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Soil-Structure Interaction Study on Group pile over Monopile Foundation

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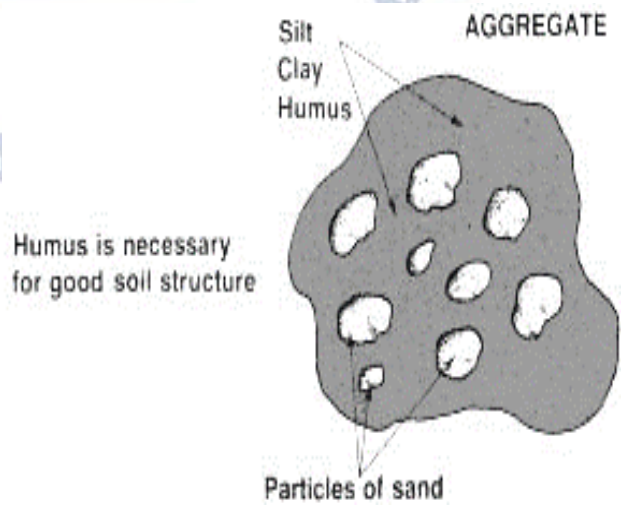
ABSTRACT

Soil structures are very important for very good strength and durability to the reinforced concrete structures. it is extensively used for bridges, turbines, dams, industrial structures, and other heavy structures. soil-structure interactions are extensively used for seismic responses to the structures. it is mostly used in geotechnical investigations on pile foundations. The main importance of soil-structure interaction is the response of soil and structure and it influences the motion of ground and motion of the structure. It is one of the important factors to know the interactions between the soil and the ground. If the soil interactions are good, then the structure will be safe and strong and withstand the seismic effects. So, the study of soil interaction is important for any structure for safety and serviceability conditions. This paper mainly focuses on group piles over the monopile foundation of soil interaction. This mainly explains the importance of a monopile foundation over the group pile foundation. Monopile foundation is simple to type construction and standard foundation nowadays. This paper is mainly focused on soil structure and its interaction and as well monopile foundation and its importance.

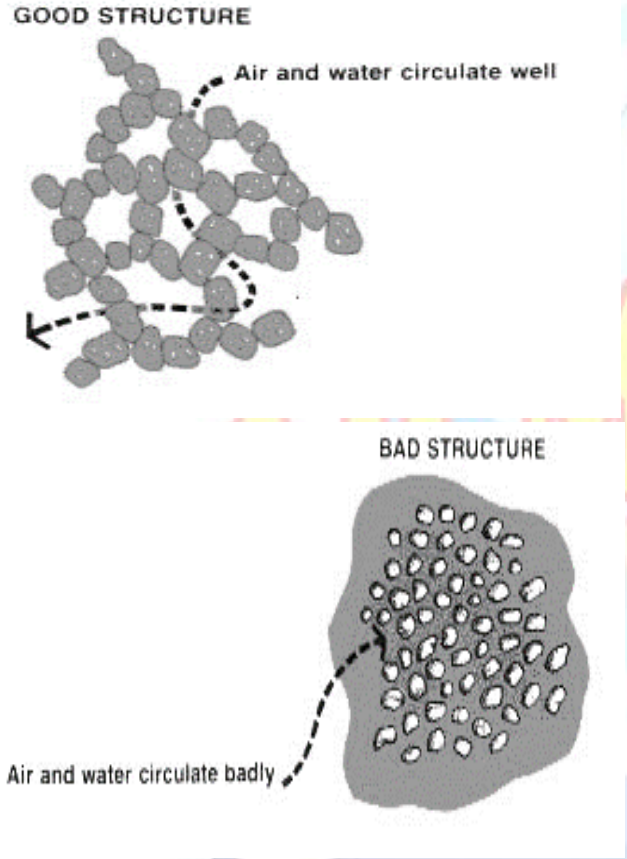
KEYWORDS: *Soil-Structure Interaction, Mono Pile, Group Pile, Foundation.*

INTRODUCTION

Soil structure consists of different types of components or particles. Which includes sand, clay, and silt. Which are combined to form a soil mix. The combination of the mixture is also known as soil structure. The combination is also called aggregates from a geotechnical point of view. It is defined in many different ways in geotechnical engineering. With help of this, we can know the structure is strong or not and as well as know the soil is weak or strong.



Soil structure consists of different types of compositions and as well as different types of patterns. Depending upon this water can pass through the structure. So, it is one of the important factors to know about soil interactions. These skilled persons are required for testing of soil interactions in the geotechnical laboratory. Specialized technicians have tested samples of soil. After the testing technicians or skilled persons talks about soil is good or not and also talks about the circulation of water and permeability of the structure. In general soil structure is expressed in grades and class. The following are some examples of good structure and bad structure.



SOIL STRUCTURE

In usually soil structures are expressed in grades and classifications and aggregates as well. Aggregates and their types and sizes are playing an important role to know them better and good quality of soil structure and as well as the soil profile. This mainly soil structure is based on its characteristics of the soil.

GRADES OF SOIL STRUCTURE

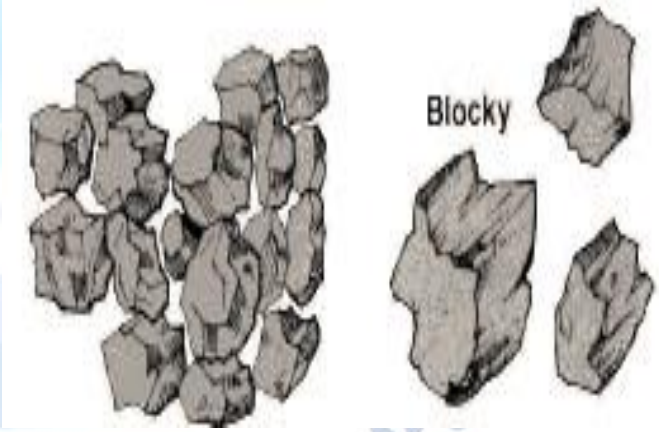
Strong/high structure: these are stronger and more durable. The soil structure is very good. It consists of large aggregates and small aggregates and also some broken materials too.

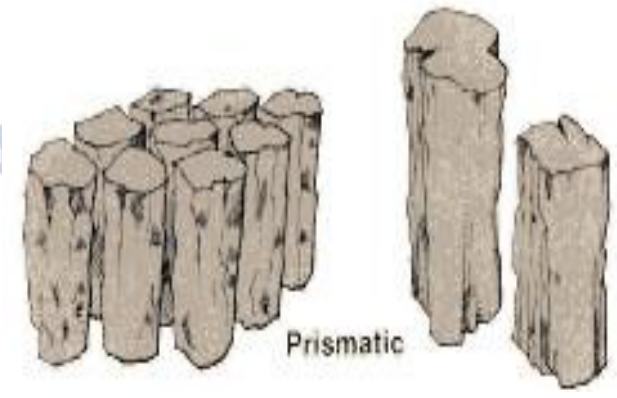
Medium/moderate structure: these are medium in strength and durable. Soil structure is also medium. It contains large aggregates and small aggregates and also some non-aggregates too.

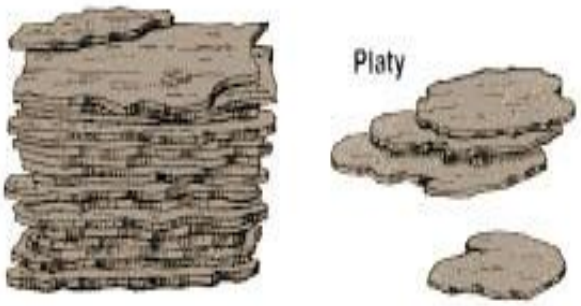
Weak/low structure: these are very poor in strength and durability. Soil structure is very weak. It contains aggregates and non-aggregate materials too.

CLASSIFICATION OF SOIL STRUCTURE

1.Granular
2.Blocky
3.prismatic
4.Platy







LITERATURE REVIEW

Bhattacharya (2017) et.al,

This author explains that soil structure interactions for offshore structure. Which involves soil interaction with surrounding soil concerning the interaction of foundations. This also explained the different types of foundations used in the structure. This author also explains about nature of loading either cyclic or dynamic to the structure. This author mainly explains the importance of a monopile foundation to offshore wind turbines.

David (2018) et.al,

This author mainly explains the importance of monopile foundations for offshore wind turbines. To improve structural design and lifetime to the structure monopile foundations are important. It is one of the important things to accurate modeling and design of structure based on geotechnical investigations. In this 3D FEM is used for the analysis of the foundation.

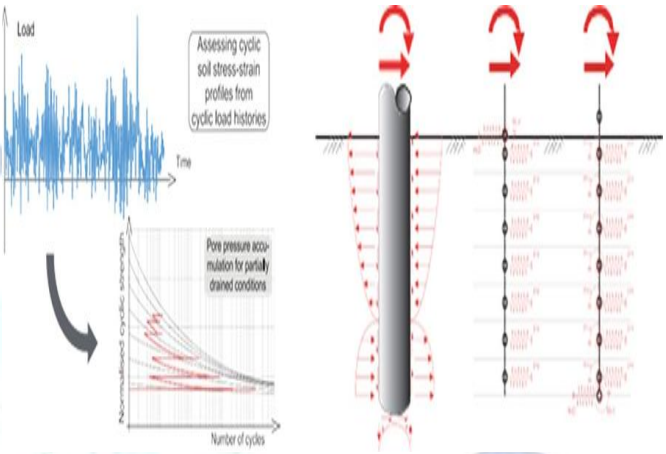
Karel N (2020) et.al,

This author mainly explains monopile based offshore structures. it is used for different depths and different conditions. It is also useful for the production of renewable energy. In these decoupling models are used for wind and offshore structures etc. it is mainly used for monopile foundation.

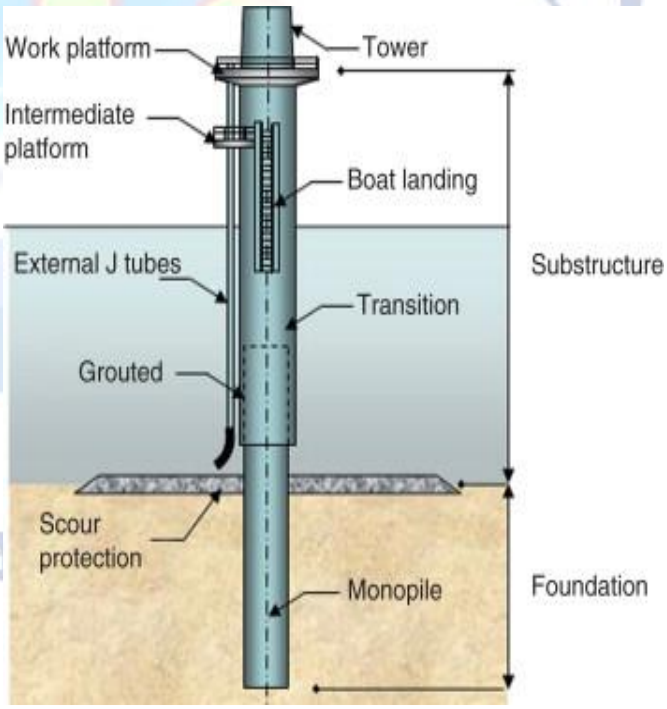
ADVANTAGES OF MONOPILE FOUNDATION OVER GROUP PILE FOUNDATION

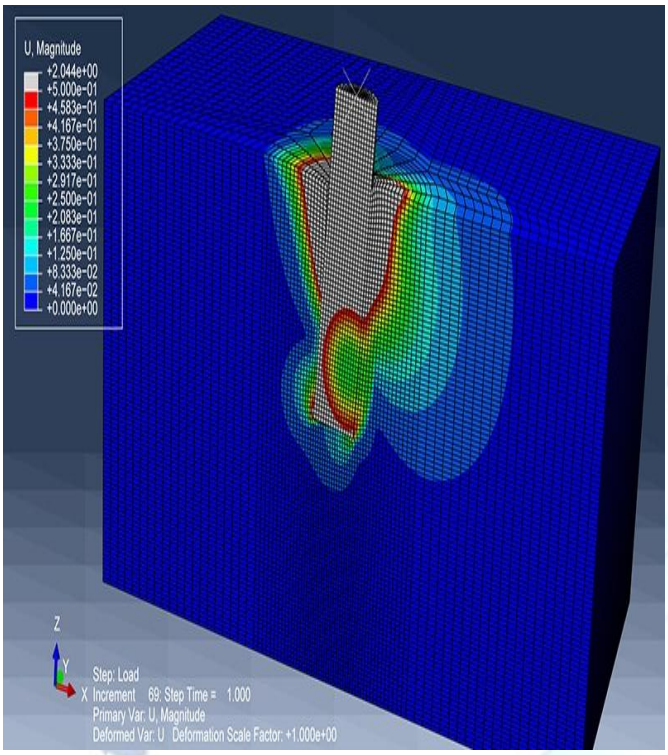
- Single foundation
- Range of dia up to 6m
- Minimize the cost of energy
- The thickness of the wall is 150mm
- Uncertainties are reduced
- The weight of the monopile foundation is 650t
- Cylindrical steel tubes are used
- Suitable for water at depth up to 30m
- Simple construction

DESIGN METHODOLOGY OF MONOPILE FOUNDATION



- Pile dimensions are minimum
- Prevent the risk of installation and cost of materials
- Understanding lifetime performance
- Accurate model and efficient design
- Location of site
- Geometry of pile
- Conditions of loading





Monopile Foundation & FEM Analysis of Monopile foundation

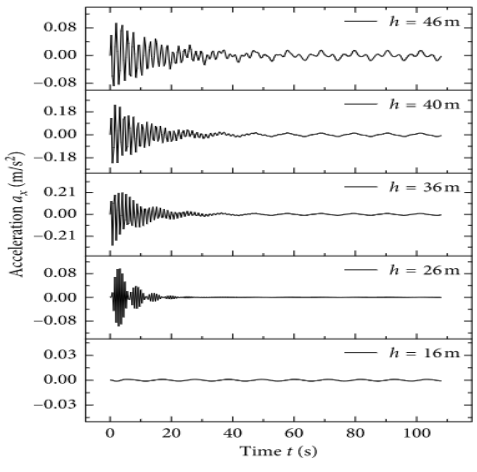
Some of the other design parameters are;

- The diameter of the monopile foundation
- Length of monopile
- The thickness of the wall

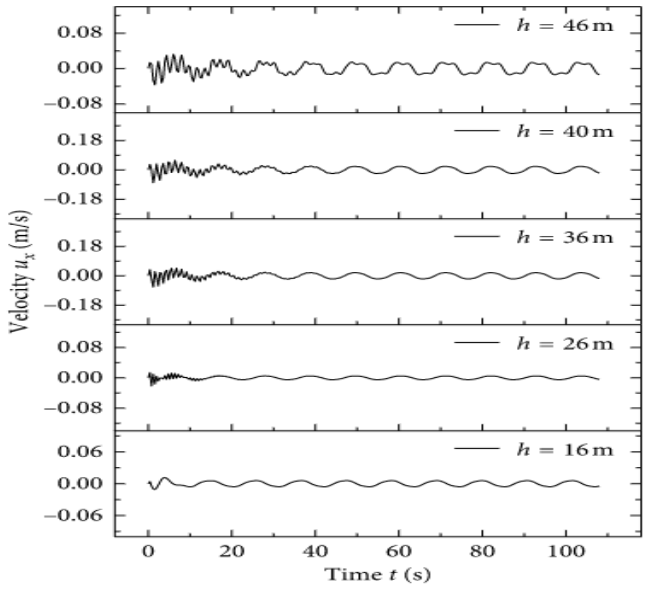
RESULTS

The following are the results of the monopile foundation over the group foundation. In which acceleration and velocity and displacement results are calculated. Following are the responses concerning the time and as well as depth, we can calculate acceleration and velocity and displacement responses.

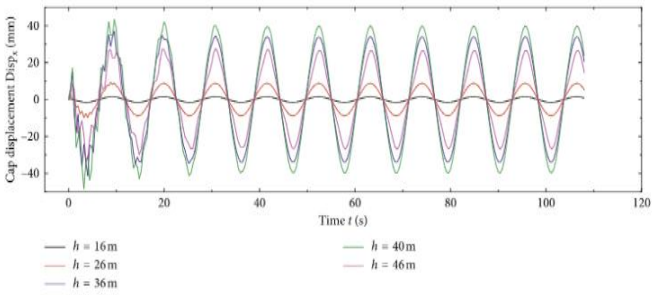
Response time series under the wave. (a) Acceleration. (b) Velocity. (c) Displacement.



(a)



(b)



(c)

CONCLUSION

Monopile foundations are simple and easy to construct. Compared to the group pile foundation, monopile foundations are very good and suitable for any type of soil. It is suitable for the stability of structures and improves performance. By using a monopile foundation we can minimize the overall cost of the structure compared to the group pile foundation and also decrease the number of piles. So, it is economical compared to group pile structures. in this response of monopile foundations are determined. All the results are good and acceptable in conditions. In this monopile foundations are used in bridges with a deep-water condition.

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