Implementation of the Excavation with Bottom-Up Method Compared with A Top-Down System

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Abstract
This method of construction is a very important part in construction projects to obtain the objectives of the project, namely the cost, quality and time. Technological aspects, very involved in a construction project. Generally, the application of this technology is widely applied in methods of construction work. The use of appropriate methods, practical, fast, and secure, very helpful in the completion of work on a construction project. Thus, the target time, cost and quality, as defined will be achieved. In the implementation of construction works, sometimes also needed a breakthrough method to complete the work in the field. Especially in the face of constraints caused by field conditions do not correspond to the previous allegations. Therefore, the application of appropriate construction methods to the field, will greatly assist in the completion of construction projects in question. Application of the method of construction, other than closely related to field conditions under which a construction project done, it also depends on the type of project undertaken. The method of implementation work for buildings of different methods of irrigation construction work, building power plants, the construction of the pier and the construction of roads and bridges. All stages of the building work have implementation methods adapted to the design of consultants. Implementation method is based on the structure of the design work, the circumstances of the project as well as sites that exist in the data project. These data are data that influence in determining and planning the implementation methods of the building. Methods of site works or bottom structure is a method which has considerable influence in the methods of work of the overall structure. Methods bottom structure will determine the accuracy of the schedule implementation structure.

Keywords: construction; bottom-structure; implementation: building: ground-surface

INTRODUCTION
The basement of the building tem construction method bottom up (conventional) and the top down on making the basement author takes references from the literature and several Internet sources that discussed the implementation of the method of construction a bottom-up system (conventional) and the system top down on making the of the building. The purpose of this paper is to knowing is a system of bottom-up and top down system on the construction., and to explaining the phase of systems and knowing the advantages and disadvantages of the general method of construction of bottom-up system of top-down system.

Implementation of the basement structure at this time there are two ways, namely:

a) System Bottom Up
In this system, the structure of the basement excavation work carried out after the entire excavation is completed achieve elevation plan (conventional system). Basement bottom plate casted in advance so that it becomes Raft foundation with methods chessboard, then the basement solved from the bottom up, using scaffolding. Columns, beams and slabs cast in place (cast in place). In this system, soil excavation can be cut open, often using dewatering cut off, but using a dewatering system pre-drainage and soil retaining wall structure using steel sheet pile which can temporarily or permanently by retrofiting strutting, ground anchor or free cantilever. In this case the dewatering work will be dismissed, must be calculated in advance whether the structure of the basement, which has been completed is able to withstand the upward pressure of the groundwater, so that deformation of the building which can lead to cracking of the structure.

b) Systems Top Down
In this system, the structure of basement held in conjunction with excavation work basement, order completion beams and slab floors starting from the top down, and during the implementation process, the structure of the plate and the beams are supported by steel columns called King Post (which is installed together with the bored pile). While casted basement walls first with diaphragm wall system, and at the same time serves as a diaphragm wall cut off dewatering.

DISCUSSION

Method of Construction Implementation System Bottom Up (Conventional)
Broadly speaking, the activities undertaken in the construction basement with a bottom-up method is as follows:
1. Mobilization of equipment.
2. The foundation of implementation of the post.
3. Implementation of the retaining wall (sheet pile).
4. Excavation and disposal of land.
5. Dewatering.
6. Poer foundation.
7. Waterproofing.
8. Tie beam and raft foundation.
9. The walls of the basement and the structure gradually upwards.
10. The basement was gradually upwards.

In general, the activities on this work is the major work items that can almost always be found in a basement work execution with a bottom-up method. Here is an overview of the implementation of the work by the sequence which work should begin on the ground floor basement.

Another possibility may occur, but in general procedures of basement bottom up method would follow such patterns. Some things that can be referred to the traits of the implementation of the basement with the usual bottom-up method implementation of descriptions above are:
1. The bottom-up method does not require the procedures for project management in particular, because in general has become a regular thing done.
2. Required control groundwater levels around intensively.
3. Retaining walls can be permanent or temporary, but it is certain to implementation cannot be performed simultaneously with other work, retaining wall is the beginning of the work to be conducted before the basement is more work starts unless underpinnings.
4. Any attempt to speed up implementation time, generally causes additional resources both human and equipment that is not comparable with the production.
5. The deeper (more number of basement) methods of implementation will be more difficult.
6. Necessary land area is sufficient to control the transportation vertical excavation.
7. As a result of the excavation and construction will need that much, then the environmental conditions of the project will be crowded and dirty.
8. The possibility of doing a combination of execution simultaneously with other activities is minimal because of the construction method thus provides a sequence of events.
9. The cost of implementation to a certain depth is relatively cheaper.

Figure 1. Implementation Basement with Method Bottom Up

Method of Construction Work Top Down Systems
In the method of construction Top Down, structures basement held in conjunction with excavation work basement, order completion beam and plate floors starting from the top down, and during the implementation process, the structure of the plate and the beams are supported by steel columns called King Post (which is installed together with bored pile). Being casted basement walls first with a diaphragm wall system, and at the same time the diaphragm walls.

Typically for basement excavation use specific tools, such as small size excavator. When the number of the basement floor a lot, eg five floors, then to smooth the work, excavation is done directly on two floors at a time, so the space is high enough for the freedom of the excavation process. The floors were passed, will be implemented in the usual way, using scaffolding (as in the usual bottom-up system).

When the structure of the basement has been finished, the king post casted concrete pole and when needed can be added reinforced Basement floor vent holes used for transportation dugouts, reseal-able. Casting upper structure, implemented as usual, ie from bottom to top (floors one, two, and so on).

For the implementation of the floor space traversed that excavation is quite loose. Then the floor is concerned casted with ordinary scaffolding system. When the king post structure strong enough. So at the time of finishing the basement, can be coupled with the upper structure (often called the system up and down).

In principle Top down method can be called as a way of building upside down, namely building from top to bottom. technically, this method has not become a problem again in Indonesia, but given that the new method recently tested, then the problem that arises is when to use these methods and how management techniques in order to achieve the main purpose of the project page.

Here are the stages in the implementation of top-down construction method:
1. Casting and installation of bored pile king post
2. Casting diaphragm wall.
3. Floor basement 1, casted on the ground with floor work
4. Excavated basement 1, implemented after the first basement floor quite strenght using a small excavator). Supplied pit floor and the ramp while for disposal of overburden.
5. Floor basement 2, casted on the ground with floor work.
6. Excavated basement 2, basement excavation carried out as 1, and so on.
7. Lastly raft foundation.
8. King post casted, as the column structure.
9. If necessary, the implementation of the basement, can be started on the structure, according to the abilities of the king post there (system up & down)

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When the structure of the basement has been finished, the king post casted concrete pole and when needed can be added reinforcement. Holes basement floor used for the transport of dugouts, reseal-able. Casting upper structure, implemented as usual, ie from bottom to top (floors one, two, and so on).

For the implementation of that space through which the excavation is quite loose, then the floor is concerned casted with ordinary scaffolding system. When the king post structure strong enough. So at the time of finishing the basement, can be coupled with the upper structure (often called the ups and downs).

One detail king post, can be explained as follows: a. The first floor and partially casted column, by placing the starter bars for the column.

The next floor is also casted in the same way. Then the starter bar field below and it connected. Then the column in question. casted.

**Disadvantages and Advantages Construction Systems Implementation Method Bottom Up and Top Down Systems**

**A. Construction Method Bottom Up**

Disadvantages of this method of construction Bottom Up among others are:

a) Vertical Transportation requires that the extent of land in proportion to its depth.
b) The need to be more intensive dewatering.
c) The use of temporary construction very much.
d) It is almost certain necessary ground anchor.
While the advantages of this construction method Bottom Up of them are as follows:

- a) Costs of equipment cheaper.
- b) The human resources adequately trained many.
- c) The equipment used is commonly used equipment for example: Backhoe, Shovel Loader and others, no special equipment is needed.
- d) Does not require high technology.
- e) The cost of retaining wall used is relatively cheaper compared with diaphragm wall commonly used for the method of Top down.
- f) Control techniques of the construction have been controlled because many building projects basement that has been done so that the experiences and examples sufficient support (project documentation).

![Figure 7. Reinforcement basement floor](image1)

![Figure 8. Reinforcement pole king post](image2)

B. **Top Down Construction Method**

Disadvantages of this method of construction Top Down among others are:

- a) It takes a special heavy equipment.
- b) It takes more precision and accuracy
- c) Human resources are limited.
- d) Specific knowledge required to control the project
e) The cost of retaining wall is used more expensive than commonly used sheet pile to methods Bottom Up.

**While the advantages of this method include the construction of Top Down is as follows:**

a) Relative do not disturb the environment
b) The implementation schedule can be accelerated.
c) Allows simultaneous jobs.
d) Land area larger project
e) Technical risk is smaller.
f) Quality retaining wall can be controlled.

**CONCLUSION**

From the discussions that have been described in before, it can be concluded as follows:

1. Bottom Up System is a method implementation construction of a basement structure that is executed after the entire excavation work is completed achieve excavation elevation plan (conventional system). Basement bottom plate casted in advance so that it becomes Raft foundation with methods chessboard, then the basement solved from the bottom up, using scaffolding. Columns, beams and slabs cast in place (cast in place).

2. Top Down System is a method implementation construction of a basement structure is held in conjunction with a basement excavation work, order completion beam and floor plate starting from the top down, and during the implementation process, plate and beam structure is supported by steel columns called King Post (which is installed together with the bored pile). While casted basement walls first with diaphragm wall system, and at the same time serves as a diaphragm wall cut off dewatering. The second method of construction for the manufacture of basement structures that method bottom up and top down, each method has its own advantages and disadvantages. Especially for the top-down method can be regarded as a new method, it still needs a lot more profound research on its application in the field. Thus, in choosing these two methods take a lot of consideration and preliminary analyzes in sufficient detail of the real situation in the field so that you can later use as efficient and economical as possible.

**REFERENCES**


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