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GEOTECHNICAL INVESTIGATION OF FOUNDATION OF TUKARAM GATHA MANDIR AT DEHU

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Abstract: The topic of strength and total structural load is presented along with a formula for determining the safety of on rock foundations. Large structure foundation designs are complicated and time-consuming because there are so many different load combinations and concurrent influences from so many different types of equipment and installations. Large constructions require reliable foundations since the local economies depend on these engineering goods. All buildings, regardless of the soil conditions, are classified into the third geotechnical category due to the significance of the investment and the high expenses. The building's foundations must meet or exceed the safety standards for the structure and guarantee good communication between the equipment and nearby objects. It is crucial to follow stringent requirements for both the overall, vertical displacement of the foundation and the differential settlements between different foundation locations in order to guarantee that the equipment is operating as intended. Rock qualities like compressive strength are experimentally determined along with comprehensive structural load calculations in order to analyse foundational strength analysis.

Keyword: Hardness & Compressive Strength, Rock Mass Stability, weathering terminology.

I. INTRODUCTION

The inaugural Conference on Rock Mechanics was held in Lisbon in 1966 at the invitation of the "International Society for Rock Mechanics" (ISFRM). The Committee on "Rock Mechanics of Geological Society" (RMOGS) of America and the Committee on Rock Mechanics of the National Academy of Sciences first coined the term "rock mechanics" in 1964 and 1966, respectively. The theoretical and applied study of rock behaviour is known as rock mechanics. The responses of rocks to their environment are the focus of that area of mechanics. Both above and below ground excavation can be done using these methods. The choice of mining techniques, the proper design of the support system, and the specifications for drilling and blasting are just a few of the numerous variables that go into planning and developing a mine. their is The study of the mechanical properties of rocks and how to apply this knowledge to solve engineering problems with rocks as construction materials are the focus of the engineering discipline known as rock mechanics. For underground buildings in rock, such as any naturally occurring or excavated subsurface aperture or network of apertures that is primarily supported by wall pillar alone and not by any supports placed within the openings, geotechnical study is necessary. A well-known temple is the Tukaram Gatha Mandir in Maharashtra. This is located in Dehu next to the Indrayani River's bank. Members of the Rich Temple Committee provided resources through various devotional funds for this endeavour. Gatha Mandir spans 30 guntas and 7 acres in total. Large garden on 2 Acres A beautiful 35000 square foot divya may be seen on the third floor of the major Gatha temple. The main temple has five spires and is 125 feet tall. It has five mythologically themed octagons. The temple has four 85-foot-tall spires, nine shikharas, 33 kalas, four squares between the octagons, and nine shikharas. the main octagon A wonderful panchadhatu enormous celestial idol of Sri Tukobaraya is something the temple truly deserves. Grand engravings of 4145 Abhangs and 108 Names of Sri Tukobaraya on beautiful marble adorn the interior wall of the octagonal shrine. An appealing immortality vision of four lovable deities and four various Jagadguru Sri Tukobaraya incarnations across the four yugas is depicted on the upper octagon wall. The interior of the Bansi Pahadpur stone carving temple features interesting coloured Poopi carvings.

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Fig.1.1 Tukaram Gatha Mandir

II. LITERATURE SURVEY

So-ngo In 2004, Patrick Omorodion Youdeowei and Clifford Teme Steel sheet piles were recommended and used as foundation systems for the shore protection works during the investigation period (18–28 November 2002), with the length of the sheet piles equal to H + Df + h, where H is the height of the sheet pile above the river bank cliff (free-board) and Df is the depth of embedment of the pile into the bearing medium. Wales of the steel variety were used to strengthen

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the sheet piles that were inserted, with vertical separations of approximately 1.50 metres. to avoid flexural and/or buckling failures causing the positioned sheet piles to fail. According to Abhishek Arya, Dr. N.K. Ameta, the foundation is the most important part of any structure in 2017. It is essential to properly design the building's foundation since it supports the weight of the entire construction. The carrying capacity of the subsurface soil and footing settling are the two primary design factors. Determining the soil's carrying capacity and the footing's settlement has taken a lot of time and work. This essay reviews the prior research on the subjects.

J. Li and E. Villaescusa appeared in 2005. New connections between critical strain and compressive strength and critical strain and modulus have been discovered for whole rocks and rock masses. The research is supported by a sizable body of data from laboratory rock testing, information on the classification of rock types, and experience with numerical modelling in underground mining operations in Western Australia. The two techniques support the hypothesis that the critical strain of a rock mass is less than that of an unbroken rock. Additionally, a brand-new relationship based on essential strain has been developed to forecast the rock mass's compressive strength. Estimates of the critical strain for rock mass strength are in agreement with hypotheses generated by using the available empirical methodologies.

Mingqing You (2015) When measuring in-situ stress during hydraulic borehole fracturing, rock tensile strength is necessary. Certain strength criteria with three parameters result in tensile strengths with substantial fluctuations even though they may accurately reflect the relationship between the strength of rock and confining pressure. While the exponential criterion produces suitable magnitudes of tensile strengths for granites while overestimating those for other cocks, the tension cut-off criterion is appropriate for all rocks. The breakdown pressure will be lower than the shut-in pressure when hydraulic borehole fracturing occurs and the maximum horizontal main stress is two times more than the normal one. Instead of being the first cycle's peak value, this is where the pressure-time curve slopes.

III. METHODOLOGY

Pre-survey:
The research papers, reports, reference books, and textbooks that were gathered and reviewed to produce the current project work served as the foundation for the technique. We first used a letter from our college to get permission from the Tukaram Gatha Mandir's president. Information about the structure was acquired after getting the President's approval, and the historical and architectural data they gave. The grounds of the structure were then captured on camera. There are various issues with the constructional perspective point that were mentioned.

Fig. Goggle Map of Tukaram Gatha Mandir

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FIELD INVESTIGATION:

We started the field inquiry after the initial site assessment and continued communication between our batch and the business. We performed a surface survey and a river basin research at the location to ascertain the valley and pier foundation. During the same visit, we picked up numerous areas of foundation analysis. We requested the real core analysis after our meeting with the corporation to ascertain the depth of new rock along the orientation of the proposed project. This analysis was compiled from several chainages and RLs.

In this way, our leader Dr. P. D. Sable oversaw the field investigation and site inspection. Each core was classed under the direction based on the location, core boxes, sequencing of the core logs in the boxes, choice of the core box, washing for accurate interpretation, and measurement with lithological features in line with various lab standards. Figure 3.2 shows the sequence of the core log in the core box.

Fig. Sequencing of Coíe Log in Coíe Box.

IV. METHODS FOR ANALYSIS

Rock mass classification systems place different emphases on the various parameters, and it is recommended that at least two methods be used at any site during the project. Methods are:-

- Rock Quality Designation.
- Rock Mass Rating.
- Rock Structure Rating.
- Rock Tunneling Quality Index

ROCK QUALITY DESIGNATION (RQD):

A rough measure of the degree of jointing or fractures in a rock mass is the rock-quality designation (RQD), which is determined as a percentage of the drill core in lengths of 10 cm or more. A high-quality rock has an RQD of above 75%, while low-quality rock has one of less than 50%. The term "rock quality designation" (RQD) has many different interpretations. The phrase that is used the most was coined in 1964 by D. U. Deere. According to measurements made along the centerline of the core, it is the proportion of solid core pieces recovered from boreholes that are longer than 100 mm. Even if a piece of core is 100 mm long, it should not be counted if it is not solid and rigid.

$$RQD = \frac{\sum Length\ of\ Core\ Pieces\ > 100\ mm}{Total\ Lenght\ of\ Core\ Run} \times 100\ \%$$

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RQD	Rock Mass Quality
<25 %	Veíy Pooí
25-50 %	Pooí
51-75 %	Faií
76-90 %	Good
91-100 %	Excellent

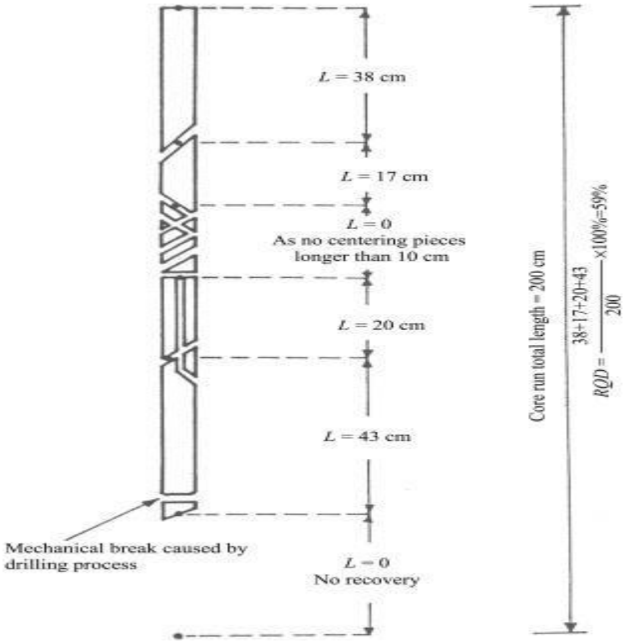

Fig. Geneíal layout of RQD

Rock mass rating:

Bieniawski provided a thorough explanation of the Rock Mass Rating (RMR) technique, sometimes referred to as the Geomechanics Classification, in 1976. Since this system has been refined over time as additional case records have been reviewed, the reader should be informed that Bieniawski has significantly altered the scores provided to several criteria. Based on the classification as it was published in 1989 (Bieniawski, 1989), the discussion that follows. Both this edition and the version from 1976 discuss the subject of estimating the strength of rock masses.

According to the RMR value of 59, the rock mass lies between the "Fair rock" and "Good rock" classes. Using the support suggested for fair rock during the first stages of design and construction is advised. If everything goes according to plan during construction, there are no stability difficulties, and the support is working incredibly well, it should be able to gradually reduce the support requirements to those recommended for a good rock mass. If the excavation must be stable for a short while, it is also advisable to attempt the more extensive support designed for good rock, which is less expensive. However, if it is expected that the nearby rock mass may experience major change.

ROCK STRUCTURE RATING:

The Rock Structure Rating (RSR), created by Wickham, Tiedemann, and Skinner, is a numerical instrument for describing the quality of a rock mass and sufficient ground support, notably for steel-rib support. The weighted numerical values provided to each parameter are added to determine the RSR value for each tunnel section.

The RSR idea is a very useful tool for selecting steel rib support for rock tunnels. The idea should not be used beyond the parameters of the adequate and reliable facts used to establish it, as with any empirical approach. Because of this, it is not recommended to employ the RSR concept when choosing rock bolts and concrete support.

ROCK TUNNELLING QUALITY INDEX:

The Q-system was developed by Barton, Lien, and Lunde to classify different rock masses. The quality of the rock mass is expressed by the so-called Q-value, which forms the foundation for design and support recommendations for underground excavations.

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V. CALCULATION

BEARING CAPACITY CALCULATIONS:

Project: Geotechnical Investigation of foundation of Talegaon Pune.

Bore Hole No.	Depth BG, ml		RQD, %	GWT, m	qc, Mpa	By RMR									By Core Strength				Safe Bearing Pressure (SBP), T/m^2
						Factors						RMR	Classification	SBC, T/m^2	qc, kg/m^2	Nj	Rw	SBC T/m^2	
	From	To				i	ii	iii	iv	v	vi	vii							
BH 01	2.10	7.5	48.10	1.30	24.98	2	8	10	20	7	-7	40	III	154.40	249.8	0.10	0.5	124.9	125
BH 02	2.10	7.00	55.87	1.70	24.39	2	13	10	20	7	-7	45	III	178.16	243.8	0.10	0.5	121.9	122
BH 03	2.70	8.00	38.81	1.80	23.35	2	8	10	20	7	-7	40	III	154.40	233.5	0.10	0.5	116.7	117
BH 04	1.50	7.00	61.20	2.90	41.62	4	13	10	20	7	-7	47	III	191.74	210.1	0.10	0.5	105.1	105

VI. CONCLUSION

Numerous foundation-related problems typically surface during civil engineering projects. The most significant of these issues is the mechanical behaviour of the ock on which the opposing foundation is designed. These kinds of topics are under the umbrella of ock mechanics. There was a thorough pre-field, field, and lab inquiry. The samples' rock mechanical behaviour was evaluated in the field, and the results were computed in the lab. With the help of these field and laboratory data, the findings were drawn.

- In case of all boreholes, the foundation rock basalt is found.
- The basalt at places shows variation in their characters.
- These basalts are decomposed, deeply weathered and becomes fragile at the top while there strength is slightly increases towards the deeper level.
- Hence or therefore the Recovery and Rock Quality Designation (RQD) of the top layers are very less than the lower fresh rock. Most of the times, the RQD is found zero in upper zone, e.g. .BH-01, 02, 04.
- This is due to the maphic behavior of Deccan Trap basalt which susceptible to hydration and oxidation reaction at the exposures.

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- Presence of the joints in especially basalt makes the avenues for circulation of surface water and resulting into decomposition of the rock.
- But, at the deeper level, due to the presence of unjointed, fresh and undecomposed rock fragments, resulting the RQD value is increased. Such rock shows suitability for the foundation, e.g. BH-02, 04.

REFERENCES

[1] Abhishek Arya, Dr. N.K. Ameta (2017), "Bearing Capacity Of Foundation ReviewPaper."

[2] Abiodun Ismail Lawal , Sangki Kwon(2020), "Application of artificialintelligence to rock mechanics: An overview."

[3] Bo Wu, Wei Huang(2020), "Uniaxial Compression Mechanical Properties ofRock Samples in Soft and Hard Composite Strata."

[4] D. B. Patila, A. B. Sanerb (2022) "Geotechnical Investigation of a Proposed Bridge SiteAcross Walva-Shirgaon, Sangli"

[5] Georgios P. Tziallas, George Tsiambaos(2009), "Determination of RockStrength and Deformability of Intact Rocks."

[6] Jianping Li, Ernesto Villaescusa(2005), "Determination of rock mass compressivestrength using critical strain theory."

[7] Mingqing You(2015), "Strength crieterion for rocks under compressive_x0002_tensile stresses and its application."

[8] Nagaratnam Sivakugan, C. R. Patra, Julie Lovisa (2014), "Determination of c and Φ ofrocks from indirect tensile strength and uniaxial compression tests."

[9] Ravi Sundaram(2017), "Geotechnical investigation in difficult Groundconditions- Indian Experiences."

[10] So-ngo Clifford Teme, Patrick Omorodion Youdeowei (2004), "Geotechnical investigations for design of foundations for erosion and flood control structures at Unwana beach, Afikpo, Ebonyi state, South-Eastern Nigeria".

[11] S. C. Handa, Swami Saran, G. Ramasamy, B. Prakash, A. S. R. Rao (1984), "Geotechnical Investigations for Foundation Design for Multistoreyed Building ."

[12] Viktor Sotornika,Petr Cernochb,Jiri Kostalc (2022) The Bilina Tunnelselectedgeotechnical aspects of a proposed underground structure .