Influence of blankets bore pile on soil characteristics irradiator gamma merah putih of serpong

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Abstract. In determining the planning of a building foundation there are two things that must be considered in the bottom soil of the foundation, namely the carrying capacity of the permitted soil and the magnitude of the foundation decline. Both of these factors determine the stability of building construction. The stress due to the existence of the building above must be able to be carried by the soil layer under the foundation and must be safe from collapse. In general, the use of pile foundation is used if the subgrade under the building does not have enough bearing capacity to carry the weight of the building and the load above it, and also if the location of the hard ground has sufficient carrying capacity to carry the weight of the building above in a very deep position. At the location of the irradiator it is known from the results of soil testing obtained hard soil at a depth of 30 m so that pile drilling is carried out to that depth. When bore pile casting is carried out it turns out that the required volume of concrete exceeds the planned volume based on BQ (bill of Quantity), so we do the pile wrapping to prevent the mix concrete from flowing out. From the results of several method changes and packaging materials, the results show that the most effective two-layer geotextile wrapper reduces concrete wastage (which functions to carry forward the burden of the building structure above it from the surface of the ground to the layer of hard soil underneath).

1. Introduction
The location of the irradiator building from the drill results obtained hard soil at a depth of -30 m so that the pile foundation was used. There are several types of pile foundations which are often used, including piles and bore piles, in this Irradiator building using bore pile because the environment around the site is close to the LIPI laboratory which has monitoring devices that are sensitive to vibrations so that vibrations cannot be disturbed due to the banging of piles.

Bore Pile foundation is a type of deep foundation in the form of a tube, which functions to carry forward the burden of the building structure above it from the surface of the ground to the layer of hard soil underneath. The bore pile foundation has the same function as the other pile or foundation foundations. The difference between the two is the way they are carried out. The bore pile foundation begins with making holes in the ground by means of the soil being drilled first and then installing reinforcing iron into the holes followed by casting bore piles with tremie.
2. Theory

Soil carrying a construction load will cause soil compaction resulting in changes in soil structure, including [2]:

- Grains of soil close / solid.
- The volume of soil decreases.
- The pore volume is reduced but the volume of the grain does not change.

2.1. Knowing the Characteristics of Soil

Parameters that affect soil characteristics:

- Grain size
- Specific gravity
- Water content
- Density
- Pore number

Pore water-saturated soil is poured so that pore shrinkage is in accordance with changes in the structure of deformed soil grains. The ability to drain cohesive groundwater is smaller than sand soil. For a long time deformation is needed, called consolidation deformation.

The nature of the ability of the soil is greater than steel or concrete because it has a large pore, when loaded with the foundation and weight of the building above it, resulting in a vertically deformed soil structure and a decrease.

Different from other materials, the soil has mechanical characteristics, namely:

- Shear strength
- Permeability

The ability of soil grains / water is technically very small, so the process of vertical soil deformation due to external loads is considered as a symptom of pore shrinkage. If the load works small, deformation occurs without a shift between the soil grains. Soil compression deformation shows elastic symptoms, so that when the load is removed, the soil returns to its original shape, elastic deformation.

The general workload causes a shift between soil grains, compression deformation or plastic deformation, if the load is removed, the soil will not return to its original shape. In planning the foundation for construction several types of foundations can be used. The selection of this type of foundation is based on:

1. The upper structure-function that will be borne by the foundation.
2. The amount of load and weight of the upper building.
3. The condition of the land where the building will be erected.
4. Foundation costs compared to the upper structure.

In general, the use of pile foundations is used if the subgrade under the building does not have enough bearing capacity to carry the weight of the building and the load above it, and also if the location of the hard ground has sufficient carrying capacity to carry the weight of the building load above located in a very deep position. From that reason, in designing pile foundations, information is absolutely necessary regarding:

1. Data on the land where the building will be established.
2. The carrying capacity of the pile itself (either single pile or group pile).
3. Negative skin friction analysis (due to additional load).

2.2. Determining Foundation Supporting Capacity
From the results of the investigation of the soil obtained a hard soil layer at a depth of 30 m, then the deep foundation is used, namely bore pile.

Carrying capacity of the foundation is a combination of two strengths of carrying capacity, namely the carrying capacity of the end \((q_e)\) and sticky carrying capacity \((q_s)\), described as follows:

A. Supporting Formula for pole ends

\[
P = \frac{q_c A}{3} + \frac{JHF \cdot O}{5}
\]

Where:
- \(P\) = Pole Carrying Capacity
- \(q_c\) = Conus value
- \(A\) = Width of Mast Section
- \(JHF\) = Value of Adequate Obstacles per pias
- \(O\) = Around the Mast
- 3 & 5 = Security coefficient

B. Carrying Power Formula of the pole end of the LCPC method, 1991

\[
q_e = q_c \cdot Kc \cdot Ap
\]

Where:
- \(q_e\) = End of pole support capacity
- \(q_c\) = Conus value
- \(Kc\) = Conus Value Factor (see table 1)
- \(Ap\) = Area of cross section of pole

| Soil Condition          | Qonus Factor of Pile | The End |
|-------------------------|----------------------|---------|
|                         | Drilling Pile        | Driven Pile |
| Clays and Silts         | 0,375                | 0,600    |
| Sands and Gravels       | 0,15                 | 0,375    |
| Chalk                   | 0,200                | 0,400    |

Table 1. Conus Value

C. Adherent Supporting Formula \((q_s)\)

\[
q_s = JHP \cdot As
\]

Where:
- \(q_s\) = Supportive capacity
- \(JHP\) = Value of Adhesive Barriers (from the Sondir test)
- \(Ax\) = Blanket pole
D. Limit Supporting Formula and Permit Carrying Capacity

\[ q_{ult} = q_e + q_s \]  

Where:

- \( q_{ult} \) = Ultimite Land Carrying Capacity
- \( q_e \) = End of pole support capacity
- \( q_s \) = Carrying Capacity

After we get the value of the Ultimate Land carrying capacity (\( q_{ult} \)), the next step is to calculate the carrying capacity of the land permit, namely:

\[ q = \frac{q_{ult}}{S_f} \]  

Where:

- \( q \) = Carrying capacity of land permit
- \( S_f \) = Security Factor (usually the value is taken 3)

2.3. Slide Force

Negative skin friction is a force acting on the side of the pile where the force actually works towards the bottom so as to provide additional vertical loads in addition to the outside load that works. Negative skin friction is different from Positive skin friction, because positive skin friction helps to provide a support force on the pole in the fight against external / vertical loads that work by providing sliding resistance on the side of the pole, with the working direction opposite from the direction of the external force or forces from negative the skin friction.

Negative skin friction occurs when the soil layer is expected to experience a substantial decrease due to the consolidation process, whereas a result of this consolidation process, the shear force is pushed downward acting on the side of the pole. This condition is called a negative shear force. If the number of force forces as a result of external and negative skin friction loads exceeds the permissible soil forces, there will be a decrease in pile accompanied by a decrease in the surrounding soil. This condition allows a substantial decrease or consolidation of land. The pile foundation should be planned in such a way that the external forces acting on the masthead do not exceed the permissible bearing force. What is meant by the permissible pole support force includes aspects of the permissible bearing force of the soil, stresses on permissible pole transfer head material, and other forces (such as differences in active and passive ground pressure).

The calculations and evaluations are not only carried out on individual piles but also must be carried out on group piles. Generally pile foundations can be viewed from:

1. Types / materials used, including: wood, steel, concrete, or composite (a combination of several materials).
2. Ways of channeling expenses. Based on the method of channeling the load can be divided into:
Fig 1: End Bearing Pile

In Figure 1, it is illustrated about load distribution where most of the carrying capacity is the result of hard ground resistance on the bearing pile end. A pile which is inserted until the hard soil layer, theoretically it is assumed that all the load of the pole is transferred to the hard layer through the end of the pole, with the following conditions[^4]:

- Non-cohesive layer (sand, gravel) has an SPT price (penetration test standard), N > 35.
- The cohesive layer has a value of unconfined compression strength qu between 3 to 4 kg/cm² or N > 15 to 20.

From the results of sondir, the value of the conus resistance S ≥150 kg/cm² can be used for non-cohesive layers, and S ≥ 70 kg/cm² for the cohesive layer.

b. Skin Friction Pile

In fig. 2 shows the load distribution which most of the carrying capacity is the result of friction between the soil and the pile side, that is, the ability of the pile to withstand the load relies solely on the shear force between the pile and the surrounding soil. This can happen because basically the facts on the ground regarding data on soil conditions cannot be predicted, so we often encounter a situation where the layer that meets the requirements as a good support layer is found at very deep depths.

In fact, the carrying capacity obtained is from friction between the sides of the pole with the surrounding soil, but that does not mean that the resistance at the end of the pole does not exist, the support at the end of the pole still has a small carrying capacity.

3. Implementation Methods

The stages of bore pile implementation are carried out following the following sequence, Irradiator Gamma Merah Putih of Serpong:

3.1. Drilling

1. Drilling must be done with a drill equipped with buckets and augers. This equipment must be able to drill and penetrate the waterproof layers, boulders, shales, stiff clays, gravels, and sands.
2. If the condition of the soil being drilled is unstable, so that it tends to landslide or flow of water into the pile shaft, the steel casing must be installed with a minimum thickness of 6 mm and with a diameter not less than the bore diameter needed to handle it. The casing connection must be waterproof.

3. In overcoming landslides, besides using a temporary casing as an option, bentonite materials can also be used. The level of the mixture of bentonite material in the borehole must be kept above the groundwater level. This must be done until drilling reaches the support layer.

4. Drilling data consists of depth drilling, classification of soil types originating from drill holes and any disturbances that occur during drilling.

3.2. Concrete reinforcement

1. The quality of concrete reinforcement used for reinforcement with a diameter of more than 12 mm using U-40 quality deform reinforcement.

2. Reinforcements must be supported centrally outside the drill hole so that no movement/shift occurs at the time of casting with a minimum concrete blanket thickness of at least 7.5 cm.

3.3. Concretion

1. For each drill pole, 3 (three) cylindrical samples must be taken. One for 7 days, one for 14 days, and one for 28 days.

2. The concrete quality requirements for the main building (bunkers and halls) are f'c = 30 mPa at 28 days of concrete with a minimum slump of 180 mm and a maximum of 200 mm. The maximum binding time is 4 hours.

3. Casting should not be carried out before the drill hole is inspected.

4. Casting must be as soon as possible on the same day.

5. During concrete casting, it should be noted that the waiting time between one mixer and the next is quite safe (smaller) than the initial binding time of the concrete.

6. The tremie pipe used must have a minimum diameter of 20 cm and the receiver funnel must have a capacity of at least the same as the pipe in question.

7. Pipe tremie must be installed so that the base of the pipe is at least 1.50 m below the concrete surface at each stage of concretion.

8. During casting, before each part of the tremie pipe is removed or removed, the pole head must be measured.

9. The pipe must reach the bottom of the drill post. The pole joint must use a quick-acting coupling so that each part can be removed as required without delay. Connections must be made waterproof with gaskets or other effective methods.

10. The top of the pipe must be connected to a funnel of sufficient size for the length of pipe used and for the amount of concrete to be poured. Arrangements to raise or lower funnels and pipes must be carried out under supervision.

11. Sliding plugs (such as steel wire mesh wrapped in plastic sheets) must be placed first which will be pushed down to the bottom of the pipe by the weight of the concrete mixture poured first to prevent mixing of the concrete mixture with the water in the pipe.
12. Sounding equipment must be held to check the level of the concrete surface and ensure that the pipe is embedded at sufficient depth to maintain airtightness and maintain the flow of concrete.

13. The funnel must be regularly loaded and continuously without delay to maintain the flow (concrete mixture) and prevent the pipe from clogging. With careful inspection, the concrete must flow if the pipe is gradually raised. If it is necessary to hit the pipe to stop the concrete, then sufficient attention needs to be given to preventing accidents due to the removal of the pipe base with the risk of disturbing the tightness of concrete.

14. In the event of disturbance of concrete tightness, data must be recorded from the disturbing depth and the pipe must be replenished by using "Sliding Plug" and it is considered to avoid scattering water from the pipe.

15. Pipe tremie must remain attached until the upper end of the casting is 1 m above the level of "cut off" so that the concrete will be 75 cm from the level required after the bad surface layer is cut and removed.

16. The actual volume of the concrete used must be recorded and checked / matched with the calculation of the volume required to detect the possibility of reduction or enlargement of the drill pole section.

17. As soon as the concrete casting is complete, the upper level of the test pole must be recorded and connected to a benchmark.

3.4. Implementation tolerance

1. Unless there is sloping drilling, the hole must be drilled vertically and if slope occurs the allowable slope tolerance is 1: 80.

2. The position of the drill point should not shift / deviate more than 7.5 cm from the location specified in all directions at the cut off level.

3. The deviation from the level of the foundation surface of the nearest transferred benchmark is 20 cm.

4. Work on the pole near the newly constructed pole should not be carried out before 7 (seven) days or at a minimum distance of 1.5 times the diameter of the drill pole.
4. Discussion

Figure 3. Image of a bore pile in the Bunker area[8]

Drilling follows figure 3, namely the position and numbering of the bore pile at the location of the bunker. At the time of implementation on pile number 59 the following results were obtained: Date 28.03.16.

Table 2. Drilling pile number 59 data

| DEPTH | SOIL CONDITION | TIME (Minute) | NOTE | DEPTH | SOIL CONDITION | TIME (Minute) | NOTE |
|-------|----------------|---------------|------|-------|----------------|---------------|------|
| 0.00  | Clay (red)    | 1             |      | -17.00| Loamy sand    | 4             |      |
| -1.00 | Clay (red)    | 1             |      | -18.00| Silt loam     | 4             |      |
| -2.00 | Clay (red)    | 1             |      | -19.00| Loamy sand    | 1             |      |
| -3.00 | Clay (red)    | 1             |      | -20.00| Silty clay    | 1             |      |
| -4.00 | Clay (red)    | 1             |      | -21.00| Silty loam    | 1             |      |
| -5.00 | Clay (red)    | 1.5           |      | -22.00| Silty loam    | 2             |      |
| -6.00 | Sandy clay    | 1.5           |      | -23.00| Silty loam    | 2             |      |
| -7.00 | sand           | 1.5           |      | -24.00| silt           | 3             |      |
| -8.00 | Sandy loam    | 1.5           |      | -25.00| silt          | 15            | Rock |
| -9.00 | Sandy loam    | 5             |      | -26.00| silt          | 15            | Rock |
| -10.00| Sandy loam    | 5             |      | -27.00| silt          | 15            |      |
| -11.00| Sandy loam    | 5             |      | -28.00| silt          | 20            |      |
| -12.00| Sandy loam    | 5             |      | -29.00| silt          | 24            |      |
| -13.00| Sandy loam    | 5             |      | -30.00| silt          | 24            |      |
| -14.00| loam           | 5             |      | -31.00| silt          | stop          |      |
| -15.00| loam           | 5             |      |        |                |               |      |
| -16.00| loam           | 4             |      |        |                |               |      |
The need for concrete volume in this hole is more than the plan, which is supposed to be 15 m³ to 44 m³. It is known from the above data that from -16 m to 22 m occurs the drill does not penetrate the soil layer (cavity / water), so that the concrete flows out of the borehole.

**Table 3. Casting results without packaging**

| NO | BORE | DATE    | CF MPa | SLUMP CM | DEPTH M | VOL PLAN M³ | VOL REAL M³ | DEV M³ | METHOD   |
|----|------|---------|--------|----------|---------|-------------|-------------|--------|----------|
| 1  | 1    | 27.03.16| 30     | 19       | 30.8    | 15.47       | 18.5        | 3.03   | normal   |
| 2  | 77   | 27.03.16| 30     | 19       | 30.8    | 15.47       | 21.5        | 6.03   | normal   |
| 3  | 59   | 28.03.16| 30     | 19       | 30.8    | 15.47       | 14          | 28.53  | normal   |
| 4  | 76   | 30.03.16| 30     | 19       | 30.8    | 15.47       | 19.5        | 4.03   | normal   |
| 5  | 67   | 30.03.16| 30     | 19       | 30.8    | 15.47       | 38          | 22.53  | normal   |
| 6  | 68   | 31.03.16| 30     | 19       | 28      | 14.07       | 25          | 10.93  | normal   |
| 7  | 19   | 31.03.16| 30     | 19       | 26      | 13.06       | 15.5        | 2.44   | normal   |
| 8  | 58   | 01.04.16| 30     | 19       | 26      | 13.06       | 18          | 4.94   | normal   |
| 9  | 98   | 02.04.16| 30     | 19       | 26      | 13.06       | 24          | 10.94  | normal   |
| 10 | 18   | 02.04.16| 30     | 19       | 26      | 13.06       | 14          | 0.94   | normal   |

To overcome the above we try in various ways, namely:

1. Using a blanket / wrapper from steel wire low mesh.
2. Using a blanket / wrapper from steel wire high mesh.
3. Using a combination of both (low mesh and high mesh wire).
4. Using blankets / wrappes from single geotextiles.
5. Using blankets / wrappes from double geotextiles.

Then the following results are obtained:

**Table 4. Pile casting table with wire mesh blankets**

| NO | BORE | DATE    | CF MPa | SLUMP CM | DEPTH M | VOL PLAN M³ | VOL REAL M³ | DEV M³ | METHOD   |
|----|------|---------|--------|----------|---------|-------------|-------------|--------|----------|
| 1  | 2    | 03.04.16| 30     | 19       | 30.8    | 15.47       | 15          | 1.94   | Single Wire |
| 2  | 9    | 03.04.16| 30     | 19       | 30.8    | 15.47       | 21.5        | 8.44   | Single Wire |
| 3  | 78   | 04.04.16| 30     | 19       | 30.8    | 15.47       | 17          | 3.94   | Single Wire |
| 4  | 17   | 04.04.16| 30     | 19       | 30.8    | 15.47       | 21          | 7.94   | Single Wire |
| 5  | 14   | 05.04.16| 30     | 19       | 30.8    | 15.47       | 23          | 9.94   | Double Wire |
| 6  | 79   | 05.04.16| 30     | 19       | 28      | 14.07       | 28          | 14.94  | Double Wire |
| 7  | 52   | 05.04.16| 30     | 19       | 26      | 13.06       | 15          | 1.94   | Double Wire |
| 8  | 12   | 06.04.16| 30     | 19       | 26      | 13.06       | 21.5        | 8.44   | Double Wire |
| 9  | 80   | 06.04.16| 30     | 19       | 26      | 13.06       | 22          | 8.04   | Double Wire |
| 10 | 16   | 07.04.16| 30     | 19       | 26      | 13.06       | 16          | 2.04   | Double Wire |
| 11 | 8    | 07.04.16| 30     | 19       | 26      | 13.06       | 18.5        | 5.44   | Double Wire |

**Table 5. Pile casting table with geotextile blankets**

| NO | PILE POINT | DATE     | DEPTH | VOL PLAN M³ | VOL REAL M³ | DEV | % DEV | METHOD |
|----|------------|----------|-------|-------------|-------------|------|-------|--------|
| 1  | 05         | 08.04.16 | 26 M  | 13.062      | 18          | 4.938| 37.80 | Geotextile Single |
| 2  | 57         | 08.04.16 | 26 M  | 13.062      | 17.5        | 4.438| 33.97 | Geotextile Single |
| No. | Date     | M.   | G.  | W.   | S.   | T.   | U.   | V.   | S.   | T.   | U.   | V.   | S.   | T.   | U.   | V.   | Double/G.       |
|-----|----------|------|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|-----------------|
| 3.  | 07       | 09.04.16 | 26 | M. | 13.062 | 16 | 2.938 | 22.49 | Geotextile Single |
| 4.  | 20       | 11.04.16 | 26 | M. | 13.062 | 14 | 0.938 | 7.18 | Geotextile Single |
| 5.  | 81       | 11.04.16 | 26 | M. | 13.062 | 23 | 9.938 | 76.08 | Geotextile Single |
| 6.  | 99       | 13.04.16 | 26 | M. | 13.062 | 28 | 14.938 | 114.36 | Geotextile Single |
| 7.  | 03       | 13.04.16 | 26 | M. | 13.062 | 24 | 10.938 | 83.73 | Geotextile Single |
| 8.  | 75       | 14.04.16 | 26 | M. | 13.062 | 20 | 6.938 | 53.11 | Geotextile Single |
| 9.  | 04       | 14.04.16 | 26 | M. | 13.062 | 16 | 2.938 | 22.49 | Geotextile Single |
| 10. | 82       | 15.04.16 | 26 | M. | 13.062 | 16 | 2.938 | 22.49 | Geotextile Single |
| 11. | 06       | 15.04.16 | 26 | M. | 13.062 | 16 | 2.938 | 22.49 | Geotextile Single |
| 12. | 74       | 07.04.16 | 26 | M. | 13.062 | 19 | 5.938 | 45.46 | Geotextile Double |
| 13. | 66       | 08.04.16 | 26 | M. | 13.062 | 18 | 4.938 | 37.80 | Geotextile Double |
| 14. | 15       | 08.04.16 | 26 | M. | 13.062 | 19.5 | 6.438 | 49.28 | Geotextile Double |
| 15. | 65       | 09.04.16 | 26 | M. | 13.062 | 21 | 7.938 | 60.77 | Geotextile Double |
| 16. | 100      | 11.04.16 | 26 | M. | 13.062 | 15 | 1.938 | 14.83 | Geotextile Double |
| 17. | 72       | 11.04.16 | 26 | M. | 13.062 | 20 | 6.938 | 53.11 | Geotextile Double |
| 18. | 60       | 13.04.16 | 26 | M. | 13.062 | 22 | 9.942 | 82.46 | Geotextile Double |
| 19. | 13       | 13.04.16 | 26 | M. | 13.062 | 18 | 4.938 | 37.80 | Geotextile Double |
| 20. | 11       | 14.04.16 | 26 | M. | 13.062 | 18 | 4.938 | 37.80 | Geotextile Double |
| 21. | 61       | 14.04.16 | 26 | M. | 13.062 | 19 | 5.938 | 45.46 | Geotextile Double |
| 22. | 49       | 15.04.16 | 26 | M. | 13.062 | 18 | 4.938 | 37.80 | Geotextile Double |
| 23. | 50       | 15.04.16 | 26 | M. | 13.062 | 16 | 2.938 | 22.49 | Geotextile Double |
| 24. | 73       | 07.04.16 | 26 | M. | 13.062 | 19 | 5.938 | 45.46 | Geotextile Double |
| 25. | 53       | 08.04.16 | 26 | M. | 13.062 | 16 | 2.938 | 22.49 | Geotextile Double |
| 26. | 10       | 08.04.16 | 26 | M. | 13.062 | 16 | 2.938 | 22.49 | Geotextile Double |
| 27. | 62       | 09.04.16 | 26 | M. | 13.062 | 19 | 5.938 | 45.46 | Geotextile Double |
| 28. | 51       | 11.04.16 | 26 | M. | 13.062 | 17 | 3.938 | 30.14 | Geotextile Double |
| 29. | 92       | 11.04.16 | 26 | M. | 13.062 | 22 | 8.938 | 68.42 | Geotextile Double |
| 30. | 63       | 13.04.16 | 26 | M. | 13.062 | 18 | 4.938 | 37.80 | Geotextile Double |
| 31. | 91       | 13.04.16 | 26 | M. | 13.062 | 18.5 | 5.438 | 41.63 | Geotextile Double |
| 32. | 83       | 14.04.16 | 26 | M. | 13.062 | 16 | 2.938 | 22.49 | Geotextile Double |
| 33. | 90       | 14.04.16 | 26 | M. | 13.062 | 20 | 6.938 | 53.11 | Geotextile Double |
| 34. | 101      | 15.04.16 | 26 | M. | 13.062 | 16 | 2.938 | 22.49 | Geotextile Double |
| 35. | 93       | 15.04.16 | 26 | M. | 13.062 | 24 | 10.938 | 83.73 | Geotextile Double |
36. 36. 11.04.16 26 M 13.062 18.5 5.438 41.63 Geotextile Double
37. 112 13.04.16 26 M 13.062 16 2.938 22.49 Geotextile Double
38. 56 13.04.16 26 M 13.062 16 2.938 22.49 Geotextile Double

Figure 4. Geotextile on reinforced pile bore

5. Conclusion
Pile foundations are used in large areas where vibrations generated during construction work do not disturb the surrounding environment, and can damage the surrounding buildings. With such conditions, the use of a bore pile foundation is the right choice of foundation. Large projects where transportation facilities support, in making bore piles, heavy equipment is often used in the form of cranes. But for small projects especially if the transportation facilities are not supportive, the use of cranes often experiences obstacles because the funds needed for mobilization are large, so that operational costs become economical. The use of a bore pile takes longer than the pile. The use of a bore pile does not cause noise and does not interfere with the office work environment. The mobilization of equipment is easier and smaller than the pile that requires a pile transport trailer. Based on table 5, it is concluded that the use of double geotextiles blankets is more effective in overcoming the above problems compared to steel wire low mesh and steel wire high mesh steel wire blankets.

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