

【DESCRIPTION】

【Invention Title】

METHOD FOR CONSTRUCTING STRUCTURE

【Technical Field】

The present disclosure relates to a method for constructing a structure, and more particularly, to a method for constructing an underground structure above ground and sinking the same into the ground, rather than installing the same underground.

【Background Art】

In constructing a basement floor on a ground with a high level of groundwater or soft ground, the outflow of groundwater may cause serious damage to not only underground structures such as adjacent tunnels, box structures, and subways, but also ground structures.

When excavation is performed beyond a certain depth, the safety of adjacent structures is partially checked before construction through the excavation depth or the like. However, in actual construction, even life-threatening accidents frequently occur due to the collapse of the earthen barrier or the like. In addition, adjacent structures or roads undergo cracks, differential settlement, and sinkholes.

In recent years, even at excavation sites where the excavation depth is not relatively deep, which is not the target excavation depth, the collapse of an adjacent building has occurred due to the collapse of earthen barriers or the outflow of groundwater. As such, excavation for the construction of underground structures in urban areas is a very difficult task. Therefore, there is a need for a method for excavation and structure construction for safer and more stable construction of underground structures.

FIG. 1 shows an underground structure that is generally used and constructed after excavation. As shown in FIG. 1, the conventional construction method is to construct an underground structure after excavating underground soil. That is, an earthen wall 500 is installed adjacent to the land boundary line, and a center pile 700 is installed in the excavation area. Then, excavation and installation of a strut 600 are repeated to complete the underground excavation. While constructing the foundation, retaining wall and basement floor, the strut 600 and the center pile 700 are removed to complete the underground structure.

There are various excavation methods. Various methods for earthen barrier construction are also applied depending on the conditions of the ground, and various water cut-off methods are applied depending on the location of the

groundwater level. After the excavation is completed, the underground structure is constructed. Alternatively, a top-down method in which the structure is constructed from the top to the bottom while constructing the temporary earthen barrier structure is used.

The conventional underground structure construction method for constructing a structure after excavation raises the following issues in terms of safety and economic feasibility. In terms of safety, damage is caused to surrounding facilities due to excavation and loss of life is caused by the collapse of the earthen barrier structure. In terms of economic feasibility, the land is not sufficiently used and construction costs are wasted due to the construction of earthen barriers.

In other words, due to the earthen wall, the underground structure is only constructed at a certain distance from the land boundary line, and accordingly a considerable underground area cannot be used. As a result, economic losses are great.

Korean Patent Application Publication No. 10-2013-0061368 relates to an underground structure construction method for constructing an underground structure such as a basement floor of a building or a subway, or burying an underground pipe, but fails to address the above-mentioned issues.

Therefore, there is a need for development of a safe, economical, and fast structure construction method.

【Disclosure】

【Technical Problem】

Therefore, the present disclosure has been made in view of the above problems, and it is one object of the present disclosure to provide an efficient structure construction method capable of ensuring safety around a construction site, reducing construction costs, and shortening construction time.

【Technical Solution】

In the present disclosure, a structure construction method for constructing an underground structure on the ground and sinking the same into the ground includes steps of: A) constructing a foundation plate 10 and a pile 20; B) installing a jack-down device and constructing a basement structure; C) performing excavation under the foundation plate 10 and sinking the underground structure; and D) dismantling the jack-down device and fixing the pile 20, wherein the jack-down device is installed on the foundation plate 10, such that a degree of sinking of the underground structure is controlled by adjusting force of the jack-down device, wherein the excavation under the foundation plate 10

and the sinking of the underground structure are performed in parallel.

In the present disclosure, a structure construction method for constructing an underground structure on the ground and sinking the same into the ground includes steps of: a) constructing an outer foundation plate 50 and a pile 20; b) installing a jack-down device; c) performing excavation under the outer foundation plate 50 and sinking the underground structure; and d) dismantling the jack-down device and fixing the pile 20, wherein the jack-down device is installed on the outer foundation plate 50, such that a degree of sinking of the underground structure is controlled by adjusting force of the jack-down device, wherein the excavation under the outer foundation plate 50 and the sinking of the underground structure are performed in parallel.

The sinking is performed by a weight of the underground structure.

Alternatively, the sinking is performed by a weight of the underground structure and additional external force.

The additional external force is generated by: increasing the load by adding a temporary load to the underground structure; using a rock anchor or earth anchor installed in the ground; or using main surface friction of the pile installed in the ground.

The excavation is performed by: using excavation equipment; using a water jet; or suctioning and discharging soil from the ground.

The method further includes constructing an additional foundation plate on the foundation plate 10 and the pile 20 after the step D).

The method further includes constructing an additional foundation plate on the outer foundation plate 50 and the pile 20 after the step d).

【Advantageous Effects】

The structure construction method according to the present disclosure has the following effects.

First, an excavation wall and an outer wall, which are the structures of an underground structure, may function as a structure, while being used as earthen barriers during the construction process. Accordingly, soil leakage and water may be prevented in the vicinity of new construction, and thus the safety of nearby facilities may be secured.

Second, when the conventional method is used, groundwater leaking during excavation is discharged through pumping, which lowers the surrounding groundwater level, thereby producing a sinkhole and causing a safety related problem to adjacent structures. On the other hand, according to the present disclosure, the groundwater is not

discharged out, but excavation is performed using a water jet in some cases. Accordingly, decrease in the surrounding groundwater level, which causes problems, may be prevented.

Third, according to the present disclosure, there is no need for a water cut-off method including a temporary earthen barrier facility, and there is no risk of collapse in excavation. Therefore, instability of the temporary structure raising several issues may be prevented.

Fourth, since temporary earthen barrier facilities are not required, time and costs required for installing and dismantling the temporary earthen barrier facilities may be reduced, shortening the construction period and reducing construction costs.

Fifth, since the surrounding ground is firmly supported by the excavation wall and the outer wall before excavating the ground, disturbance of the surrounding ground may not occur.

Sixth, as the earth wall is not installed, the underground structure may be constructed up to the land boundary line. Accordingly, the utility value of the land may be increased and the underground space may be used as much as possible.

Seventh, the pile for construction of an underground structure may function as a support and guide to control settlement of the underground structure during construction,

and function as a deep foundation after construction is completed.

Eighth, the amount of settlement of underground structures may be controlled using a hydraulic jack. Accordingly, precise construction may be ensured.

Ninth, since the temporary earthen barrier facility is not required, accidents caused by the collapse of the temporary earthen barrier facility may be prevented.

【Description of Drawings】

FIG. 1 shows conventional technology.

FIGS. 2 to 7 illustrate a procedure according to a first embodiment of the present disclosure.

FIGS. 8 and 9 illustrate a second embodiment of the present disclosure.

FIGS. 10 and 11 illustrate a third embodiment of the present disclosure.

FIG. 12 is an enlarged view of a foundation plate, a pile, and a hydraulic jack.

※ Brief description of reference numerals

100: Underground structure

10: Base plate 11: Block out

12: Excavation wall 13: Tip shoe

14: Equipment entrance 20: Pile

30: Second basement structure

31: Bottom plate 32 Outer wall
33: Pillar 34: Second basement floor
40: First basement level structure
41: Bottom plate 42: Outer wall
43: Pillar 44: First basement level
50: Outer foundation plate
60: Outer basement structure
300: Hydraulic jack
310: Anchor 311: Anchor fixture
320: Pressure plate 330: Pressurizing stand
400: Land boundary line
500: Earth wall 600: Strut
700: Center file

【Best Mode】

Hereinafter, embodiments of the present disclosure will be described in detail with reference to the accompanying drawings such that those of ordinary skill in the art can easily implement the present disclosure. However, the present disclosure may be implemented in various different forms and is not limited to the embodiments described herein. In the drawings, parts irrelevant to the description are omitted in order to clearly describe the present disclosure. Similar reference numerals are used to refer to similar parts throughout the

specification. Throughout the specification, when a certain portion "includes" or "comprises" a certain component, this indicates that other components are not excluded and may be further included unless otherwise noted. Hereinafter, preferred embodiments of the present disclosure will be described in detail with reference to the accompanying drawings.

Conventionally, an underground structure is constructed in an underground space after excavating the ground. On the other hand, in the present disclosure, a structure is constructed in a manner in which an underground structure is constructed on the ground, and then sunken into the ground while excavating the part under the foundation plate.

The underground structure 100 of the present disclosure includes a foundation plate 10, a pile 20, and a basement structure. The basement structure may have one layer or two or more layers. In first and second embodiments, the basement structure includes a 2-level basement structure 30 and a 1-level basement structure 40.

FIGS. 2 to 7 show the first embodiment of the present disclosure for constructing the underground structure 100. Hereinafter, each construction step in the case of constructing the second basement floor will be described in detail with reference to FIGS. 2 to 7.

① Construction of the foundation plate 10 (see FIG. 2).

A foundation plate 10 made of reinforced concrete is constructed on the ground. As shown in FIG. 2, the edge of the foundation plate 10 may be directly adjacent to the land boundary line 400, or may substantially coincide with the land boundary line 400.

In the construction method, the outer wall of the underground structure is used as an earthen barrier. Accordingly, a separate earthen barrier is not required. The foundation plate and the outer wall of the underground structure are constructed so as to contact the land boundary line as much as possible to maximize the underground space.

First, since the foundation plate 10 is constructed, and then the pile 20 is constructed, a hole through which the pile 20 can be installed should be formed in the foundation plate. Therefore, in constructing the foundation plate, a sleeve for forming a hole for the pile 20 is installed in advance. A steel pipe may be used as the sleeve.

After sinking of the underground structure is completed, a groove is formed in the foundation plate by a certain thickness to form a blockout 11 in order to make a space for fixing the upper part of the pile 20 to the foundation plate (see FIG. 12). After fixing the file,

grouting is performed in the blockout 11.

An excavation wall 12 may be arranged at the lower edge of the foundation plate 10. The excavation wall 12 may be used as an earthen barrier wall during excavation work. In addition, a tip shoe 13 having an inclined tip is disposed at the lower end of the excavation wall 12, such that the underground structure may be easily inserted into the ground.

To form the tip shoe 13, a steel plate, which is a permanent mold, may be used or concrete may be formed to have an inclined cross section.

After the excavation wall 12 is first constructed, concrete for the foundation plate is poured such that the excavation wall 12 and the foundation plate 10 are integrated.

In constructing the foundation plate 10, a required number of jack-down anchors 310 may be pre-installed by calculating the load of the underground structure (see FIG. 12). The quantity and capacity of the anchors 310 may be applied according to the weight of the underground structure and the load generated when the underground structure is sunken.

The lower end of the anchor 310 is provided with an anchor fixing member 311 for fixing the anchor to the foundation plate. The anchor fixing member 311 may be

buried in the foundation plate 10, or may be fixed to the bottom of the foundation plate 10.

It has been described that the anchor 310 for jack-down is pre-installed. In some cases, however, the anchor may not be pre-installed. Instead, the jack-down may be performed after installing a chemical anchor after construction of the foundation plate.

The thickness of the foundation plate is determined in consideration of the load required for jack-down and the structural stability of the underground structure.

② Construction of the pile 20 (see FIG. 2).

When the foundation plate 10 is installed, the pile 20 is installed through a hole formed by the sleeve for construction of the pile 20. The pile 20 may be a steel pile, a ready-made reinforced concrete pile, a PHC pile, a composite pile, a cast-in-place concrete pile, or the like. Installation of piles may be performed using a method such as driving, drilling after excavation, or the like. The pile is installed up to the basement bedrock that may exhibit the end bearing capacity.

When the pile 20 is not used as a deep foundation after construction of the underground structure is completed, that is, when the foundation is a spread foundation rather than a pile foundation, only minimum temporary piles required for jack-down of the underground structure may be

constructed.

In the case of an underground structure designed with a pile foundation, the jack-down device may not be installed on every pile, but may be installed only on as many piles as necessary to jack down the underground structure. The load to be applied at this time is applied in consideration of the weight of the underground structure constructed during jack-down and the amount of reduction due to buoyancy.

In the case of an underground structure designed with direct foundation, the minimum number of piles necessary for jack-down is constructed and used for jack-down. The load to be applied at this time is applied in consideration of the weight of the underground structure constructed during jack-down and the amount of reduction due to buoyancy.

③ Installation of jack-down device and construction of basement two-story structure (30) (see FIG. 3)

A jack-down device capable of controlling the settlement amount and settlement speed of the underground structure is installed, and the basement two-story structure (30) is constructed. At this time, in order to reduce the construction period by efficiently proceeding the work, construction of the second basement structure 30 may be performed while installing the jack-down device.

Referring to FIG. 12, which shows a jack-down device, a pressurizing stand 330 is fixed to the top of the pile 20,

and a hydraulic jack 300 is installed on the pressurizing stand 330. The lower end of the anchor 310 is fixed to the foundation plate 10 by an anchor fixing member 311, and the upper end of the anchor 310 is fastened to the pressure plate 320. A nut may be used to fasten the upper end of the anchor 310 to the pressure plate 320. By controlling the pushing force that the hydraulic jack 300 applies to the pressure plate 320, the amount of settlement of the foundation plate may be precisely controlled.

The jack-down device shown in FIG. 12 is merely an embodiment, and the hydraulic jack, the anchor, the pressure plate, and the pressurizing stand may be combined in a different structure.

The second basement structure 30 may include a bottom plate 31, an outer wall 32, and a pillar 33. The outer wall 32 may function as an outer wall of the underground structure and an earthen barrier at the same time. The pillar 33 includes a pillar and a wall supporting the bottom plate 31.

④ Excavation under the foundation plate 10 and jack-down of the underground structure (see FIGS. 3 and 4)

When the part under the foundation plate is excavated after the installation of the jack-down device is completed, the second basement structure will naturally sink due to its own weight and the weight of the foundation plate.

Various methods may be used to excavate the part under the foundation plate depending on the condition of the ground under the plate.

In the case of soft ground, the soil under the foundation plate may be removed by suctioning the soil. The jack-down device is to be controlled while accurately measuring the amount of settlement such that the structure does not non-uniformly sink when the soil is removed. After a certain amount is excavated, the structure is sunken using the jack-down device. This process is repeated to place the underground structure at a desired location. Depending on the viscosity and moisture content of the clay, water jetting and agitation are performed to facilitate suction. The sucked muddy water is separated into soil and water through a dewatering process. The separated soil and sand may be taken out to the sandy soil site and the separated water may be reused at the site to prevent environmental pollution.

When the ground under the foundation plate is relatively good, suction or dewatering may be additionally performed together with water jetting or excavation may be performed in parallel to sink the structure.

When the ground under the foundation plate is hard like bedrock, an equipment entrance 14 is formed in the foundation plate, and the ground under the foundation plate

is excavated using the excavation equipment, and then the structure is brought down.

⑤ Construction of the first basement structure 40 (see FIG. 5)

When the second basement structure 30 is placed on the foundation plate and sinks by a required depth (FIG. 4), the first basement structure 40 is constructed on the ground level on the second basement structure 30 (FIG. 5).

The first basement structure 40 may include a bottom plate 41, an outer wall 42, and a pillar 43. The outer wall 42 also functions as an outer wall of the underground structure and an earthen barrier at the same time. The pillar 43 includes a pillar and a wall supporting the bottom plate 41.

⑥ Repetition of excavation under the foundation plate 10 and jack-down of the underground structure (see FIGS. 5 and 6)

After the construction of the first basement structure 40, the underground structure is sunken by controlling the jack-down device while excavating the earth under the foundation plate. The sinking is performed up to the required depth (FIG. 6).

⑦ Completing sinking, dismantling the jack-down device, and settling the pile (see FIG. 7)

Once sinking to the required depth is complete, the

jack-down device is dismantled. After cutting the anchor 310 and fixing the anchor 310 and the upper end of the pile 20, grouting is performed in the blockout 11 to fix the pile on the foundation plate.

After performing steps ① to ⑦ above, the construction of the interior of the underground structure and construction of the ground structure are carried out as necessary. Then, the construction of the structure is completed.

FIGS. 8 and 9 illustrate construction of an underground structure 100 according to a second embodiment of the present disclosure.

In the second embodiment, the pile 20 is first constructed, and then the foundation plate 10 is constructed. In other words, in the second embodiment, step ② is performed first, and then step ① is performed. Then, steps ③ to ⑦ are performed as described above.

In the first and second embodiments, the process of forming the first basement structure and the second basement structure has been described. However, the present disclosure is not limited to the first basement structure and the second basement structure. That is, only the first basement structure may be formed, or a plurality of basement floors of two or more basement levels may be formed by repeating steps ④ and ⑤ described above.

FIGS. 10 and 11 illustrate construction of an underground structure 100 according to a third embodiment of the present disclosure.

The third embodiment may be applied when an area where an underground structure is constructed is large. That is, when the plan area of the underground structure is large, forming the entire foundation plate as one body and sinking the same may be difficult and have a risk of damaging the foundation plate, and may be rather inefficient.

In this case, an outer foundation plate 50 is constructed for a certain width at the land boundary line 400. Then, the outer foundation plate 50 is sunken in the same manner as described above. An outer basement structure 60 may be constructed on the outer foundation plate 50 and then sunken. In this operation, while excavating the soil under the outer foundation plate 50, the outer foundation plate is sunken. Once sinking of the outer foundation plate is completed, a foundation plate and the basement structure are constructed.

At this time, the internal soil inside the outer foundation plate 50 may be left as it is. Then, the internal soil may be excavated after sinking of the underground structure is completed. In addition, while the outer foundation plate 50 is sunken by a certain degree, the internal soil may be excavated.

In the third embodiment, after constructing the outer foundation plate 50, the pile 20 may be installed. Alternatively, after installing the pile 20, the outer foundation plate 50 may be constructed.

In the above embodiments, it has been described that the foundation plate 10 or the outer foundation plate 50 is constructed as a single floor. In some cases, after the sinking is completed, an additional foundation plate may be formed on the foundation plate 10 or the outer foundation plate 50.

That is, when a concrete pile or a pile with a large diameter is used as a pile foundation, it may be difficult to implement rebar arrangement on the foundation plate 10 due to the pile. Further, it is difficult to firmly fix the upper portion of the pile to the foundation plate. Therefore, after the sinking is completed, an additional foundation plate is preferably constructed on the foundation plate 10. In constructing the additional foundation plate, the jack-down foundation plate 10 is constructed as thin as possible. After the sinking of the underground structure is completed, the pile and the foundation plate 10 are settled. Then, rebar arrangement is performed on the pile and the foundation plate 10, and then a mat (for the additional foundation plate) is poured to construct the additional foundation plate.

In constructing an additional foundation plate on the foundation plate 10, the reinforcement and thickness of the entire foundation are considered and reflected in the floor height of the underground structure. By constructing the additional foundation plate, sufficient rigidity of the mat may be obtained even with a pile having a large diameter. In addition, in constructing an additional foundation plate, reinforcing bars must be constructed in advance at a location determined in consideration of the connection between the additional foundation plate and the foundation plate 10, and the connection between the additional foundation plate and the wall and pillar.

On the other hand, when a steel pipe pile is used, an additional foundation plate may not be required, and only the foundation plate 10 may be used because the diameter of the pile is not large enough to interfere with the arrangement of reinforcing bars on the foundation plate,.

In sinking an underground structure, it may be difficult to sink the structure by the weight of the underground structure alone. In this case, the structure may be sunken using the following method.

First, a load may be added. The load may be increased by adding a temporary load on the foundation plate or the underground structure.

Second, a rock anchor or earth anchor may be

installed in the ground, and the structure may be sunken by pulling the rock anchor or earth anchor.

Third, the friction on the main surface of the installed pile may be used. When the hydraulic jack is contracted, a force that pulls the foundation plate downward is generated because the pile is fixed in the ground by the main surface friction force.

While the present disclosure has been described with reference to the embodiments shown in the drawings, this is only exemplary, and those of ordinary skill in the art will understand that various modifications and other equivalent embodiments are possible therefrom. Therefore, the scope of the present disclosure should be determined by the technical spirit of the appended claims.

【CLAIMS】

1. A structure construction method for constructing an underground structure on a ground and sinking the same into the ground, the method comprising steps of:

A) constructing a foundation plate (10) and a pile (20);

B) installing a jack-down device and constructing a basement structure;

C) performing excavation under the foundation plate (10) and sinking the underground structure; and

D) dismantling the jack-down device and fixing the pile (20),

wherein the jack-down device is installed on the foundation plate (10), such that a degree of sinking of the underground structure is controlled by adjusting force of the jack-down device,

wherein the excavation under the foundation plate (10) and the sinking of the underground structure are performed in parallel.

2. A structure construction method for constructing an underground structure on a ground and sinking the same into the ground, the method comprising steps of:

a) constructing an outer foundation plate (50) and a pile (20);

b) installing a jack-down device;

c) performing excavation under the outer foundation plate (50) and sinking the underground structure; and

d) dismantling the jack-down device and fixing the pile (20),

wherein the jack-down device is installed on the outer foundation plate (50), such that a degree of sinking of the underground structure is controlled by adjusting force of the jack-down device,

wherein the excavation under the outer foundation plate (50) and the sinking of the underground structure are performed in parallel.

3. The method of claim 1 or 2, wherein the sinking is performed by a weight of the underground structure.

4. The method of claim 1 or 2, wherein the sinking is performed by a weight of the underground structure and additional external force.

5. The method for claim 4, wherein the additional external force is generated by:

increasing the load by adding a temporary load to the underground structure;

using a rock anchor or earth anchor installed in the ground; or

using main surface friction of the pile installed in the ground.

6. The method of claim 1 or 2, wherein the excavation is performed by:

using excavation equipment;

using a water jet; or

suctioning and discharging soil from the ground.

7. The method of claim 1, further comprising:

constructing an additional foundation plate on the foundation plate (10) and the pile (20) after the step D).

8. The method of claim 2, further comprising:

constructing an additional foundation plate on the outer foundation plate (50) and the pile (20) after the step d).