WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

FOUNDATION ANALYSIS OF RESIDENTIAL BUILDING AT KOTHRUD

[1]Mr Abhijeet Mahadev Jamdade, [2]Mr Shrikant Satish Waghmare, [3]Prof. Sachin . J. Yadav

[1] Student of APCOER , [2]Student of APCOER, [3]Assistant Professor of APCOER

ABSTRACT:

This study analyzes the foundation of a residential building in Kothrud, Pune, focusing on geotechnical properties and structural integrity. Geotechnical investigations, including soil sampling and in-situ tests like SPT ,porosity ,RQD, unconfined comprehensive test ,water absorption reveal that Kothrud's soil, mainly decomposed basalt and lateritic, has moderate to high bearing capacity with moisture-related challenges. A deep foundation system, such as bored piles, is recommended to ensure stability. Proper drainage systems are also advised to address risks from water infiltration and erosion due to the monsoon climate. The analysis emphasizes compliance with local building codes and continuous monitoring for long-term safety and durability, providing a robust framework for resilient residential construction in Kothrud.

Keywords: Foundational analysis, residential building, Kothrud, Pune, geotechnical investigation, deep foundation, drainage system.

Introduction:

Kothrud, a rapidly developing suburb in Pune, India, presents unique challenges and opportunities for residential construction due to its varied topography and soil composition. Understanding the foundational requirements for buildings in this area is crucial for ensuring structural safety and longevity. This study focuses on the comprehensive analysis of the foundation for a residential building in Kothrud, addressing geotechnical aspects such as soil bearing capacity, shear strength, and compressibility. By conducting detailed geotechnical investigations, including soil sampling, laboratory tests, and in-situ tests like the Standard Penetration Test (SPT) and Cone Penetration Test (CPT), this research aims to identify suitable foundation systems. Additionally, the study reviews local building codes to ensure compliance with safety standards. The insights gained from this analysis will contribute to the development of resilient residential infrastructure capable of withstanding the region's geological and environmental conditions.

The two-rock mechanics is the branch of engineering concerned with mechanical properties of rock and application of this knowledge in dealing with problems in these areas of rock materials. Underground structures in rock, i.e., any excavated or natural subsurface opening or system of openings that is virtually supported by wall pillar only and not by any support placed within the openings need geotechnical study. To design and stability evaluation—a) the stresses and/or deformation in the structure resulting from external or body load; b) the ability of structure to withstand the stress or deformation which need to be determined .Rock Material Classification Rock material classification in core drilling provides unique and valuable information crucial for various geological and engineering applications. The primary reasons for classifying rock material during core drilling include.

Rock Material Classification

The classification process consists of identifying the rock units at the site of investigation, describing them in terms of appropriate classification elements, and conducting the performance assessment. The performance assessment includes selecting the performance objectives for the proposed engineering uses of the rock and classifying the rock material within each selected objective.

Identification of rock units

a. Description of rock units by classification elements

- .Rock material properties
- .Rock mass properties
- Geohydrologic properties

b. Selection of performance objectives

- Hydraulic erodibility in earth spillways
- Excavation characteristics
- Construction quality
- Fluid transmission
- Rock mass stability

For the purpose of design and to evaluate the stability of underground structure, mechanical properties of the rock must be known. It provides the knowledge of material deform or fail, under the action of applied force. The mechanical properties are tensile strength, compressive strength, shear strength, creep or time properties and strain or deformation properties. The mechanical properties can be determined by static testing which includes uniaxial (unconfined) compressive, tensile, shear and flexural strength, triaxial compressive, shear strength etc. and also elastic constants, i.e., modulus of elasticity and Poisson's ratio obtained from uniaxial, triaxial stress-strain relationship**.**

Objectives

The primary objective is to conduct a comprehensive foundation analysis for a proposed residential building in Kothrud. This includes evaluating the soil properties, determining the appropriate type of foundation, and ensuring that the design complies with local building codes and standards.

The main objectives of the present work is as given below

- check the quality of underground rock.
- To suggest the suitability of foundation type for the proposed site.
- To test the strength of foundational rock**.**

Literature Review

General

The foundation plays a crucial role in any structure, making it essential to understand the subsurface conditions and soil behaviour beneath the foundation. In order to assess fault lines, fractures, and permeability of the soil beneath the ground surface, we will thoroughly investigate various rock parameters outlined in the literature paper.

- Jianping Li & Ernesto Villaescusa (2005) New relationships have been established between critical strain and modulus and between critical strain and compressive strength for intact rock and rock masses.
- G. Tsiambaos, George Tsiambaos and Harry Saroglou (2009). Original correlations of intact rock properties have been proposed in order to determine indirectly the uniaxial compressive strength and modulus of elasticity of intact rock.

- Lianyang Zhang (2015). Involves the methods for determining rock quality designation (RQD) and evaluated the empirical methods based on RQD for estimating the deformation modulus and unconfined compressive strength of rock masses.

- Keykha, H.A. and Huat, B. B. K. (2011), Determination Rock Quality Designation (RQD) Basis on Joints. Engineering Journal of Geotechnical Engineering. European Journal of Geotechnical Engineering. Bund. D. (16), pp 322-526.

Literature Gap

Despite extensive studies on foundation analysis, specific literature on the unique geotechnical challenges of residential buildings in Kothrud remains limited. Existing research often generalizes soil properties without addressing localized variations in Kothrud's geological strata. Additionally, the impact of rapid urbanization on soil stability and foundation integrity in this area is underexplored. There is a lack of comprehensive risk assessments considering the recent increase in seismic activity. Finally, economic feasibility studies tailored to Kothrud's construction market are scarce, necessitating targeted research to inform cost-effective foundation solutions.

- A literature gap related to foundation analysis for residential buildings in Kothrud could be the lack of studies specifically focusing on the geological conditions of the area and how they impact foundation design.
- Additionally, there might be a need for research on innovative foundation technologies or sustainable materials suitable for the unique soil characteristics found in Kothrud**.**

Methodology

- Literature review regarding the subject

- Gap in literature review
- Visit to residential building for collection of information
- Study existing methods
- Finding alternative method & trial of new methods
- Working on error of methods
- Results and Conclusion
- Final review and report writing

Site Selection

We initially studied literature reviews and online data, but did not find any data about foundation analysis of residential building at KOTHRUD. Hence, this site was selected for the present study, situated in Kothrud, Pune district Maharashtra in India.

Data Collection

To understand the behaviour characteristics of the ground level material, a sufficient amount of samples were collected for the required further analysis in the Civil engineering testing laboratories. The collected core samples of the sites are having the 1m to 17 m depth of foundation.

Field Investigation

After the preliminary investigation of site, the continuous correspondence of our batch with the company we started the field investigation. On the date 08th Oct 2023, at the site we have done a surface survey and extracted core from site with help of Rotary Drilling Machine by Core Cutting method. During same visit we discovered various aspect for foundation analysis. After discussion with the company, we requested for the actual core analysis which they were taken from same location to know the depth of fresh rock along the alignment of proposed building.
In this way, we visited the site on 20h feb 2024 with Dr. P. D. Sabale under the guidance, the field investigation was carried out. Under the guidance, the classification of core according to location, core boxes, sequencing of core log in boxes, selection of core box, washing of core for proper interpretation, measurement of each core with lithological characters as per different norms in lab were carried out.

TEST CARRIED ON FIELD

- Standard penetration test
- RQD

TEST CARRIED ON LAB

- Specific gravity
- Dry density
- Bulk density
- Water absorption
- Porosity
- Unconfined compressive test

Site Visit Location

Fig. site visit location area (based on Google earth, 2023).

Methods for Analysis

Different rock mass classification systems focus emphasis on different factors, hence it is advised that at least two approaches should be used at any given site during the project. Methods include:

- Rock Quality Designation.
- Rock Mass Rating.
- Rock Structure Rating.
- Rock Tunneling Quality Index.
- Unconfined compressive strength.

Rock Quality Designation (RQD)

Rock Quality Designation (RQD) serves as a rough indicator of the extent of jointing or fractures within a rock mass, expressed as a percentage of the drill core length measuring 10 cm or more. Rock of high quality typically exhibits an RQD value exceeding 75%, while lowquality rock falls below 50%. Various definitions exist for Rock Quality Designation (RQD), with the most widely adopted one formulated by D. U. Deere in 1964.

Results

sumarry of Rock test Result

project : Foundation analysis for residentional building at kothrud

						Test Method		IS:13030		Is:1122	IS:8764		IS:9143
BH.NO	Pice NO	Volume(n	Depth(M)	Sample Type	Lab.no	Condition	Dry Density g/cc	Bulk Density g/cc	Water absorption %	Porsity %	Specific Gravity	Point load test kg/cm^2	Actual load kn	unconfined compressive strength kg/cm^2
1	28	249.22		Core	69/1	Soak	2.33	2.37	6.093	13.63	12.81		40.9	213.68
1	40	245.84		Core	69/2	Soak	2.38	2.45	2.89	6.911	6.71		55.5	255.88
1	42	246.13		Core	69/3	Soak	2.27	2.38	4.45	10.15	18.53		81.6	423.59
1	48	241.61		Core	69/4	Soak	2.56	2.62	2.41	6.21	7.29		69.4	364.51
1	55	243.68		Core	69/5	Soak	2.49	2.57	3.12	7.79	10.02		90.5	467.93
1	59	242.33		Core	69/6	Soak	2.37	2.48	4.52	10.12	20.78		61.4	316.69
2	36	256.81		Core	70/1	Soak	2.53	2.57	1.68	4.28	4.61		84.4	423.73
2	43	253.81		Core	70/2	Soak	2.56	2.6	1.53	3.99	4.24		106.4	530.92
2	48	257.52		Core	70/3	Soak	2.62	2.67	2.22	5.82	6.68		137.9	689.04
2	52	252.87		Core	70/4	Soak	2.7	2.73	1.17	3.16	3.28		149.4	751.92
2	58	250.31		Core	70/5	Soak	2.32	2.42	4.12	9.58	15.82		44.8	223.88
3	24	249.52		Core	71/1	Soak	2.65	2.7	1.65	4.47	4.82		127.8	660.26
3	29	249.37		Core	71/2	Soak	2.86	2.87	3.12	0.81	14.13		65.8	343.083
3	37	243.96		Core	71/3	Soak	2.63	2.69	0.28	5.79	6.32		76.3	403.63
3	41	250.51		Core	71/4	Soak	2.42	2.49	2.63	6.56	7.33		82.5	421.93
3	46	244.76		Core	71/5	Soak	2.36	2.44	3.27	7.76	8.31		95.1	495.32
3	51	249.94		Core	71/6	Soak	2.55	2.6	1.88	4.8	5.33		150.9	782.3

Conclusion

- In the present context Rock mechanical investigation of three cores taken at different depth for residential purpose at Gujarat colony Kothrud Pune . studied in all respect to get about the foundation investigation details of this project conducted by soiltech ground engineer and consultant Pune in 2023 – 24.
- The 1st borehole were taken into Sandy silty material followed by the deeply weather basalt underlaned by thin and thick flows of amaglydol basalt which showing favrable condition for foundation.
- Borhole 2nd is taken at highly weathered grey highly basaltic exposed material followed byamaglydol basalt of seed jointed and compact and amaglydol flows underlaned sequencelythe lower compact of amaglydol shows good to fear quality for the foundation point of view.
- While the 3rd borehole taken in the silty sandy soil followed by amaglydol basalt flows and the pink grey amaglydol was held at the bottom here amaglydol basalt lower flows shows suitable charsteristics to beer the load of upper proposed structure.
- In addition to this to get understand the quality of foundation materials various laboratory test were perform on Rock and core /samples collected from different drill hole.This test includes specific gravity, dry density, water absorption, porosity and unconfined comprehension test ,point load test or point load index ,modulus of elasticity and poison ratio in addition to this grain size collected sediment were also perform to understand the nature of material details .
- In stratographical point of you studied at different three bore holes taken at different location clearly indicate that the upper part of surface is covered with the thin carpet of soil include Sandy silty followed by deeply weather Rock underlaned by jointed and fractured moderately weather rock and end of the depth of borehole mostly the nature of basaltic rocks are favourable in engineering geological point of view because of the lassed disscontunities and fractured in the body of the rock is in (especially amaglydol basalt and compact) they can bear load of above structure.

- At places where the weather foundation is observed it should be strengthen by using standard engineering geological procedure because the weak rocks need to be replaced with thin or thick curtain or the jointed and fracture bodies need to be a grouted and bolted as per requirement.
- In short the site is suitable for present construction but as per the requirement at number of places the treatment to weakar section of the rock should be provided and the foundation may be constructed at the given location.

REFRENCES

1. Keykha, H.A. and Huat, B. B. K.. (2011), Determination Rock Quality Designation RQD Basis on Joints. Engineering Journal of Geotechnical Engineering. European Journal of geotechnical Engineering. Bund. D. (16), pp 322-526.
2. Li, L., Oullet, S., and Aubertin M., (May, 2009), An Improved Definition of Rock Quality Designation, RQD Proceedings of the 3rd CANUS Rock Mechanics Symposium, Toronto.
3. Naderi, M., (2011), Non-Destructive Evaluation of Engineering Properties of Intact Rock Using the Friction-Transfer Method, Arabian Journal for Science and Engineering. American Journal of Structural Engineering, (36), pp 215-226.
4. Taylor. R.. (1990). Interpretation of the Correlation Coefficient: A Basic Review. Journal of Diagnostic Medical Sonography, Journal of Defense Modeling and Simulation, (6), pp 35-39.
5. Singh, B. and Coe,l R. k., (1999). Rock Mass classification, A Practical Approach in Civil.
6. Ván. P., and Väsärhelyi. B., (2010), Relation of rock mass characterization and damage, Rock Engineering in Difficult Ground Conditions- Soft Rocks and karst- Vrkljan (ed), Taylor & Francis group, London, ISBN 978-0-415-80481-3, pp 399-404.
7. Zhang, L. (2010), Prediction of End-Bearing Capacity of Rock Socketed Shafts Considering Rock Quality Designation (RQD), Canadian Geotechnical Journal, (47),
8. Z., T. (1976): Rock mass classification in rock engineering. Proceeding of the Symposium on Exploration for Rock Engineering (ed. Z. T. Bieniawski), 97 – 106, Cape Town.
9. Hoek E., Kaiser P. K and Bawden W. F. (1995): Support of underground excavations in hard rock, A A Balkema, Rotterdam, 215
10. Li.j and Villaescusa E. (2005). Determination of rock mass compressive strength using critical strain theory Journal of Symposium on Rock Mechanics.
11. Deere, D. U. and R. P. Miller (1966) “Engineering classification and index properties of rock,” Tech. Report Air Force Weapons Lab., New Mexico, 65-116
12. G.Tsiambaos,and Harry Saroglou (2009). "Determination of Rock Strength and Deformability of Intact Rocks." Electronic Journal of Geotechnical Engineering.
13. Lianyang Zhang (2015). " Determination and applications of rock quality designation (RQD)." Journal of Rock Mechanics and Geotechnical Engineering.
14. Bashar Tarawneh (2016). "Predicting standard penetration test N-value from cone penetration test data using artificial neural networks." Journal of Geoscience Frontiers.
15. Ravi Sundaram (2017). "Geotechnical Investigation in Difficult Ground Conditions - Indian Experiences. Journal of "GeoPractices".
16. Aria Mardalizad, Andrea Manes (2017). "Investigation on the Unconfined Compression Strength of Rocks by Experimental Tests and Advanced Numerical Modelling Technique." Journal of "Key Engineering Materials".
17. Bo Wu & Wei Huang (2020). " Uniaxial Compression Mechanical Properties of Rock Samples in Soft and Hard Composite Strata". Journal of Advances in Materials Science and Engineering.
18. Abiodun Ismail Lawal & Sangki Kwon (2020). "Application of artificial intelligence to rock mechanics". Journal of Rock Mechanics and Geotechnical