

Study of Block-formed Retaining Wall for Reducing Construction Waste

Chun-Ho Kim

Dept. of Civil Engineering, Division of Construction Engineering, Joongbu. Univ.

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Existing retaining walls are usually made from only one cast form and any damage must be promptly repaired. However, when a part of a retaining wall is repaired, a gap can be created between the repaired and existing parts, along with an unpleasing visual effect. As such, the whole structure is often reconstructed, rather than repairing one part, resulting in construction waste and possible contamination of the environment. Accordingly, the current study proposes a construction method for a retaining wall that uses separate blocks to downsize of quantity of construction waste. In addition, by changing the color or modifying the block cover a more environmentally friendly retaining wall construction method is achieved.

Key words : retaining wall, separate block, retaining wall block

1. Introduction

Existing retaining walls are commonly either made by striking and structuring on the construction site or continually laid as a solid pattern based on rectangular parallelepiped. When parts of a retaining wall are damaged or collapse, repair work must be carried out promptly to maintain slopes. As a result, the retaining wall is inclined to be cleft due to differences in the quality of materials between the existing and repaired parts, and also include various defects, like fissures, due to breaks in the originally constructed continuous pattern. As such, the repaired parts create an ugly and displeasing appearance and the wall is also more likely to collapse again. Therefore, to solve this problem, the whole retaining wall is usually dismantled and then reconstructed, which produces a lot of construction waste that pollutes the surrounding environment. Accordingly, the current study aimed to show that the construction and maintenance of a retaining wall can be easily

accomplished based on soil blocks on the river bank and on the cutting surface of the protected bank based on constructing a retaining wall using a separate section blocks to reduce the construction waste. Furthermore, an environmentally friendly retaining wall construction method is introduced based on changing the color or modifying the block cover.

2. Block-formed Retaining Wall

A block-formed retaining wall is proposed to solve the problems and take advantage of the merits of an existing retaining wall.

2.1 Structural Elements

A block-formed retaining wall consists of front blocks, anchor blocks, cap blocks, and division blocks.

1) Front Blocks

These blocks make up the front side of the retaining wall and are under soil pressure from the back, as shown in Fig. 1.

2) Anchor Blocks

These blocks support the front blocks from the back of the retaining wall, as shown in Fig. 2.

Corresponding author ; Chun-Ho Kim, Dept. of Civil Engineering, Division of Construction Engineering, Joongbu. Univ.

Phone : +82-41-750-6679

E-mail : chkim@joongbu.ac.kr

3) Cap Blocks

These blocks are added to the top of the completed retaining wall, as shown in Fig. 3.

4) Division Blocks

These blocks are used to divide the retaining wall, as shown in Fig. 4 & 5. The division block in Fig. 4 is used to divide a straight line pattern, while the division block in Fig. 5 is used to cover various angular defects in the front blocks(T-formed blocks) that do not consist of straight lines. As such, division blocks enables the retaining wall to be established based on the lie of the land. Plus, they can be changed according to the location and angle of the guiding wire home as well as the location of the connecting home of the T-formed retaining block using a simple change in the production frame. If division blocks are used to repair defective parts this reduces construction waste and allows for the economical construction of a continuous retaining wall.

2.2 Proposed Method of Constructing Blocks for the Retaining Wall

1) Section of construction using retaining blocks.

A completed section of construction using retaining blocks is shown in figure 6.

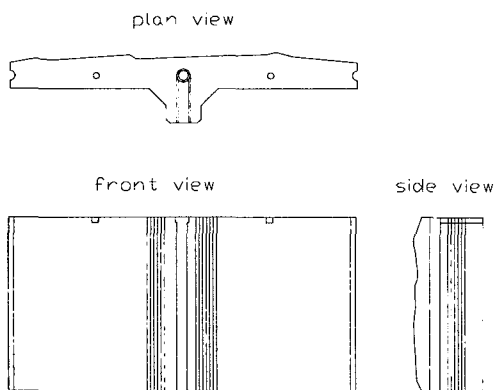


Fig. 1. The Front Block.

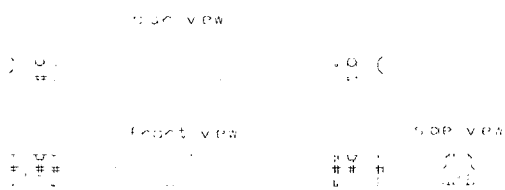


Fig. 2. The Anchor Block.



Fig. 3. The Cap Block.

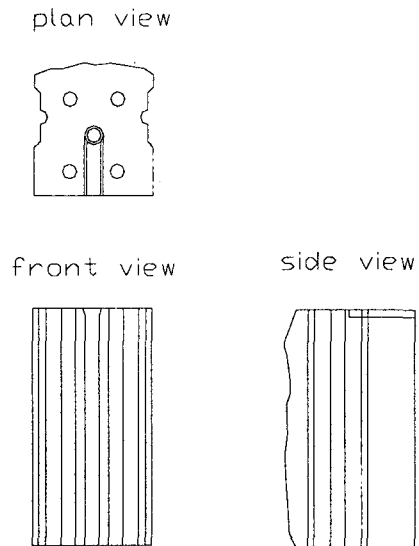


Fig. 4. The Division Block(A).

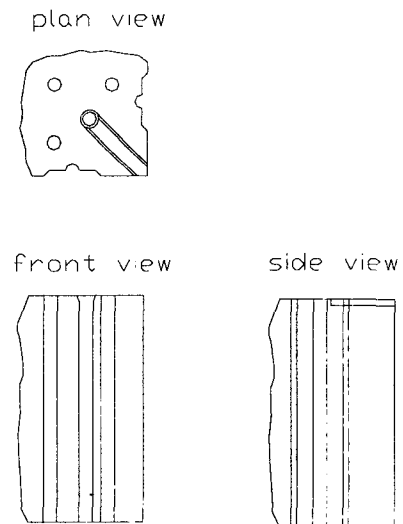


Fig. 5. The Division Block(B).

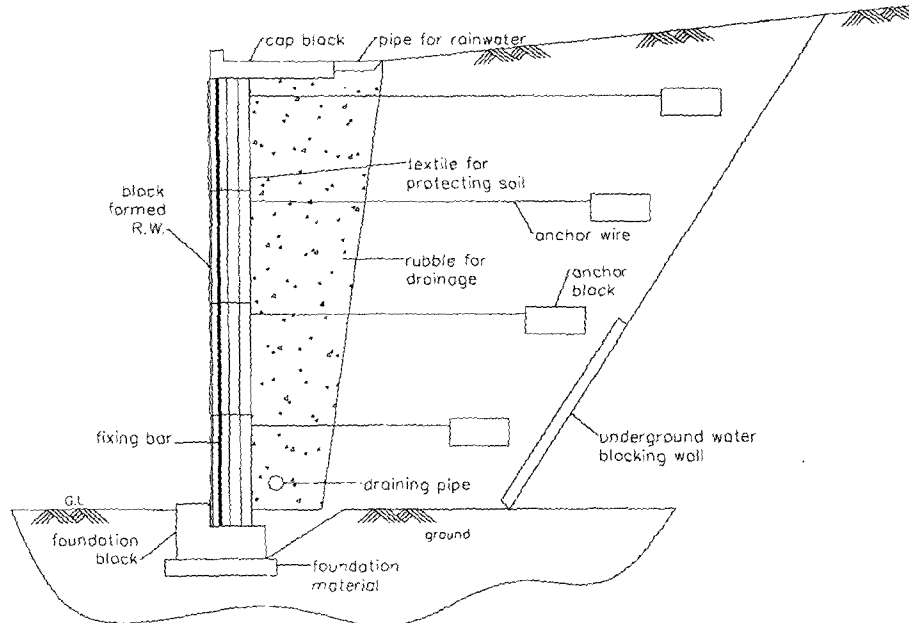


Fig. 6. The section drawing of Construction by Retaining Block Method.

2) Culling the Basic Ground.

(1) Foundation Work

Preparatory work is carried out in the order shown in Fig. 7.

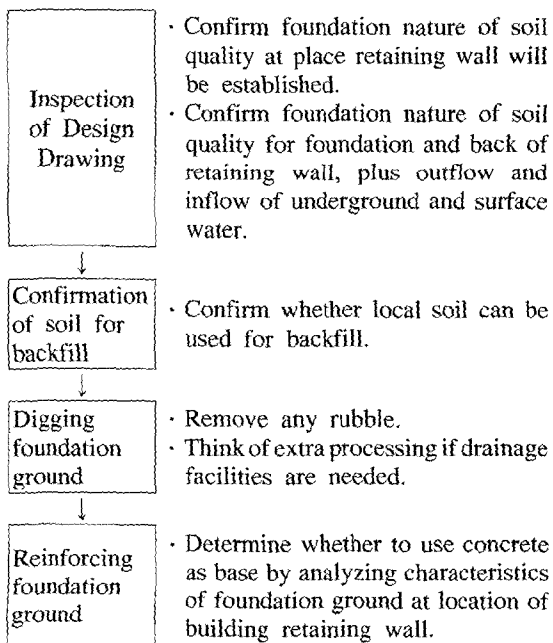


Fig. 7. Flow Chart of Foundation Work.

(2) Digging foundation ground

① Case when foundation ground is good:

If the foundation ground is strong enough to sustain a retaining wall structure, the foundation ground is dug after considering the basic rubble depth and the depth of the basic blocks, while also securing space to fill the soils on the backside of the blocks.

② Case when foundation ground is unsuitable:

Decide whether concrete is required and depth of replaced foundation.

③ Case of weak foundation ground: Determine how to reinforce foundation ground after inspection by expert.

(3) Culling foundation ground

① Secure at least 15cm of foundation ground using thick sand, sand mixed with gravel, and aggregates with good drainage.

② After constructing the selected foundation materials, confirm whether the foundation ground can maintain a horizontal state with strengthening.

3) Establishing blocks.

(1) Establishing first panel

The first panel must be level in all directions, because the horizontal line of the first panel has

an influence on the whole retaining wall, then use soil to fill up the inside and backside according to the local conditions,

① Insert the panels side by side and establish using a panel fixing bar.

② Inspect whether the line form, height, and inclination of the first panel are consistent with the drawing.

③ Confirm the line form by floating the construction line so as to agree with the front of the panel.

④ Confirm the inclination by lowering a ball from the upper part of the backside of the panel to the base.

⑤ Install well-drained soil and fill-up from the backside to the center. At this point, to prevent any movement, fill with soil and harden on the front.

⑥ After soil is filled up to the 9th back part of the first panel according to the initial design, allow it to harden. (Standard : standard hardening, density : 90 %)

⑦ Grout the fixing bar and center of the panel.

(2) Establishing second panel

① After establishing first panel and fillin the inside and backside, the second panel is established crosswise to the first panel constant based on the hole of the fixing panel bar.

② Lay the panels by filling the inside and the backside with soil and maintain the line form and inclination of the whole retaining wall.

(3) Grouting fixing panel hole

① Use non-contracting grouting materials.

② Use materials among those listed in table 1 according to expert advice.

(4) Backfill and hardening.

① Backfill of retaining wall

If possible use soil from construction site, as shown in table 1.

② Hardening

A small hardening machine should be used to prevent horizontal displacement of the upper part within 1 meter of the whole wall. When large equipment is used, abrupt braking and rotating should be avoided. Effective hardening should include over 90 percent of the wall.

③ Establishment of anchor wires

According to the height of the retaining wall, a wire with a diameter ranging between 13m/m

and 22m/m should be selected and its extending power established to maintain the anchor blocks.

Table 1. Material of Backfill

Size of sieve	Percentage of passing(%)
2 inch(50.0mm)	100 ~ 75
3/4 inch(19.0mm)	100 ~ 75
NO.4	100 ~ 20
NO.40	0 ~ 60
NO.200	0 ~ 35

3. Conclusion

The current study proposed a block method for constructing a retaining wall with the following qualities.

1) Environmentally friendly method of making a retaining wall based on separate blocks.

2) Effective construction through dividing into sections in advance.

3) The gap between retaining walls can be handled, making the wall very safe. If part of the wall does collapse, it can be economically repaired without dismantling the whole wall.

4) When piling up the blocks, the automation and construction expenses can be reduced as only a few workers are required and certain equipment.

5) The front of the wall has a pleasing and environmentally friendly appearance based on painting various colors and shapes harmonized with the natural colors of the separate blocks.

6) The parts required to repair or reinforce the different blocks, the quantity of construction waste, and site pollution are all reduced if connecting blocks are dismantled.

Acknowledgement

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