

KCS 11 80 10 : 2019

# Reinforced Earth Retaining Wall

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KC CODE



# Foreword

- To address needs that were caused by changes in the construction standard code system, the overlaps and conflicts between existing construction standards (design standards, standard specification) were compared and reviewed and then integrated into a new document that can be maintained as a standard code.
- These standards were revised and enacted as standards by integrating the Construction Work Slope Surface Standard Specification and the corresponding parts of the Road Construction Work Specification. Major matters related to the enactment and revision of these standards are as follows.

Construction Standards	Major Contents	Enactment · Revision (Month, Year)
Construction Work Slope Design Standards	• Construction Work Slope Surface Design Standards enacted.	Enactment (May 2006)
Construction Work Slope Design Standards	• Construction Work Slope Surface Design Standards revised.	Revision (Dec 2011)
KCS 11 80 10 : 2016	• Integrated and maintained as a code according to changes in the construction standard code system.	Enactment (June 2016)
KCS 11 80 10 : 2016	• Revised to harmonize Korean Standards with Construction Standards.	Revision (July 2018)



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## 1. General Matters

### 1.1 Scope of Application

- (1) These standards are applied to the materials and construction of block or panel type facings and reinforced earth retaining walls prepared by using metal or geotextile reinforcing materials.

### 1.2 Reference Standards

#### 1.2.1 Related Regulations

Not applicable.

#### 1.2.2 Related Standards

- KCS 44 50 05
- KS F 2306 Test method for water content of soils
- KS F 2311 Test method for soil density by the sand replacement method
- KS F 2312 Test method for soil compaction using a rammer
- KS F 2343 Testing method for direct shear test of soils under consolidated drained conditions
- KS F 2405 Standard test method for compressive strength of concrete
- KS F 2422 Method of obtaining and testing drilled cores and sawed beams of concrete
- KS F 4009 Ready-mixed concrete
- KS F 4416 Concrete blocks for retaining wall and revetment
- KS F 4419 Concrete interlocking block for side walk and road
- KS F 2103 Standard test method for pH of soils

### 1.3 Definitions

Not applicable.

### 1.4 Transportation, Storage, Handling

- (1) The materials shall be transported as stacked layers on a pallet and carefully loaded up and down from a vehicle so as not to damage the materials during transportation, storage, and handling. In addition, the materials shall not be thrown or rolled during construction works, and they shall be transported in small units manually or by using a crane.
- (2) The materials shall be labelled with information including the manufacturers, product names, lot and product numbers, and specifications. Fiber products shall be stored

indoor or covered with a protective covering to protect from UV light as exposure of fiber products to UV may change the product quality.

- (3) The products shall be handled carefully during transportation and construction to avoid damage, and damaged materials shall not be used.
- (4) Concrete panels shall have lifting lugs for their transportation and installation.
- (5) Concrete panels shall be carefully handled to avoid partial breakage, cracking, face damage, and deformation joint pins and connecting materials. Concrete panels shall be stored horizontally by placing wood supports between panels, and the stacking of the panels shall not exceed five layers.

## 2. Materials

### 2.1 Materials

#### 2.1.1 Front Facing

- (1) Materials and manufacturing
  - ① Details about block materials and manufacturing shall be in accordance with the standards specified in Articles 5 and 6 of KS F 4416.
  - ② Panel-type front facings shall satisfy the production standards for the facing product and shall have structural stability.
- (2) The shape and dimension of front facings shall be in accordance with the design drawings.
- (3) Quality
  - ① The average compressive strength of at least three concrete front face block specimens shall be at least 28 MPa by following the test methods specified in KS F 2422 or KS F 2405. The average compressive strength of at least six panel-type front facing specimens shall be at least 30 MPa with reference to 28 days of curing.
  - ② The average water absorption ratio of concrete blocks measured using the absorption ratio test according to KS F 4419 shall be less than 7% and shall not exceed 10%.
  - ③ The shape and dimensions of the concrete blocks shall allow for integration with a reinforced wall. The dimensional errors of concrete blocks in height and depth shall not exceed  $\pm 1.6$  mm and  $\pm 3.2$  mm, respectively. The dimensional errors of the panels shall not exceed  $\pm 5$  mm.

#### 2.1.2 Reinforcing Materials and Joint Parts

- (1) Materials and manufacturing



- ① Geotextile reinforcing materials shall be manufactured using materials that are not deteriorated by the acids, alkalis, and salt existing in the soil and not degraded by microorganisms, and their structure shall not have joints or vulnerable connecting parts.
  - ② Geotextile reinforcing materials shall ensure stability against creep strain particularly in the long-term behavior.
  - ③ Metallic reinforcing materials shall be those that have undergone anti-corrosion treatment and those that can provide reinforcement even after damaged or broken during construction work.
  - ④ All the reinforcing materials shall have the constructability specified by the designer.
  - ⑤ The shape, dimensions, and quality of the detailed types of reinforcing materials shall satisfy the manufacturing specifications prepared to satisfy the design drawings and design conditions.
- (2) The connecting parts shall be the products in the forms specified by the manufacturers of reinforced earth retaining walls or in the design drawings according to the methods of anchoring the front facings with the reinforcing materials. The standards of the connecting part materials and the general quality standards are provided below.
- ① The structure of connecting parts shall be able to increase the strength of connection between a front facing and a reinforcing material and the strength of the connection with the reinforcement shall be more than the long-term tensile strength of the reinforcement.
  - ② Connecting parts shall be made of materials that are not decayed in the soil and that have sufficiently high strength to satisfy the design conditions of the applied reinforcing earth structure, such as metals or high-strength fibrous glass. Metallic materials shall have undergone anti-corrosion treatment and shall be able to provide reinforcement even after damaged or broken during construction work.
  - ③ The horizontal displacement of the joints connecting the blocks or panels with the reinforcing material during joint installation shall be within the values provided in the design drawings.
  - ④ Rubber pads shall be installed between horizontal joints during panel assembly in order to prevent damage caused by direct contact with the concrete.
  - ⑤ A certain width of non-woven fabric shall be installed at joints that are in contact with the earth in order to prevent leakage of the earth between the horizontal and vertical joints of the panels.

### 2.1.3 Backfilling Materials

- (1) Backfilling materials shall be selected by referring to the design drawings and

shall specifications. Unless specified otherwise, the values provided in this current specification shall be referred to.

(2) The general characteristics of backfilling earth are shown below.

- ① The backfilling earth shall have a high frictional effect between the soil and the reinforcing material. The internal frictional angle of the earth measured by the direct shear testing specified in KS F 2343 shall be greater than the value provided by the design drawings.
- ② The backfilling earth shall have sufficient water drainage capability, shall show little change in the strength depending on the water content, and shall have a plasticity index (PI) equal to or less than 6.
- ③ Chemical components which may decrease the durability of the reinforcing materials, shall be minimized in the backfilling earth.
- ④ The general particle size distribution for backfilling earth is shown below.

**Table 2.1-1 Particle size of reinforced earth backfilling soil.**

Sieve opening size (mm) (sieve number)	Passing weight percentage (%)	Notes
102	100	
0.425 (No. 40)	0 ~ 60	
0.075 (No. 200)	0 ~ 15	

- ① Even when the No. 200 passing percentage is over 15 %, a material with a 0.015 mm sieve passing percentage of less than 10 % or a material with a 0.015 mm sieve passing percentage between 10 % and 20 %, an internal friction angle of over 30°, and a PI equal to or less than 6 may be used.
- ② The maximum particle size of the backfilling materials is 102 mm. When a reinforcing material that may be easily damaged during construction work is used, it is appropriate to limit the maximum particle size to below 19 mm or to evaluate the degree of damage during construction.

⑤ The pH shall be between 5 and 10 according to KS F 2103.

⑥ If the reinforced soil mass is under water, the No. 200 sieve passing percentage shall be less than 5%, and a material with high drainage capability shall be used.

(2) Table 2.1-2 shows the general specification of the filling materials for internal block spaces and spaces between blocks.

Table 2.1-2 Particle size standards of block filling materials.

Nominal sieve size	26.5 mm	19 mm	4.75 mm (No.4)	425 $\mu$ m (No.40)	75 $\mu$ m (No.200)
Passing weight percentage (%)	75 ~ 100	50 ~ 75	0 ~ 60	0 ~ 50	0 ~ 5

### 3. Construction

#### 3.1 Verification of Construction Conditions

##### 3.1.1 Preliminary Survey

- (1) Before the construction of a reinforced earth retaining wall, the design conditions, construction position, cross-sectional dimensions, and the conditions of the back face of the retaining wall (including the separation distance from the structure, surcharge, position of underground utilities, and presence of spring water) shall be verified. If the construction work is judged as inappropriate by the design drawings, reinforcing countermeasures shall be taken immediately, and a change of design shall be requested.

##### 3.1.2 Items for Review Before Construction

- (1) Confirmation of bearing capacity of the foundation ground
  - ① Before the construction of a reinforced earth retaining wall, the contractor shall check the bearing capacity and settlement of the ground foundation specified in the design drawings. If the required bearing capacity and settlement may not be obtained after trenching or if the construction is judged as inappropriate by the design drawings, the design shall be changed by immediately implementing countermeasures such as substituting the foundation or changing the foundation type.
- (2) Protection and reinforcing works
  - ① If the design conditions and the retaining wall height specified in the design drawings are not consistent with the site conditions, the gap and the length of the reinforcing materials and the retaining wall height shall be changed according to the site conditions.
  - ② Presence of the slope surface at the top and bottom of the reinforced earth retaining wall shall be checked. If the slope surface behind the retaining wall is poor and has risk of sliding, or where a large amount of spring water is expected,

protection and reinforcing works shall be carried out.

(3) Material selection for backfilling, refilling, and filling

- ① The backfilling materials, refilling materials or filling materials may be the applicable materials among those produced from construction excavation sites. If the materials fail to satisfy the backfilling material specifications, the materials that satisfy the standards for backfilling materials or filling materials may be secured from a borrow pit or the design may be changed (change of the reinforcing materials gap and length, etc.) in accordance with the conditions of the earth available at the construction site. A method that is cost-effective and applicable shall be selected from the options.

(4) Material and product data

- ① The product data, specifications, installation manual, and quality test report provided by the manufacturers shall be reviewed with regard to the facings, reinforcing materials, and connecting part materials.

(5) Construction work plan and drawings

- ① Reinforced earth retaining wall installation plan
  - A. The plan shall be reviewed details about the installation scope of the reinforced earth retaining wall, work schedule, including the work areas, date, and time, construction work order and method, labor and equipment supply plans, and plan for bringing in materials, etc.
- ② Design review report
  - A. If the design drawings are not consistent with the site conditions, the countermeasures, including the modified drawings, calculation sheets, and review comments provided by an executive engineer of the field shall be reviewed.
- ③ Cross-sectional views of each area, including the spatial relationship between the reinforced earth retaining wall and nearby structures as well as the earth work finishing plan for the top of the retaining wall shall be reviewed.
- ④ Drawings (longitudinal section) of the reinforced earth retaining wall considering the topographical features of the installation ground shall be reviewed.
- ⑤ Detailed installation drawings for edges, bending, areas with changing inclination, curves, etc. shall be reviewed.

### 3.2 Work Preparation

Not applicable.

### 3.3 Construction Standards

### 3.3.1 Foundation of Wall Front Face

- (1) The levelling pad on the wall front face is installed to secure the flatness of the front face of a reinforced earth retaining wall. Since the stress is concentrated on the lower part of the wall, the bottom ground shall have a structure securing the stability of bearing capacity and settlement. The levelling pad of a wall front face shall primarily satisfy the standards specified in the design drawings. The general standards are shown below.
- ① When rubble is used, the rubble shall be crushed stones or pebbles that are hard and free of any deterioration, and shall include large and small stones with a diameter of about 50 to 150 mm with an appropriate particle diameter distribution.
  - ② When concrete is used, the concrete shall be the ready-mix concrete specified in KS F 4009 and shall have a strength over 18 MPa. The air volume shall be 4.5 %  $\pm$  1.5 %, the slump 8 cm  $\pm$  2.5 cm, and the maximum coarse aggregate size smaller than 25 mm.

### 3.3.2 Trenching

- (1) Trenching shall be performed in accordance with the cutting specifications in KCS 11 20 10.
- (2) The excavated bottom surface shall be levelled flat. The over-excavated parts shall be compacted to have a density equal to that of the original ground by using the standard embankment materials or the rubbles for the foundation.
- (3) For soft ground or ground with groundwater, countermeasures shall be implemented to secure the necessary bearing capacity, such as substituting the foundation or changing the foundation type.
- (4) Trenching work shall be performed only in workable areas in consideration of the plans for bringing in materials, labor and equipment supply, meteorological conditions, slope surface shape and height, and timing of refilling work. The consequent work shall be carried out after all the trenching works have been completed, including the refilling work.
- (5) The foundation ground of the front wall of the reinforced earth retaining wall shall be inserted to a depth deeper than the minimum insertion depth specified in the design drawings or the freezing depth. The foundation ground shall be longer than the length of the reinforcing material from the facing, and shall be sufficiently compacted to secure the bearing capacity and settlement specified in the design drawings.

### 3.3.3 Foundation Works for Wall Front Face

- (1) The foundation works for a wall front face shall be constructed with rubble or plain

concrete.

- (2) Concrete shall be placed if the front face is a concrete panel, and a good quality of sandy layer shall be placed on a rubble layer if the front face is a concrete block or a pavement. However, if the height is over 10m, concrete shall be used even for a block-type retaining wall. Nevertheless, if deemed necessary by the construction supervisor and a responsible engineer in the field of ground, concrete may be used even for a block-type retaining wall with a height lower than 10m.
- (3) Since the stability and appearance of a reinforced earth retaining wall are significantly dependent on the accuracy of the foundation installation, the top part shall be finished to be horizontally flat to make for perfect contact with the bottom surface of the block.
- (4) When a retaining wall is constructed on a slope surface, the foundation shall be finished as steps by using plain concrete.
- (5) When rubble is used for construction, the foundation shall be sufficiently compacted according to the auxiliary base course compaction standards provided in KCS 44 50 05 (3.2.4) or other corresponding standards.
- (6) When construction is performed using cast-in-situ concrete, the thickness shall be over 150mm, and curing shall exceed more than 12 hours after concrete placement.
- (7) In areas where rigidity drastically changes, such as the slope foundation and one-side cutting and one-side embankment boundary, the construction work shall be carefully carried out for accurate construction. Unless the construction works for these areas are specified in the design drawings, the construction works shall be performed according to the instructions given by the construction supervisor or after being reviewed by an executive engineer.
- (8) The foundation of the front wall of reinforced earth retaining wall facing shall be constructed using the method separately specified in the design drawings with rubble or plain concrete with a compressive strength over 18MPa. However, if the condition of the foundation ground is poor, the reinforced concrete shall be constructed.
- (9) If the foundation ground has an inclination or a level difference, the foundation shall be constructed as steps considering the panel size and assembled shape so that the panels may be installed horizontally.

#### **3.3.4 Batter Board Installation**

- (1) Batter boards shall be installed to verify the perpendicularity (or inclination) and the level of the front face of the retaining wall, and shall be inspected by the construction supervisor. The leading string shall be installed to be tight in order to maintain the level.
- (2) The standard installation gap of batter boards is 10m. However, the batter boards shall

be installed at the any starting points, end points, and points where the planes and cross-sections change.

### 3.3.5 Facing Installation

- (1) The first layer of a facing shall be precisely installed in line with the leading string to maintain the linearity and parallelism of the front face. The front face of the block shall be anchored using steel reinforcements or others in order to prevent the sliding of the block due to refilling or banking works.
- (2) When an upper layer is installed, the top of the lower layer shall be completely cleaned, and the upper layer shall be firmly anchored using the specified anchoring method. During embankment work, the inclination and level of the front face of the retaining wall shall be checked frequently.
- (3) Facings shall be stacked into layers. Block filling and backfilling shall be performed for each layer before stacking the next layer.
- (4) When a convex or concave curve need shall be formed, a detailed construction drawing shall be prepared before starting the construction work to obtain the approval of the radius of rotation at the curve and the banking method. Reinforcing methods shall be considered for convex or concave curves where stress is concentrated.
- (5) The top part of the retaining wall shall be completely anchored to the top surface of the immediately lower layer using an approved cohesive or mortar.
- (6) Concrete panels are installed to maintain the perpendicularity (or inclination) using a small crane or a back hoe. In backfilling work, an inclination of about 1 % ~ 3 % may be placed on the side of the back face in consideration of wall deformation.
- (7) When a panel is installed on another panel, connecting pins shall be inserted to the grooves at both ends to join the upper and lower panels together. The panel shall be accurately adjusted according to the lines and vertical positions, and shall be anchored to the adjacent panel using a clamp. The backfilling work of the existing panel shall be completely compacted up to the top of the panel before starting the installation of the next panel.
- (8) When the next panel is installed, the top of the lower block shall be cleaned completely by removing impurities, and the level and verticality of the block shall be verified.
- (9) After the final block is installed, the impurities on the top shall be removed, and the covering block shall be anchored using an adhesive.
- (10) Connecting pins shall be installed at each block to join the upper and lower panels together. If the block has a hollow structure, the inside of the block shall be filled with a water-draining material with a maximum particle size of 25 mm.

- (11) At the interface of the structure, geosynthetic filters shall be installed to prevent loss of backfill materials between the backfill of the facing and the structure, and filled with filling materials between the facing and the structure. The front of the interface of the structure shall be finished with a sealant or an L-type guide attached to the structure.

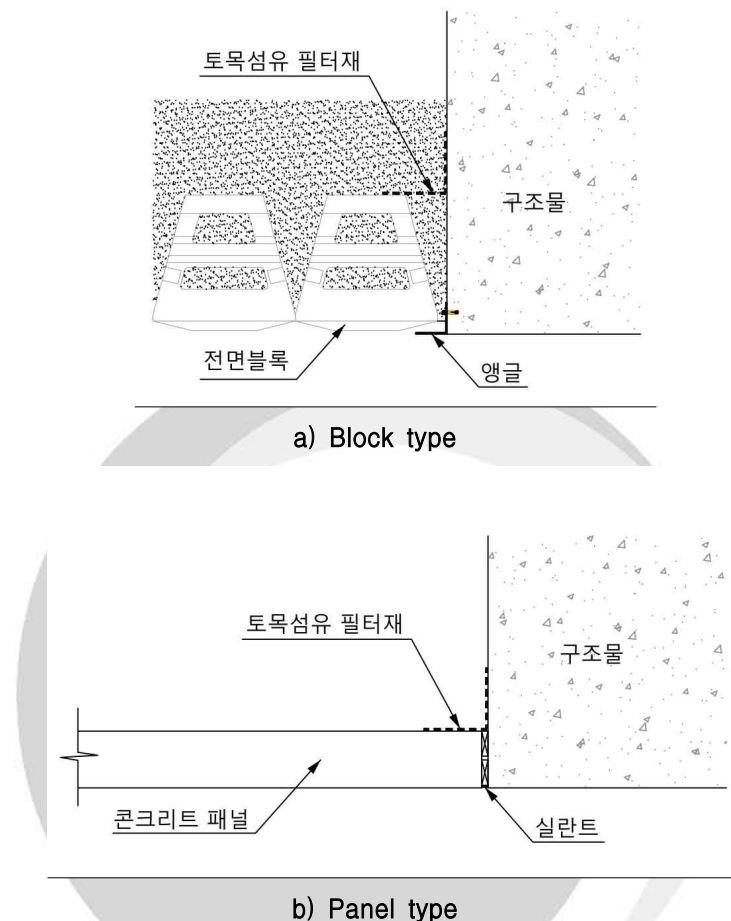


Figure 3.3-1 Example of treatment of structure connection

### 3.3.6 Backfilling Work Compaction and Block Filling

#### (1) Backfilling compaction

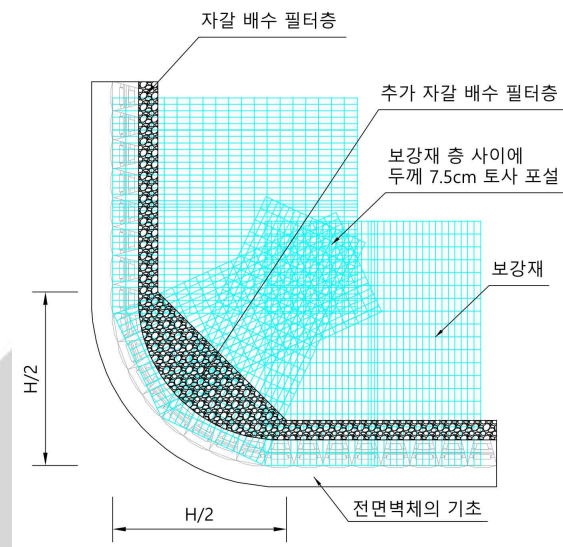
For a reinforced earth retaining wall, compaction of the embanking material decreases the relative movement of the soil in the embankment work and makes an important contribution to the durability of the soil structure. Therefore, compaction shall be performed uniformly to satisfy the design standards.

- ① The construction thickness of a single layer of backfill shall be determined as the height of one layer of the block, and shall not exceed 20~30 mm or cause any problems in securing stability.
- ② The material shall be placed from the facing side in parallel with the facing in order to prevent the flexural bending of the facing. Placement on the top of a reinforcing

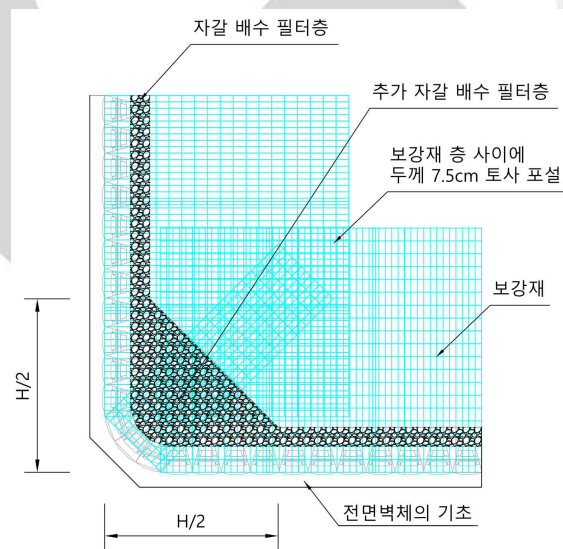


material shall be performed carefully not to cause movement of or damage to the reinforcing material.

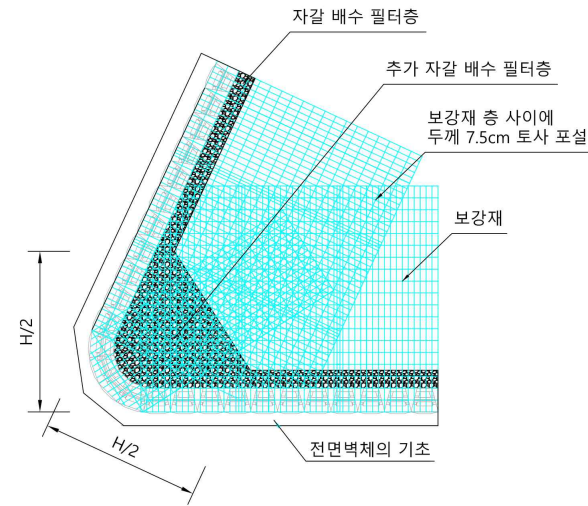
- ③ Since it is difficult to compact in corners and curves with a intersection angle of less than  $120^\circ$ , the width of the gravel drain/filter layer behind the block shall be extended to one-half the height of the retaining wall as shown in Figure 3.3-1.



a) At smooth angles



b) At right angles



c) At acute angles

Figure 3.3-2 Width extension of gravel drain/filter layer on corners and curves

- ④ Placement and leveling shall be performed manually within 1.0 m from the facing in the case of a block-type reinforced earth retaining wall, and within 1.5 m from the facing in the case of a panel-type reinforced earth retaining wall. Compaction shall be performed using a small vibration compacting machine.
- ⑤ The compacting machine shall be operated in the direction parallel to the facing. The density after compaction shall be over 95% of the maximum dry density (methods D and E).
- ⑥ A compaction machine with tires shall run at a speed below 20 km. Sudden braking or rotation shall be avoided during compaction work.
- ⑦ In the compaction of the side where reinforcing material is installed, the compaction machine shall not be directly applied on the reinforcing material, while an appropriate thickness of backfilling material has to be deployed prior to any compaction practices shall.
- ⑧ The placement and compaction of the backfilling material shall be carefully performed so as not to deform the structure. If deformation of the facing is found, all construction works shall be halted immediately, and re-construction shall be performed after modifying the structure.
- ⑨ The front and rear surfaces of the bottom (reinforcing wall insertion part) of the facing shall be backfilled as soon as possible to prevent scouring caused by rainwater, etc.
- ⑩ Placement and compaction of the backfilling material shall be performed only when the air temperature exceeds 1.5°C. In the cases of rainfall or snowfall during construction works, the construction work shall be immediately halted, and the work

surfaces shall be covered with a polyethylene covering or other covering to prevent the infiltration of rain water. The work shall not be resumed until the site and soil conditions are suitable for compaction. If it is deemed that the saturation of the reinforced soil will increase significantly due to water generated from the ground, the installation of waterproofing paper shall be considered.

(2) Compaction of refilling materials

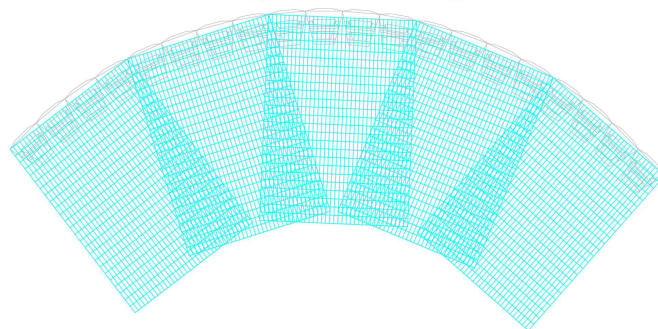
- ① Since the re-filled section between the reinforced materials and the ground is affected by the groundwater and rainfall, and is related to ensuring the overall stability of the reinforced earth retaining wall, the required compaction specified in the design shall be secured and drainage functions shall be sufficiently secured to prevent the effect of water on the reinforced soil.

(3) Block filling

Once one layer of block is stacked, the inside of the block and the space between the blocks shall be tightly filled with the specified filling material.

### 3.3.7 Reinforcement Material Installation

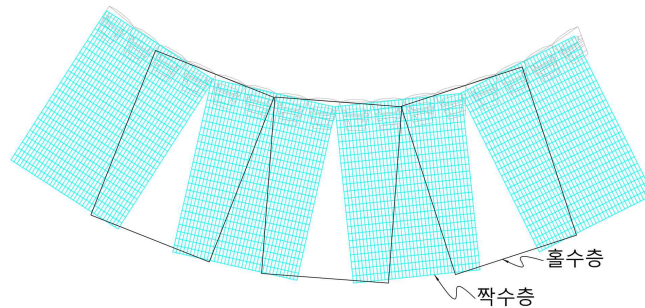
- (1) The entire surface on which a reinforcing material is to be installed shall be kept clean by removing any dents, loose stones, or tree roots. The evenness of the bottom surface shall be measured by applying a straightedge (over about 3 m) onto the bottom, or maintained by employing a separate method.
- (2) The reinforcing material shall be installed to be perpendicular to the facing, and shall have the height and length specified in the design drawings.
- ① When using front-spreading reinforcing materials such as geogrid and geotextile, the area where overlap of the reinforcing materials occurs on the convex curve shall be filled with at least 7.5 cm of backfill soils between the reinforcing materials so that the friction between the reinforcing material and the soil does not deteriorate.



**Figure 3.3-3 Example of installing reinforcing material on a convex curve**

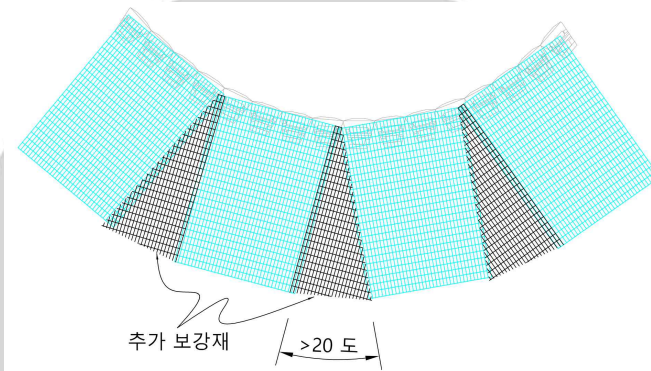
- ② When front-spreading reinforcing materials such as geogrid and geotextile are installed at concave curves, non-reinforced parts in the shape of  $\triangle$  shall be filled

during the following construction layer of reinforcing materials.



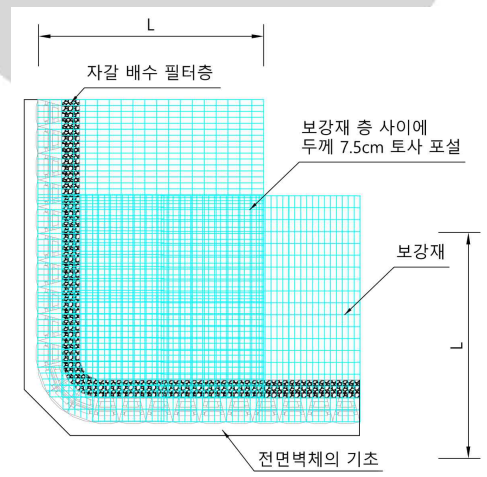
**Figure 3.3-4 Example of installing reinforcing materials on a concave curve**

- ③ When using front-spreading reinforcing materials such as geogrid and geotextile, additional reinforcement shall be placed in areas with an angle of  $20^\circ$  or greater where the reinforcing material is not to be laid on the concave curves.

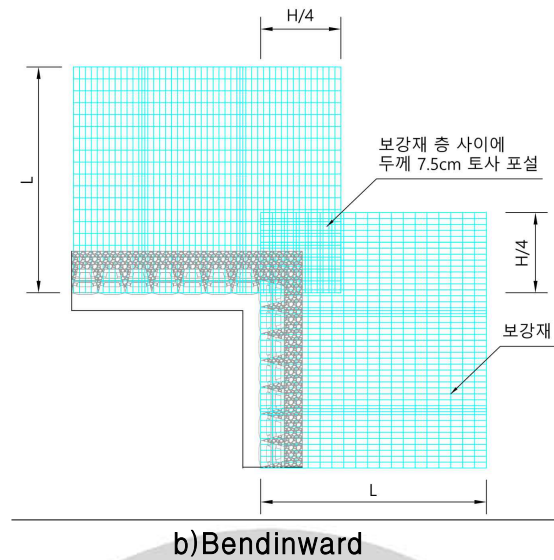


**Figure 3.3-5 Examples of additional reinforcing materials**

- (3) At corners and curves close to right angles, the main reinforcement directions of even and odd layers shall be arranged alternately.



**a) Bend outward**



**Figure 3.3-6 Example of reinforcing material installation at curves**

- (4) The reinforcing material shall be installed as tightly as possible by stretching it to the maximum, and shall not be moved by the placement and compaction of the backfilling material. A band-type fiber reinforcing material shall be firmly anchored on the bottom using an anchoring pin at the end. Unless otherwise specified in the design drawings, the gap between anchoring pins shall be the same as the width of the reinforcing material or shall not be less than 1.5 m.
- (5) When a reinforcing material shall be installed under the original ground line, cutting shall be performed to 0.2 m under the height of the reinforcing material installation, and then the backfilling material shall be placed and compacted. After that, the reinforcing material may be installed.
- (6) Connection in the direction to which the load of a reinforcing material is applied shall be mostly avoided. If reinforcing materials have to be connected unavoidably, the method of connection shall be approved by the construction supervisor before the start of the construction work.
- (7) In the connection for width direction of front-spreading reinforcing materials such as geogrid and geotextile, the overlapping width shall be larger than that specified in the design drawings in consideration of movement during construction work. In particular, the overlapping width shall be maintained at the facing or the anchored ends.
- (8) Since the fiber reinforcing materials manufactured by combustible materials are very vulnerable to fire and heat, nearby inflammables and any potential causes of fire shall be removed before the construction work.
- (9) If there is a risk of fire near to a retaining wall under service, a fiber reinforcing material shall not be used in principle. If the use of a fiber reinforcing material is



unavoidable, a fire and heat prevention facility shall be installed in front of the reinforced earth retaining wall, such as a block protection film, to prevent flames directly reaching the fiber reinforcing material.

### 3.3.8 Weep Hole

- (1) A reinforced earth retaining wall is a structure that is supported by the frictional resistance between the reinforcing materials and the backfilling soil, and flowing water may reduce the strength and cause failure of the structure. Therefore, in cases where this problem is anticipated, although not specified in the design drawings, weep holes shall be installed inside and outside the reinforced soil mass by modifying the design in consultation with the construction supervisor.

### 3.4 Allowable Construction Errors

Not applicable.

### 3.5 Repair and Re-construction

Not applicable.

### 3.6 Site Quality Management

- (1) Various tests for quality management shall be implemented in the presence of the construction supervisor. In cases where the specified requirements are not satisfied, modifications shall be made immediately.
- (2) Compaction test is performed using Method D or E of KS F 2312 each time the backfilling material is changed. The result of the compaction test is used as the reference density for measuring the compactness of the construction site.
- (3) The water content test is performed in accordance with KS F 2306 or by using a rapid water content measurement equipment. The test shall be performed after reinforced earth placement and before compaction at a frequency determined by the quantity specified in the design drawings. If the test result shows that the water content is low, water shall be additionally sprayed. If the water content is too high, spadework shall be performed to secure the optimal water content before compaction.
- (4) The in-situ density test shall be performed in accordance with KS F 2311 at a frequency determined by the quantity specified in the design drawings. The test is performed at the positions 1m behind the facing and 1m before the end of the reinforcing material.
- (5) The slope surface protection work on the top of a retaining wall or the drainage work for the treatment of runoff water related to the construction of a reinforced earth

retaining wall shall be completed as soon as possible to avoid any problems with the stability of the retaining wall structure. The works shall never been neglected to ensure prevention of any damage to the reinforced earth retaining wall.

- (6) Although a reinforced earth retaining wall is a structure that allows for a measure of displacement, it shall be constructed within the allowable displacement error specified in the design drawings in consideration of the stability of the structure as well as instability due to excessive front displacement.
- (7) All works performed near to a reinforced earth retaining wall shall be performed within a range that does not damage the structural stability of the retaining wall. Neither an overload or impulse load exceeding the design standards nor any actions that may decrease the friction between the backfilling material and the reinforcing material shall be allowed.

