Volume 9, Issue 5, May – 2024 International Journal of Innovative Science and Research Technology
ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24MAY1980

Analysis of Pile Foundation for Hospital Buildings

Yash V Patel[1*]; Swapnil Sharma[2*]
*[1]M.Tech Scholar, Department of Civil Engineering, MITCOM, MIT ADT University, 412201, Loni Kalbhor, Pune, India.
*[2]Assistant Professor, Department of Civil Engineering, MITCOM MIT ADT University, 412201, Loni Kalbhor, Pune, India.

Abstract:-

- **Pile foundations are widely employed to provide support for bridges and various structures, ensuring the safe transfer of structural loads to the ground while preventing excessive settlement or lateral movement. They excel in transferring structural loads from weaker or compressible soil layers to the stronger, more stable soils and rocks beneath. Pile foundations constitute an integral component of a structure.**
- **In this research work the foundation of the hospital (G+6) was design by the pile foundation. We have used M25 grade of concrete for the preparation of design mix. The characteristic strength and load bearing of soil was tested by Plate load test and other materials tested by slump cone test , aggregate Impact Value test cement compressive strength test (cement fineness test construction water PH value . The expected result of SBC is 20000kg approximate.**
- **Project reports typically encompass introductions and problem definitions, along with literature reviews pertinent to the project. They detail the study area's location and the project site, as well as providing concise information about the equipment utilized on-site.**
- **Additionally, it covers crucial tasks such as centerline marking, boring, reinforcement placement, concrete pouring, excavation, and chipping of pile caps.**

***Keywords**:- Cast in Situ Pile, Concrete (m25), Steel (20mm Dia), Bentonite , Dynamic Load Test, Integrity Test.*

I. INTRODUCTION

In the present study the foundation is an important part of the structure. Pile foundation is one of the most important types of the DEEP FOUNDATION.

- The building requires a pile foundation design due to the low load-bearing capacity of the soil at the hospital site in Odisha, where the foundation will be constructed.2. Pile foundation are common foundation for bridge abutment piers and building resting on soft soil. The pile subjected to both vertical and horizontal forces.
- The popularity of tall structure is increasing day by day withstand the load of these structure proper foundation is to be used such as pile foundation.
- The foundation is a part of a sub structure which transfer to super structure load to the soil. The foundation into two main categories.

➢ *Shallow Foundation*

It transfer the load to shallow depth. A shallow foundation is a building foundation type that transfers structural load to the earth close to the surface, unlike a deep foundation, which extends to subsurface layers or various depths. Typically, a foundation is deemed shallow when its width exceeds its depth. Compared to deep foundations, shallow foundations are less complex, making them more cost-effective and the preferred choice for relatively light structures.

➢ *Deep Foundation*

A deep foundation is positioned at a considerable depth beneath the ground surface, serving to transmit structural loads to the earth at deeper levels. Typically, the depth-to-width ratio of such a foundation exceeds 4 to 5. It effectively transfers the load well below the ground level.

- The construction procedure for a deep foundation is both more intricate and costly compared to shallow foundations. Nevertheless, in situations involving inadequate soil conditions at shallow depths, substantial design loads, and site limitations, a deep foundation is often the most suitable solution.
- Pile is defined as vertical structure element of deep foundation drilled deep foundation drilled deep into the ground of construction Sites. The pile is applicable for a very large load. Deep foundation are usually piles installed by driving, pushing or constructed in-situ,
- Piles can be made of wood, concrete or steel or of composite member. The pile can be rounded, square, hexagonal, rectangular, even triangular or conical. They can be short and long.
- Since the stability of the structure is dependent upon the soil foundation system. All forces may act on the structure during its life time should be considered. Typically, foundation design always includes the effect of the that load plus the live load On the structure other miscellaneous forces that may have be considered result from the effects of wind, water, heat, ice, earthquakes, and explosive blasts.
- Constructing a deep foundation involves greater complexity and cost compared to shallow foundations. Nevertheless, in scenarios involving shallow soil conditions, heavy design loads, and site constraints, a deep foundation often emerges as the most effective solution.
- As we continue to advance clean, renewable energy options, there remains a persistent demand for offshore oil and gas platforms, which play a crucial role in our energy portfolio. These platforms often rely on jacket

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24MAY1980

structures, which are typically supported by open-ended steel tubular piles, primarily subjected to axial loading.

- Companies in this sector face the dual challenge of lowering expenses while simultaneously enhancing safety measures. New opportunities for exploitation are scarce and tend to be situated in deep-water regions with complex geological conditions.
- The re-evaluation and extension of the lifespan of aging platforms are increasingly significant. A key advantage for developers and operators is that the updated CPT-based design methods for axially loaded piles, now incorporated into offshore design standards, typically permit the adoption of higher axial pile capacities, especially in dense sand deposits.
- The CPT-based design methodologies, which consider factors such as friction fatigue, stress levels, interface shearing characteristics, and plugging, have demonstrated greater reliability compared to conventional design methods in database evaluations conducted by Chow (1997), Schneider (200), and others. Nevertheless, uncertainties persist regarding the impact of pile aging and cyclic loading on axial pile capacity.
- Section 2 of the paper discusses these concerns. Numerous countries across Europe have set ambitious goals for renewable energy generation. Offshore wind farms are considered essential in attaining these objectives. Situating turbines offshore offers several advantages, including: (i) access to high, unhindered wind speeds, (ii) the potential for utilizing larger turbines, and (iii) the opportunity to establish integrated wind and wave/solar energy installations as alternative renewable energy solutions that become economically feasible.
- Most turbines erected thus far have been supported by monopile foundations. However, due to deeper water depths and larger turbines, the diameters of monopiles are increasing, with planned developments featuring piles up to 10 meters in diameter. Foundation costs can represent over 30% of the total development cost for an offshore wind farm, emphasizing the urgent need for advancements in pile design to achieve cost savings. Moreover, critical issues such as the impact of cyclic loading, soil-structure interaction for dynamic analyses, and environmental concerns regarding the installation of large-diameter piles have prompted the initiation of large-scale industry-academia R&D projects.
- Section 3 of the paper covers these topics. The concluding section explores onshore piling issues, including the utilization of low displacement piles to address environmental concerns and field tests examining negative skin friction on piles.

II. LITERATURE REVIEW

- Amey D. Katdare, Nandkumar K. Patil, and Seema S. Shiyekar authored the paper titled "Pile Foundation Design for a Site in Sangli District of Maharashtra." They emphasize the significance of the foundation as a crucial element of the structure. Pile foundations are highlighted as one of the essential types of deep foundations, alongside shallow foundations. The study focuses on the OPD building in Sangli District, Maharashtra, serving as a case study. The soil at the site is identified as clayey, necessitating the design of piles due to its low bearing capacity.
- Imran Khan Pathan, Amanana Venkatesh "A study of pile foundation to enhance soil bearing capacity for the structure". This paper outlines a case study on piling foundation and testing conducted for a Commercial Project located in the southern region of India. The project encompassed the installation of over 1600 RC piles, totaling a length exceeding 25,000 meters. The contractor took the risk of expediting the testing procedure based on the assumption that the bearing capacity of a pile driven into cohesive soil might significantly increase over time (known as the set-up effect).
- K. Ishihara Chuo, University Kiso, Tokyo "Case studies on the behavior of pile foundations subjected to lateral spreading in liquefied deposits" reveal that liquefaction of surrounding soils during earthquakes can impact the effectiveness of pile foundations, potentially resulting in damage or collapse. Indeed, instances exist where liquefaction-induced lateral movement of soils has caused significant damage to piles.
- IS: 2911[1] The formula for calculating the load-carrying capacity of a single pile under various soil conditions is derived from the Code, providing valuable insights for the design of bored piles, driven piles, and pile caps within the pile group. The recommended spacing, pile behavior within the group, and reinforcement specifications for the pile group are all determined according to the guidelines outlined in the code.
- The lateral resistance of a single pile is determined using the method outlined in the code, while the bearing capacity is derived from the same source. J.E. Bowles introduced a novel concept revolving around the rate of pile shifting and the settlement rate of the surrounding soils, which has been proposed for investigating negative skin friction.
- Negative skin friction arises when the settlement rate of the surrounding soils exceeds that of the piles. Several equations have been developed to delineate the negative friction zone of piles. The magnitude of negative skin friction is influenced by the time factor and the extent of consolidation of the soil mass, and it may be insignificant when the soil mass is nearly fully consolidated. K. R. Arora provides comprehensive classification of various types of piles. Additionally, foundational theories for analyzing single piles and a basic understanding of pile groups are drawn from this reference.
- Reviewing literature and engaging with construction industry experts facilitated the accurate identification of programmatic and project-specific construction risk factors in highway projects. Previous studies conducted qualitative risk assessments, which were leveraged in this study to identify significant risk factors and formulate a risk assessment framework for the projects

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24MAY1980

under consideration. However, prior research failed to establish connections between project characteristics and different construction risk factors in road projects through quantitative evaluations. This underscored the necessity for additional investigation and served as the impetus for the current study. (Diab 2011).

- To address this need, this article analyzes and presents correlations of dependence between the use of risk analysis, some characteristics of the reported projects, and cost and schedule impact estimates of the observed risk factors.

III. METHODOLOGY

The construction sequence / procedure of the bored cast in-situ piles is as follows:

- ➢ Setting Out
- ➢ Excavations
- ➢ Arrangement of Reinforcements
- ➢ Concreting
- ➢ Stippling Pile Heads and Enhancing Bonds

➢ *Setting Out*

The initial and paramount stage, undoubtedly, in piling operations is setting out. Typically, a certified surveyor engaged by the contractor will establish the positions of the piles as indicated in the pile layout plans of the detailed designs, showing the Northing and Easting coordinates of the center of each pile along with their diameters, etc. The positions marked by the surveyor are secured and maintained with pegs.

➢ *Excavation*

The excavation of the pile bore is accomplished through either the auger method or conventional percussion boring. In the auger cast piling process, a continuous flight auger drill is employed to dig a hole by rotating a hollow shaft auger to a depth at least equal to the length of the pile. Auger piling is recognized as the most noise-efficient piling method and is both rapid and highly cost-effective. It constitutes a cast in-situ process particularly suitable for soft ground conditions where the use of deep casings or drilling support fluids might otherwise be necessary.

➢ *Arrangement of Reinforcements*

The majority of cast in-situ concrete piles are reinforced along their entire length with a reinforcement cage anchored in the ground and subsequently lowered into place using a crane prior to concrete pouring. Typically, the reinforcement for pile foundations comprises vertical main bars of #11 diameter, accompanied by a spiral of smaller diameter reinforcement to enhance shear strength and prevent buckling failure in the pile foundation.

The reinforcement bending schedules are first properly prepared by the contractor which is submitted to the Engineer for approval. After approval the bar bending schedule is used for cutting and fixing of the rebar at site.

➢ *Concreting*

The tremie method of concrete placement is used for the concrete pouring of the pile foundation. This method uses a vertical pipe, through which concrete is placed by gravity feed blow water level. The lower end of the tremie pipe is kept immersed in fresh concrete so that concrete rising from the bottom displaces the underground water. The dia of the tremie pipe varies from 20 to 30 cm.

➢ *Stippling Pile Heads and Bonding*

Pile Chipping is the extra pile that is above the cutoff level, which provided for good and sound concrete. The main purpose of chipping is to remove the surplus slushy concrete (a mixture of concrete, slurry, and mud) over the cutoff level.

IV. DATA ANALYSIS

Examining and interpreting the frequency table and chi-square dependency data revealed intriguing findings. Concerning the utilization of risk assessment in public and private sector projects, around 51% of respondents apply risk assessment in certain projects, while 36% employ it in all projects. Moreover, 70% of respondents reported possessing over 10 years of experience, a reassuring factor that bolsters the credibility of the survey data concerning risks associated with manual rig piling. A majority of respondents acknowledge the pivotal role of risk management in the cost and time efficiency of pile foundation projects in the social sector. In fact, approximately 80% of respondents underscore the importance of risk management, highlighting its significant impact on the long-term performance of pile foundations and the effective transfer of loads to the underlying bedrock in the region. This recognition underscores the critical role that risk management plays in project success.

V. CONCLUSION

- The analysis and design of the pile foundation were conducted. Soil testing revealed that the site comprises a sandy soil with a mixture of clay.
- The load bearing capacity of soil has been found to be very low and the load coming on the column which transfer to the ground is high, Hance pile foundation has been processed for the soil.
- The length of the pile is 12 to 18 m. Diameter of rod is 20 mm and Diameter is 750 mm.
- In This project we use the pile foundation for increase the SBC. The value of SBC is 15 ton concerted to 20 to 22 ton by piling.
- The deflection of a laterally loaded pile tends to increase with a higher stress-displacement response of the soil layers.
- The extent of pile deflection relies on both the stiffness of the piles and that of the underlying soil strata.
- An advantage of the investigated Negative friction method is its variable nature; it develops during construction and gradually diminishes afterward.

- Pile-soil interaction notably influences the behavior of a laterally loaded pile group.
- For a specific load, the incremental deflection decreases as the spacing between pile groups increases.
- With a constant lateral load per pile, the group deflection is observed to rise as the number of piles in a group increases, while maintaining a particular pile spacing.
- It is noted that the pile cap significantly contributes to resisting lateral loads.
- Various factors such as pile length, spacing, pile cap position, and depth of the pile cap impact the lateral resistance of the pile cap.

REFERENCES

[1]. Is 2720 (part V- 1976), India standard method of test for soil.
[2]. Is 2720 (part2- 1973), method of test for soil. Part 2 Determination of water content.
[3]. Is code 2911 part -1 for pile foundation.
[4]. Analysis of pile foundation
[5]. Kanakeswararao Thadapaneni,Sarikonda Venkata sivaraju,Ravi teja Grandhi
[6]. Amey D. Katdare, Nandkumar K Patil, Seema S. Shiyekar “Design of Pile Foundation for site in Sangli district of Maharashtra”.
[7]. Imran Khan Pathan, Amanana Venkatesh “A study of pile foundation to enhance soil bearing capacity for the structure”.
[8]. K. Ishihara Chuo, University Kiso, Tokyo “Case studies of pile foundations undergoing lateral spreading in liquefied deposits”. https://www.researchgate.net/publication/301771181_Research_and_Development_Activities_on_Pile_Foundations_in_Europe https://www.researchgate.net/publication/335292296_ANALYSIS_DESIGN_OF_PILE_FOUNDATION_ FOR_G20_RESIDENTIAL_BUILDING
[9]. I.S, 2911, (Part I / Sec I) -1979, Bureau of Indian Standard, New Delhi, June 1980. June, 1980 • J. E. Bowles, “Foundation Analysis and Design”, McGraw Hill Publishers, 1996.
[10]. K.R Arora, “Soil Mechanics and Foundation Engineering”, fifth edition, Standard Publisher Distributors, New Delhi, 2001.
[11]. M.J. Tomlinson and V.N.S. Murthy, “Pile Design and Construction Practice”, fourth edition, E & FN Spon Publishers, U.K., 1994.
[12]. P.C. Varghese, “Analysis and Design of Sub-Structure”, Oxford & IBH Publishers, New Delhi, 1996. • S. C. Gupta, “Analysis and design of piles in a group”, The Indian Concrete Journal, June 2003, pp 1143-1146.
[13]. S.Ramamurtham, “Soil Mechanics and Foundation Engineering”, Khanna Publishers, Delhi, February-2001.
[14]. Tridibesh Indu, “Truss analysis of pile caps”, The Indian Concrete Journal, September 1997.
[15]. K. Paik; R. Salgado; J. Lee; and B. Kim, Behavior of Open- and Closed-Ended Piles Driven Into Sands.
[16]. Meyerhof, G.G., Compaction of sands & Bearing capacity of piles (1959). JSMFD, ASCE, 85, SM 6, 1-29. IS: 1498 (1970), Indian Standard Methods of Test for Soils: Classification and Identification of Soil for General Engineering Purposes, Bureau of Indian Standard