Alternative Design Option For Second Sand Layer Of Bangkok Clay

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Summary

In this paper, a design approach is presented in which a Piled Mat Foundation (PMF) system is adopted for a proposed 23 stories building (built in 1993) development on the first sand layer of Bangkok Clay. The PMF is supposed a design to limit maximum and differential settlement. It consists of driven piles (25 m long) strategically located on uniform area and piling to on the first sand layer while the pile top interconnected with a rigid mat foundation. The piles will act as a pile group effect. The wider dimensions both width and length will increase the ability of reducing overall and differential settlement.

Keywords: Driven Pile Foundation ; 23 Stories Building ; First Sand Layer ; Settlement.

1. Introduction

Generally, when an engineer designs a structure, he has to consider design load based on total load of structure plus factor of safety that specified in Code of Practice. There is no particular requirement concerning allowable settlement specified in any code.

In practice, allowable settlement is specified by the engineer of that project. Mostly a maximum of 25 mm settlement is used to affirm its stability. This limit is given by system engineer who concerns about leaking in piping work due to differential settlement. Allowable settlement may be more severe in the case of glass structure which requires zero differential settlement.

In order to design a foundation within the allowable limit, there are two design methods namely Pile capacity table and Boring results. Moreover, past experience of normal practice, site accessibility of equipment, product availability in the market also have to be taken into consideration.

2. Alternative Design Option

2.1 Description of Building

The case study is a 23 stories residential building. Foundation is sitting on an area of 40 x 60m with a total number of 1,500 piles. The thickness of the mat is 2m. The piles are solid square pre-cast concrete pile of 0.40 m width and 25 m long. The minimum distance between two piles is taken equal to 1.2 m . Pile capacity is 9 KN per pile with a factor of safety 2.5.

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2.2 Soil Condition Record

Four borings were drilled to 60 m depth . In the area of this building (BH-1) , the soil consists of about 15 m soft to medium clay. Followed by another 10 m thick of stiff silty clay up to the depth of 25 m. A dense sand of about 15 m thick is located between the depths of 25 m to 40 m If the pile tip is embedded at least 1 m within this layer. The 15 m thickness of this layer is more than sufficient to resist majority building loads in Bangkok. The very dense sand is started from the depth of 50 m next to the bottom of dense sand level. Majority of the engineers today get use to design pile resting on this stratum.

2.3 Piles Condition After Been Driven

The designer of this building decided to use pile length of 25 m resting on first dense sand layer rather than a long pile resting on 55 m depth on very dense sand of second layer. Therefore, the tower of the building is sitting on a mat foundation. From the piles condition record , it is found that all piles have been driven satisfactory to a very uniform level with the design blow counts.

2.4 Existing Condition

This building was built in 1993 and being used for almost 17 years now. In the area of this building (BH-1) , present condition of building and surrounding car parks is still in very good condition. There is no significant crack or differential settlement appear.

3. Discussion of Results and Conclusion

There were many high-rise buildings constructed in Bangkok during the last two decades. Deep bore pile with wet process was introduced to use for these buildings. Hence, engineers are get used to design pile foundation sitting on very dense sand of second layer disregard to very expensive construction cost. According to the case study as described above, it is confirmed pile foundation on first dense sand layer is also a good alternative option for the client to save cost for their future projects. Pile foundation on first dense sand layer will act like a pile group effect. The wider dimensions both width and length will increase the ability of reducing overall and differential settlement [1].

References

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