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Bore Pile Foundation Construction without Caused Fine Cracks at Three Heritage Building

Nusa Setiani Triastuti

Abstract

Bore pile foundation close heritage building should be no damage. Install the bore pile process had to perfect, nonporous concrete, no necking, no sliding soil, no mixed deep water, Objective the construction of bore pile near heritage buildings did not deformation and no crack. The case study methodology was surveying the process of the installation bore pile at the soft soil. Analyzing the results of the loading test, the process of installing bore piles with limited space, without damaging heritage buildings. Monitoring will determine the success of the bore pile structure, including a slight decrease in the water table in the area and outside the building site. The vibration drill equipment damped by the trench so that it was safe from cracks in the heirloom building. Monitor the mud content in the water that went out at bore done of soil, monitor concrete every 2 m depth of bore pile the volume of concrete the heirloom building was not damaged. Axial bore pile test, lateral test according to design.

Keywords: reduce vibration, trench, cut off the vibration waves, no crack in heritage building

1. Introduction

Heritage buildings must be a true original, only cleaned and painted in a similar color, which should be taken care of when any construction was nearby. Heritage buildings could not change from the original, so that if the defect could not be like the original, Care must be taken to implement the three basement floors which are very close to the three heritage buildings with shallow foundations and high groundwater. In addition, the heritage building sits on 1.5 m fill soil. The fill soil and foundation shallow of the heritage building are very susceptible to ground active pressure, vibrations, and groundwater subsidence. The influence of the organic content on the compaction and consolidation characteristics of highly compressible organic clay (**Figures 1 and 2**) [1].

The 3-storey basement research building used a bore pile to a depth of 39 m, groundwater -1 m was removed from a pile hole with a diameter of 1.2 m and 1 m which needs to be monitored for the reduction in groundwater around the heritage building and the impact of large vibrations. The foundation strength followed on the soil layer type under the foundation [2].

The variation type soil and rainfall, the more difficult of structure.

Figure 1.
Three heritage buildings at research area.

Figure 2.
Heritage research area.

According to Suyono and Kazuto [3] the type of sub structure had to analysis include that's

- a. Selection of suitable foundation type. Type of soil, bearing capacity, hard soil depth
- b. The large load included vertical l and dynamic loads
- c. Heritage building area with a limited project footprint. Foundation work had to not damage heritage buildings and environments
- d. Duration and budgeted for a work project as targeted.
- e. Some disadvantages of bore pile foundations with limited space and very close to heritage buildings:
- f. Dirty land, mud (soil mixed with water from the borehole), reduce the dirty with mud wrapped in plastic
- g. Drilling hole may proceed with the density problem if the soil was an easy collapse, then use bentonite overcome avalanche

- h. Space was limited. Installed the reinforced concrete and casting
- i. The water that flowed into the borehole reduced the bearing capacity of the soil toward the pile. The water from the drilling was fed back into the water pool.
- j. Install a temporary casing so that the ground does not enter the borehole
- k. To prevent drill vibrations, a 40 cm wide channel 2.5 m deep is made outside the basement area to break the waves. The channel was given a barrier so that the ground does not collapse from vibrations

The bore pile has the highest bearing capacity and is the fastest way to support the load. Undoubtedly, the bored pile system has its advantages and disadvantages. This is the most important requirement of geotechnical engineering [4]. The advantages of drill foundation, install:

- a. Deep foundation with less vibration than piles
- b. Vibration had to be reduced/eliminated so as not to crack the walls of the heritage building
- c. Above the bore pile, the column was placed directly.
- d. Drilling equipment could be penetrating rocks, but hammer no penetration rock.
- e. Bore pile diameter was large compared to a piling. The lowest end drill pole could be larger to increase the bearing capacity.
- f. No risk of bore pile was uplifted.

2. Objective

The construction of the bore pile near the heritage buildings, but the heritage buildings remain intact without slight cracks

3. Methodology

Case study, the author plans the work by paid watched to the site of limited area, 4 sides of heritage low building and old buildings with shallow foundations, the site attentions were carried out since preparing construction planning, observing vibrations, the impact of drilling machines, monitored the groundwater level, the bore pile processed, to the end of the hole in terms of quality water The concrete volume that enters the bore pile every 2 m was monitored according to the volume calculated based on the design drawing. Analyzing the results of the loading test based on the soil test. The dry drill construction was using an ordinary bore bit (spiral plate) that was rotated while being put into the ground using drill equipment and diesel power.

Axial load carrying capacity bore piles depend on the drilling method, concrete quality, concrete method, staff experience and soil conditions [5].

Bore pile construction were as follows:

- a. The bore pile location was plotted according to the shop drawing
- b. Installation of the bore pile so that the ground did not fall out, a temporary casing was installed
- c. Installation of the bore pile so that the ground did not fall out, a temporary casing was installed
- d. Drilling equipment was installed and theodolite was installed to monitor vertical alignment
- e. The depth of the bore pile was 36–40 m so that the 18 m length tool was used gutter to pump that the concrete was cast the lowest hole and groundwater quickly enters the drainage
- f. Checked by Field Inspection to ensure drilling reaches Toe Level
- g. Installed reinforced concrete in the drill hole, according to the shop drawing
- h. Drill pile using diesel engine and vibration was damper due to a trench

Groundwater monitoring in the project area and at neighboring sites and the drilling process was observed water and soil.

To control the concrete volume of cast for every 2 m height of the cast, the diameter of the drill pile was 1 m and 1.2 m so that the bore pile was solid/not hollow so that the quality of the concrete was met.

4. Result

Heritage buildings, did not deform, no cracks, even fine cracks did not occur. This was because the vibration waves were suppressed, the groundwater around the heritage building was kept, not descending. The environment was protected from liquid waste, solid waste, and heritage buildings were closed, so they did not get dusty. The success of the heritage building as before, had not changed because of the vibration protection, fixed ground water level, heritage building dust protection. Bored piles are significant elements for foundation. Supervise the productivity, estimating cost and the time of the process construction [6].

5. Discussion

In bore pile construction things that must be considered were

- a. Drilling speed depends on soil type. Wet soil was very difficult in the process of soil disposal
- b. Avoided soft bore holes, so that they do not collapse and the diameter hole reduced
- c. The holes are always kept dry so as not to add the water mixture to the concrete, besides that, placing the drilling machine was easy and steady when the holes were dried
- d. Reinforced concrete followed the shape of the holes

The results showed that the method of bored pile was little complicated compared the concrete pile method. The concrete pile method was more effective and efficient than the bored pile method based on time and cost of the construction method [7].

The control did were:

- a. Groundwater level was monitored every day. When groundwater falls quickly to fill, it was the fact that groundwater does not drop in the research location.

Installed 6-point holes for measuring groundwater subsidence (**Figure 3**).

The development of the system has changed the conventional drill pile construction management, to improve efficiency and progress project information [8]. Control of the vibration by giving a sign to the heritage building had not changed. This was because a trench was made around the heritage building, so that the vibration waves were not continued.

A distance of upper-level A, length to B was measured every time, Length B difference each time indicated a drop in water ground. Distance A level with length B indicated C level. Difference peil C to peil D, it means water ground level drop.

Controlling of the dewatering hole 1: At times 15 o'clock shows length B was 6100 mm, tomorrow hours 15 showed B length was 6050 mm, groundwater 50 mm was dropped, so little did not affect the buildings at the site

- b. Knowing the end bearing by paying attention to the level of mud in the water that comes out during drilling, if the water being drilled was clear it means the drilling has reached hard ground i.e., sand and stone.
- c. Casting one bore pile at a time, so that the concrete unites/monoliths. High-pressure concrete pump, so that groundwater was drilled out into the channel. Every time was installed for casting concrete, so that the fall the concrete was low, avoiding segregation
- d. The concrete volume was controlled 1.6 m³ for 1 m and 2.3 m³ the 1.2 m hole diameter so that necking occurred as early as possible. Each concrete casting was carried out compaction.

Figure 3.
Water level ground measurement used multi meter tool in the (OW 1 until OW6) point.

Figure 4.
Bore pile equipment.

Figure 5.
Tensile test of load at bore pile.

- e. The cleanliness of the concrete, iron and the number, distance, dimensions of the control are put into the borehole.
- f. 2000–2120 tonnes compressive axial test results exceed 200% design load and 200% bore pile tensile load, displacement was 12.05 mm (**Figures 4 and 5**).

Researchers and construction managers are aware of rising and falling water level at hole, high water level in the study site

$$h = z + U / \gamma_w \quad (1)$$

h = height total pressure at one point.
point z = elevation power at height.
U = pore water pressure.
 γ_w = water/unit weight.

6. Conclusion

Three heritage buildings did not do deformation or failure, because level water was little drop and trench were reducing vibrations Prevention was carried out so that heritage buildings did not experience deformation by controlling and prediction of the construction. Other information the tensile test, the compression test got more than 1400 tones, it was 200% of design load bore pile were 1200 mm, 1000 mm and rate of displacement was 12.05 mm smaller than analyzed

displacement clearance 25 m. The result has been eligible as just as to the design needed. The bored pile was diameter 1000 mm and 1200 mm reached the excellent quality.

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Author details

Nusa Setiani Triastuti
Universitas Krisnadwipayana, Indonesia

*Address all correspondence to: nusasetiani@unkris.ac.id

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References

- [1] Adejumo T.W. (2013). African Journal of Engineering Research, **1**(2) pp 17-22.
- [2] Frick H. (2001). Ilmu konstruksi bangunan 1. Label: 690.01 FRI i. Penerbit: Yogyakarta: Kanisius.
- [3] Suyono S, Kazuto N. (1984). Mekanika Tanah dan Teknik Pondasi Structural Engineering & Underground Construction Pradnya Paramita, Underground Construction 624.1
- [4] Toprak B., Sewim O., Totic E., Kalkan I. (2018). The Functions of Pile Types and Piles used in Construction International Journal of Advances in Mechanical and Civil Engineering, ISSN: 2394-2827 Volume-5, Issue-2, Apr.-2018 <http://iraj.in>
- [5] Akbar A., Khilji S., Khan S.B., Qureshi M.S, Sattar M. (2008). Pakistan Journal of Engineering and Applied Sciences, Vol. 3, No. 3, 2008, pp. 54-60
- [6] Zayed T. M., Halpin D. W. (2005). *Journal of Construction Engineering and Management*, ASCE, vol **131**, issue 6 (2005).
- [7] Lutfiansyah Y, Akhsan M. (2019). Comparative Analysis Method of Work, Time and Cost of Concrete Spun Pile Work with Bored Pile On Construction of the Light Rail Transit (LRT) <http://jurnal.ahmar.id/index.php/asci> Journal of Applied Science, Engineering, Technology, and Education Vol. 1 No. 1 (2019) <https://doi.org/10.35877/454RI.asci1137>
- [8] Hu H., Jil X., Liang H., (2019). Study on construction schedule optimization of bored pile based on genetic algorithm IOP Conference Series: Earth and Environmental Science 300 022020 REES2019 IOP Publishing doi:10.1088/1755-1315/300/2/022020 1 Corresponding author e-mail:rainbow6116@163.com