typical 16th century stone foundation. First, the calculations were performed using the method, then the analysis of calculations and calculations was determined in accordance with EC-7 [1]. Next, the BC was assessed using a simplified analysis. The calculation of the fund was also evaluated at the suggestion of Kerisel.

Fig 5: Typical view foundations historical building in Olsztyn, GdaĔsk,(Ref. Przewlockia J., Zielinskab M. (2016))

The articles concluded that the EC7 methods to solve the issue and more such type's method required for the analysis of historical buildings.

Lanko A.. Ulybin A. (2016)

The article describes the methods of determining the depth of the foundation. The results of the study focus on determining future reconstruction costs. We conducted an experimental survey of the basement, comparing different methods.

Table 1: Comparison deals with work process (ref. Lanko A.. Ulybin A. (2016)

Speed survey for one object	4 man/hour	8 man/hour in the case of the concrete floor
The extent of damage to the basement from the survey	Small holes, easy to fix Large	damage of the floor
Requirements for equipment and training of workers	Requires special equipment and qualified staff trained to work on it	Can do with general work skills, a professional inspection is needed only at the last stage of the survey
The difficulty of reconciling work with the current owner	More simple because of the insignificant damage	Can do with general work skills, a professional inspection is needed only at the last stage of the survey
The difficulty of reconciling work with the current owner	More simple because of the insignificant damage	Complicated, because of the serious damage

The research methods (complexity, work, damage) and quality of data obtained were compared. The document describes the analysis process, as well as the algorithm for obtaining basic depth. Over time, recommendations are made with the choice of method to determine the depth of the foundation.

Namdar A., Feng X. (2014)

In this research the various soil layers were made to form a mixed soil. The carrying capacity of the soil base was calculated by changing the parameters of the mixed soil and the size of the feet. Made 180 feet of 15 types of soil. Groundwater is thought to have no effect on soil strength. The results of the numerical analysis and mixed soil techniques were combined. The numerical analysis supported the design of the mixed soil and presented the appropriate results for the soil base design. The effect of mixed soil on soil depth and width was compared. The mixed soil design has influenced the results of the numerical analysis and helps to select the economic soil design, the appropriate dimensions. Based on research, it is concluded that the results of the numerical analysis support the codes of geotechnical and structural engineering, the perception of natural hazards, the prevention and understanding of basic soil behavior, predict the stability of the structure and age differences. This research approach supports the use of integrated land for the purpose of basic land planning.

Xia H ,Zhang J. & et. al. (2020)

The literature examines aeol sand to ensure safety and engineering use, and it is necessary to study the components of aeol sand. The paper focuses on the ability to carry aeolian sand in the Mu US desert and select 6 minimal web sites. A large number of soil machine steps have been collected in SLT and CCT laboratory. Primary treatment indicates that it incorporates mixing and easy mixing (which clay and water affect the ability of aeol sand.

Amornfa K., Phienwej N.(2012)

The researcher is using a high-level project in Bangkok, Thailand, to explore areas of development. A well-researched study has shown that modern design techniques are dominated by design engineers. They often used the standard test method, which is consistent stress, as well as plate testing at wells. The results of the study show that the current implementation of plans does not promote the correct outcome of the plan in terms of economic potential. The second part of the study is to study the benefits of adopting the idea of laying the foundation for a pile wire. Comparative study of three-dimensional test results (3D FEM) and different test methods currently in use. The results show that the plate method on pile wells, which does not care for pile and pile interaction, yields very different results from 3D MEM results. 3D-FEM shows that only 70-80% of the total construction load is piled up when the raft is placed on a hard clay layer. The number of piles at the base of the pile can be greatly reduced, especially if the true basic concept of piles of piles is accepted, and the basic reduction will only increase slightly.

Fu Zhu F, Wanxi Zhang W.& et. al. (2017)

The solution to the Mohr-Coulomb theory is a unique theoretical issue of combined power. The proposed plans for an additional railway project in a convenient location were evaluated and validated. The calculated results show good agreement with the test results. These new methods not only offer the idea of calculating the potential of simple soil foundations, but also address the measurement of the total height of subspecies in a simple soil surface. Using new methods of calculating the bearing strength of flexible ground foundations and columns that fill height under different degrees of

integration, it is possible to understand the structure of the fundamental power difference during steel construction, which provide essential guidance for filling waste with safe, easy soil foundations.

Dev H., Singh R. (2012)

Characteristics of the migration of gravel soil load depend on different factors, i.e.. the type of soil, the tension / shrinking of soil molecules and most importantly most of the rocks below. The foundation load test deals with the study of underground objects in the design of the foundations of single and multi-storey buildings, above water tanks, columns and bridge bags in gravel areas. Load supply capacity can be used to obtain the recommended yield and allowable levels for the basic plan. Field testing is the only tool to detect gravel properties immediately. Laboratory tests performed in small samples do not represent the correct behavior of such a complex structure. This paper discusses the outcome and description of in situ experiments of Colony's proposed freight forwarding at the Sangaldan station of the Udhampur Srinagar-Baramulla project.

Du P., Liu X. (2017)

Combining the literature examples, in this paper a different analysis of the theoretical formula and the full final dynamic formula was performed to ensure the accuracy and elevation of the additional load in the section. The study can provide guidance for practical engineering calculations and assessment of load capacity.

C.M. Martin (2003)

In an effort to create unique load calculations for a wide audience using the feature method, a computer program called ABC (Analysis of Bearing Capacity) was written.

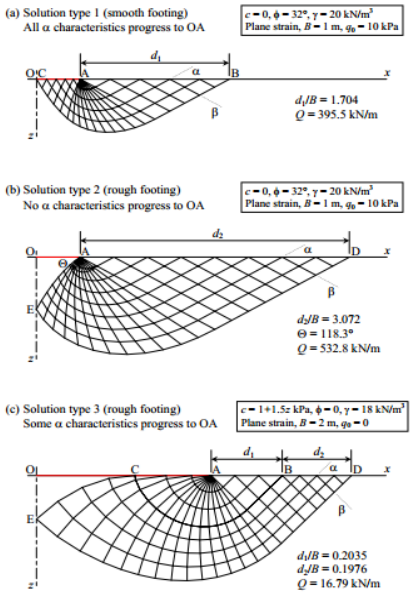

Fig 6: Typical Stress distribution for the soil

It can calculate the load-bearing number of round and round particles - smooth or hard - in compact and aggregate ground at additional cost and / or weight. A standard linear standard, the isotropic Mohr-Coulomb, was adopted, which allows c to vary in sequence in depth, but speculative. Systematically, within the analysis of the hard plastic border, the stress field solution was calculated using ABC.

Vilas, Moniuddin K. (2015)

For this purpose, the type of numbers was improved using PLAXIS. FEA is performed using the Coulomb Mohr failure method to represent a 2D soil type. The base is simulated as a square base and increases the load until the type of soil fails. The final load capacity is defined as the minimum pressure on which the base soil shifts. Distribution of land pressure and relocation that takes place in different areas is available. In plaxis, active stress is seen as the ultimate load-bearing force. Preliminary studies of black cotton soil collected at the 6 km road junction from Bhalki Taluka show that it belongs to high-grade plastic (CH) according to USCS. The final load of the various D / B divisions was calculated from the Terzagi equation, knowing the earlier world standards for black cotton and the input frame, which was successfully compared with the software of Plakix.

Arya A., Ameta N.K. (2017)

This paper discusses the work that has been done so far. Soil compaction with soil capacity and foundation is an important function in a basic project, so it is very important to know their value well. Outcomes should be based in the same way as their educational solutions. This field requires further research into the different types of soil. If any unsuitable material is used for the foundations of the structure, there is a high risk of the structure collapsing. Different types of constructions use different types of foundations, each of which has a unique design and a certain configuration, which makes a certain structure stronger and more durable. The second type of foundation is used in bungalows and tall buildings

Sujata Gupta S. Mital A. (2019)

This study investigates the influence the profile of the soil with help of the required soil analysis software i.e. PLAXIS. To find thee deformations and stability parameter, the FEM method is taken to find each node analysis under 2D & 3D with rectangular base. The required curve is adopted by stress-stress-time curve. PLAXIS software is an excellent tool that can be used to explain ground behaviour and landslides under different download conditions. 3D approach is more accurate and finite result of soil profile.

Magar J., Kudtarkar A. (2020)

The lower base of the structure is the upper part itself, because it connects the main body superstructure with the ground. This lower foundation is known as the foundation. In this article, we will discuss the types of foundations used in the construction industry, design, and what alternative materials we can use as a foundation material that can make it stronger, more durable, and more environmentally friendly. As for the built structure, it is very important to build a solid foundation that holds the superstructure in all climatic conditions, without collapsing and collapsing. It is very important to know what type of foundation needs to be used in a particular superstructure, which materials are more suitable, which structures to use. If any unsuitable material is used for the foundations of the structure, there is a high risk of the structure collapsing. Different types of constructions use different types of foundations, each of which has a unique design and a certain configuration, which makes a certain structure stronger and more durable. The second type of foundation is used in bungalows and tall buildings. This study summarizes the types of foundations, what type is used for which superstructure, what structure is suitable, and more specifically we will discuss how we can make the foundation environmentally friendly, cost-effective and durable and strong to withstand natural disasters.

M.S. Dixit (2009)

M.S. Dixit carried the impact of base of soil based on the SBC of that soil. The various depths are considered for the analysis and other parameters are constantly used in it. The analysis is found that with increment the dimensions of footing at with increment in depth then it direct influence the increment in bearing capacity. On compared the various theory associated with SBC such as Terzagi's code and IP etc. is taken under changing type and the various shapes of the footing such as strip, square, circle and rectangle. Strip foundation gets minimum value under it.

Conclusions

The following conclusions are made which are as follows:

- Based on research it is concluded that the result of numerical analysis supports geotechnical and structural engineering codes, forecasting of natural threats, prevention and understanding of the behaviour of the soil foundation, predicts the stability of the structure with different ages, etc.
- Some researcher used the study on soil profile such Aeolian, black cotton etc which direct impact the SBC and required structure on it.
- The increase in bearing capacity under the influence of compaction is the main feature of the soft foundation at the stage of filling the subclass.
- The results of laboratory studies of soil mechanics help in the accurate design of the soil foundation and improve the mitigation of failures. Mixing soil design has been used in many geotechnical engineering to improve soil.
- It is found that study of foundation design with respected to soil condition is must require to get the stable and safe design of high rise and multi-storey buildings.
- To evaluated earthquake resisting building under the foundation depth can be evaluated through both manually and software mode and for the analysis of building or any structure using linear and non-linear approach is compulsory.
- The assessment of bearing capacity wither manual and test procedure such SPT, Core test is required the before the construction of building design.
- The study is also based on use of different types of software used for analysis such Plaxis, FEM, ABACUS, ETABS with 3D FEM analysis in it. etc.
- The studies of some researchers are based on the testing approach used in the analysis the soil, foundation and it's failure mechanism.

Future Scope

The following work are to be carried out in the future to extend the work based on the review of various articles:

- To use both software and manual analysis.
- To give complete information on different depth cases required.
- To evaluate the number of floors required in given SBC of soil.
- To show the case study approach when plate load test carried out.
- To show the strata profile beneath the ground at a particular place of the applied research.
- Analysis of different types of foundation through software mechanism.

Acknowledgment

I extend my deepest gratitude to my guide Dr. Yusuf Ali, HOD & Associate Professor, and my Co-guide Mr. Arvind Vishwakarma, Assistant Professor, Civil Engineering Department, Oriental University, Indore, M.P., India for providing all the necessary facilities and feel thankful for his innovative ideas, which led to successful completion of this review work.

References

Przewlockia J., Zielinskab M. (2016) "Analysis of the Behavior of Foundations of Historical Buildings" *World Multidisciplinary Civil Engineering-Architecture-Urban Planning Symposium(WMCAUS),* Procedia Engineering 161 (2016) Pp 362 – 367

Lanko A.. Ulybin A. (2016) "Express methods for determining the foundation depths" *15th International scientific conference "Underground Urbanisation as a Prerequisite for Sustainable Development"* Procedia Engineering 165, Pp 1710 – 1716.

Namdar A. , Feng X. (2014) "Evaluation of safe bearing capacity of soil foundation by using numerical analysis method" *A. Namdar et alii, Frattura ed Integrità Strutturale*, 30 (2014) 138-144; DOI: 10.3221/IGF-ESIS.30.18

Xia H ,Zhang J. & et. al. (2020) "Study on the Bearing Capacity and Engineering Performance of Aeolian Sand" Hindawi Advances in Materials Science and Engineering Volume 2020, Article ID 3426280, https://doi.org/10.1155/2020/3426280

Amornfa K., Phienwej N.(2012) "Current Practice On Foundation Design Of High-Rise Buildings In Bangkok, Thailand" Lowland Technology International Vol. 14, No. 2,70-83, December 2012 International Association of Lowland Technology (IALT), ISSN 1344-9656

Fu Zhu F, Wanxi Zhang W.& et. al. (2017) "A new calculation method for the bearing capacity of soft soil foundation" Advances in Mechanical Engineering 2017, Vol. 9(10) 1–7 DOI: 10.1177/1687814017732520

Dev H., Singh R. (2012) "Determination of Bearing Capacity of Gravel Boulder Deposit From Footing Load Test" Proceedings of Indian Geotechnical Conference December 13-15,2012, Delhi (Paper No A 102)

Du P.,Liu X. (2017) Discussion of the Method to Determine the Ultimate Bearing Capacity of Soil Foundation 1st International Global on Renewable Energy and Development (IGRED 2017) IOP Publishing IOP Conf. Series: Earth and Environmental Science 100 (2017) 012007 doi:10.1088/1755-1315/100/1/012007

C.M. Martin (2003) New software for rigorous bearing capacity calculations, Foundations: Innovations, observations, design and practice, Thomas Telford, London, 2003

Vilas, Moniuddin K. (2015) Typical meshes of stress characteristics Finite Element Analysis of Soil Bearing Capacity using Plaxis, International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181 IJERTV4IS060813,Vol. 4 Issue 06, June-2015

Arya A., Ameta N.K. (2017) Bearing Capacity of Foundation-Review Paper American Journal of Engineering Research (AJER) American Journal of Engineering Research (AJER) e-ISSN: 2320-0847 p-ISSN: 2320-0936, Volume-6, Issue-7, Pp-42-45.

Sujata Gupta S. Mital A. (2019) Numerical analysis of bearing capacity of rectangular footing IOP Conf. Series: Journal of Physics: Conf. Series 1240 (2019) 012039 IOP Publishing doi:10.1088/1742-6596/1240/1/012039

Magar J., Kudtarkar A. (2020) Study and Analysis of Types of Foundation and Design Construction International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 07 Issue: 08 ,p-ISSN: 2395-0072

M.S. Dixit (2009) Study Of Effect Of Different Parameters On Bearing Capacity Of Soil IGC 2009, Guntur, INDIA