

KCS 11 75 25 : 2019

Debris Flow Prevention Facility

December 06, 2019

<http://www.kcsc.re.kr>

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 standard, 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 River Construction Standard Specification, Road Construction Standard Specification, and Construction Environment Management Standard Specification. Major matters related to the enactment and revision of these standards are as follows:

Construction Standard	Major Contents	Enactment · Revision (Month, Year)
Construction Work Slope Surface Standard Specification	• Construction Work Slope Surface Design Standards enacted.	Enactment (May 2006)
Construction Work Slope Surface Standard Specification	• Construction Work Slope Surface Design Standards revised.	Revision (Dec 2011)
KCS 11 75 25 : 2016	• Integrated and maintained as a code according to changes in the construction standard code system.	Enactment (June 2016)
KCS 11 75 25 : 2016	• Revised to harmonize Korean Standards with Construction Standards.	Revision (July 2018)



Table of Contents

1. General Matters	1
1.1 Scope of Application	1
1.2 Reference Standards	1
1.3 Supplied Materials	1
1.4 Definitions	1
1.5 System Description	1
1.6 Allowable System Error	1
1.7 Deliverables	2
1.7.1 Construction Plan	2
2. Materials	2
2.1 Materials	2
2.1.1 Concrete	2
2.1.2 Steel Materials	2
2.1.3 Wire Rope	2
2.1.4 Other Materials	2
2.2 Components	2
2.3 Equipment	2
2.4 Accessory Materials	3
2.5 Mixing	3
2.6 Assembly	3
2.7 Finishing	3
2.8 Allowable Assembly Error	3
2.9 Material Quality Management	3
2.9.1 Concrete	3
2.9.2 Steel Materials	3
3. Construction	3

3.1 Verification of Construction Conditions	3
3.1.1 Items for Review Before Construction	3
3.2 Work Preparation	4
3.3 Construction Standards	5
3.3.1 General Matters of Construction	5
3.3.2 Valley Protection Work	5
3.3.3 Debris Flow Blocking Facility	6
3.4 Allowable Construction Error	9
3.5 Repair and Reconstruction	9
3.6 Site Quality Management	9



1. General Matters

1.1 Scope of Application

- (1) These standards are applied to the construction of facilities to prevent or reduce the damage to structures by debris flows.

1.2 Reference Standard

- KCS 14 20 10 General concrete
- KS B 1344 Wire clips for wire strand or wire rope
- KS D 3503 Rolled steels for general structure
- KS D 3515 Rolled steels for welded structure
- KS D 3566 Carbon steel tubes for general structural purposes
- KS F 4009 Ready-mixed concrete
- KS F 4603 Steel H piles
- KS F 4602 Steel pipe piles
- KS D 3514 Wire ropes
- KS L 5105 Testing method for compressive strength of hydraulic cement mortar
- KS D 0201 Testing methods for hot-dipped zinc coating
- KS B 1002 Hexagon head bolts and hexagon head screws
- KS B 1012 Hexagon nuts and hexagon thin nuts
- KS D 3702 Stainless steel wire rods

1.3 Supplied Materials

Not applicable.

1.4 Definitions

Not applicable.

1.5 System Description

Not applicable.

1.6 Allowable System Error

Not applicable.

1.7 Deliverables

1.7.1 Construction Plan

- (1) A construction plan shall be prepared and submitted in accordance with the construction work schedule.
- (2) The construction plan shall include general details about the construction works, including the construction location, construction schedule, sequence and method of construction, construction equipment, temporary facilities, and specifications and plans for bringing materials to be used.

2. Materials

2.1 Materials

2.1.1 Concrete

- (1) The concrete used for the main body of the prevention facility shall satisfy the conditions provided in KS F 4009, and shall have a strength equal to or higher than the strength required by the design.

2.1.2 Steel Materials

- (1) The steel materials used for the main body of the prevention facility shall be those specified in KS D 3503, KS D 3515, KS D 3566, KS F 4602, and KS F 4603.
- (2) If necessary, the steel materials used in the main body shall be treated by non-corrosion materials.

2.1.3 Wire Rope

- (1) The wire rope shall have performance equal to or higher than that specified in KS D 3514.

2.1.4 Other Materials

- (1) For the materials not specified in the current standards, only those of which performance and quality have been verified shall be used after obtaining approval from the construction supervisor.

2.2 Components

Not applicable.

2.3 Equipment

Not applicable.

2.4 Accessory Materials

Not applicable.

2.5 Mixing

Not applicable.

2.6 Assembly

Not applicable.

2.7 Finishing

Not applicable.

2.8 Allowable Assembly Error

Not applicable.

2.9 Material Quality Management

2.9.1 Concrete

- (1) The concrete quality management shall be performed in accordance with KDS 14 20 10.
- (2) The strength test of concrete shall be performed in accordance with KS L 5105.

2.9.2 Steel Materials

- (1) For the quality management of steel materials, appearance inspection, dimension inspection, and testing of zinc-plating attachment quantity shall be performed for verification.
- (2) The testing of the zinc-plating attachment quantity shall be performed using the antimony trichloride method (indirect method) specified in KS D 0201. For plate-type members, an instrument for measuring the coating thickness shall be used.

3. Construction

3.1 Verification of Construction Conditions

3.1.1 Items for Review Before Construction

- (1) The contractor shall prepare a construction plan before starting the construction works.

The following items shall be sufficiently investigated to understand all the conditions of the construction site for the preparation of the construction plan.

① Topographic Survey

- A. The topographic survey shall be based on the topographic drawings or the design floor plans used for the design, and include the information about the flow rate of rivers, water level, exposed rock beds, collapsed areas, and boulders.
- B. The scope of survey includes temporary facilities and drilling lines. In particular, when the stability of the drilling surface and the slope needs to be reviewed, the scope of the survey shall be extended to the necessary areas.

② Geological Survey

- A. Necessary geological surveys shall be performed after obtaining approval from the construction supervisor, including the survey for determining the construction conditions, for predicting the possibility of collapse during construction works, and for deciding on the appropriateness of the construction in consideration of the conditions of the foundation excavation rock surface.

③ Meteorological Survey

- A. Meteorological conditions are the most important factors to the planning and implementing of construction works. Necessary surveys shall be performed with respect to the precipitation, monthly number of days with precipitation, rainy season, snowy season, and air temperature to estimate the number of days allowing construction works and to prepare the flowing water conversion plan and the safe construction work schedule.

④ Aggregate Survey

- A. Sources of aggregates shall be the areas where aggregates satisfying the quality requirements shall be obtained in a sufficient quantity.

⑤ Other Surveys

- A. A preliminary survey shall be performed for temporary construction works and material transportation before the main construction works depending on the conditions of the construction site.
- B. Other surveys include the investigation and survey of the land required for the construction. Considering the recent environmental issues, an environmental survey shall be performed, if necessary.

3.2 Work Preparation

Not applicable.

3.3 Construction Standards

3.3.1 General Matters of Construction

- (1) The specific installation locations and ranges of the prevention facilities shall be reviewed in consideration of the site conditions and consulted with the construction supervisor before the starting of the construction works.
- (2) The construction work site shall occupy the minimum area required for the construction, minimizing the damage to the existing ground or surrounding environment. However, trees and others shall be removed through the consultation with the construction supervisor in advance, if they may fall due to torrential rain and strong wind to disturb the flow of water in the valley or to cause landslides through the erosion and scour of the surrounding areas.
- (3) If not specified, a prevention facility shall be supported by a bedrock.
- (4) The excavation shall be performed in the depth, width, and inclination not affecting the building of the prevention facility. The floor surface shall be compacted to be flat or shall be made flat using lean concrete.
- (5) For the excavation, the existing water channel shall be transferred to prevent pooling of water on the cutting surface.

3.3.2 Valley Protection Work

- (1) Valley protection work is a construction method for preventing the erosion and scour of the bottom and sides of the valley by reducing the inclination of steep slope by making several steps. Valley protection work is carried out as specified below.
 - ① The uneven ground surface around the construction site is leveled off.
 - ② The foundation of the valley protection work shall be sufficiently inserted into the ground in order to not be exposed by the scouring during a flood.
 - ③ In the stacking of stone materials or blocks, they shall be completely attached to the concrete.
 - ④ In the stacking of stone materials or blocks, they shall be stacked alternately between upper and lower layers, and the final stacking layer shall have a constant height.
 - ⑤ In the stacking of stone materials or blocks, applying impact to the existing layer shall be avoided so as not to loosen the stacking layers.
 - ⑥ After the completion of the construction work, the surrounding ground shall be leveled off to stabilize the surface soil. If necessary, stabilization works shall be performed by pitching stones or the vegetation on the ground surface.

3.3.3 Debris Flow Blocking Facility

(1) Concrete Debris Flow Barrier

- ① The excavation shall be performed in the depth, width, and inclination specified in the design drawings, and the bottom shall be compacted to be flat. Then, the construction may be performed after obtaining approval from the construction supervisor.
- ② The subsequent process shall be rapidly carried out to avoid weathering of the exposed trenching surface.
- ③ For the excavation of the key, the excavation shall be performed as vertically as possible to minimize disturbance to the surrounding ground.
- ④ In the presence of groundwater, a diversion channel shall be installed to sufficiently degrade the groundwater level for the excavation.
- ⑤ If the trenching surface is not even, lean concrete shall be horizontally placed for the construction of the main body.
- ⑥ An installation drawing of concrete form shall be prepared in accordance with the shape of the retaining walls and shall be approved by the construction supervisor. When a design form is used, thickness of the retaining wall shall not be reduced due to the design.
- ⑦ Finishing of the concrete surface shall be performed using a plywood form to make the surface smooth. Chamfer strips of 50 mm × 50 mm shall be installed to prevent damage to the edges.
- ⑧ The retaining walls shall be constructed to secure the covers for steel reinforcement.
- ⑨ The drainage holes installed on the main body of the barrier shall be prepared as specified in the design drawings.
- ⑩ Wire nets or drainage materials shall be anchored on the back of the barrier to prevent clogging of the drainage holes.
- ⑪ The quality of the concrete shall be managed as follows.
 - A. The concrete materials shall always be tested during construction work to manage the quality.
 - B. The machines and apparatuses used for the concrete construction works shall be tested on a regular basis to maintain the required concrete quality.
 - C. Specified concrete tests shall be performed for quality management and quality inspection.

(2) Stone Concrete Dam

- ① The contractor shall sufficiently compact the stone concrete for complete attachment

between stones and concrete. The following rules shall be followed.

- A. The stones shall be placed on the transported concrete and sufficiently compacted to completely attached to the concrete.
- B. The stones shall be arranged alternately with each other. The mixing ratio of the specified stone materials shall be kept constant while the concrete is placed.
- C. In the arrangement of the stone materials, $\frac{2}{3}$ of the height of the stone materials shall be buried into the concrete, and $\frac{1}{3}$ shall be exposed. The stones shall be placed sequentially.
- D. During concrete placement, the concrete shall be carefully placed so as not to impact the existing stone materials buried into the concrete, thus loosening the attachment.

(2) Steel Debris Flow Barrier

- ① A steel debris flow barrier shall be installed in accordance with the design drawings. After the final finishing works, the end-part height of the steel and the connecting points shall be at the right positions.
- ② The steel shall be carefully handled and constructed to avoid deterioration of the plating or painting works caused by impact to the steel materials.
- ③ When steel pillars are buried into the ground, auger boring, drilling, and pile-driving shall be performed in the inclination specified in the design drawings.
- ④ When steel is buried into the concrete, installation holes shall be installed or steel materials shall be installed before placing the concrete.
- ⑤ The depth of the steel burial shall be as specified in the design drawings.
- ⑥ The bolts and nuts used for the connecting or anchoring of the steel shall satisfy KS B 1002, KS B 1012, and KS D 3702. All bolts and nuts shall be zinc-plated products.
- ⑦ When stones with a small diameter are mixed, a steel net of fine meshes shall be attached to the front of the steel frame or stones with a large diameter shall be filled on the external of the steel frame.
- ⑧ When a heavy machine is used to fill the inside of the steel frame with gravel, boulders, and broken stones, impact shall not be caused to the steel frame by the heavy machine.
- ⑨ Construction work shall not climb up to the steel frame during backfilling and compaction works.

(4) Debris Flow Capture Net

- ① A debris flow capture net consists of a capturing net, a joint supporting rope, and an anchor.
- ② The anchor for anchoring the supporting rope shall be marked at the anchor

installation point, and shall be installed according to the position, direction, and length specified in the design drawings.

- ③ The anchor shall be installed on solid ground that has the required pullout resistant strength.
- ④ The wire clips specified in KS B 1344 shall be used to anchor the supporting rope. The type, number, and screwing torque, and the installation interval of the wire clips shall be determined depending on the tensile strength of the applied supporting rope.
- ⑤ The capturing net shall be installed in the form of a curtain, and anchored to the supporting rope using a connecting material.
- ⑥ Capturing nets shall be connected or jointed using a connecting material with tensile strength equal to or higher than that of the nets.

(5) Water Channel Reinforcement Facility

- ① The scope of water channel reinforcement covers the length and heights specified in the design drawings and includes areas where collision of flowing water is expected according to the site conditions.
- ② The depth of inserting the water channel reinforcement units to the foundation shall be a depth that may sufficiently prevent the scouring of the bottom of the foundation in consideration of the valley inclination, the slope inclination of existing water courses, and the site conditions.
- ③ Water channel reinforcement works shall be installed in accordance with the slope inclination of the existing water channels or to expand the width or increase the inclination of the water channels.
- ④ At both ends of the reinforcement section, reinforcement works shall be performed on the inside of the slope surface of the existing water channels to prevent scouring or erosion due to collision of flowing water.
- ⑤ Stone materials or blocks shall be completely attached to the concrete for stacking.
- ⑥ In the stacking of stone materials or blocks, they shall be stacked alternately between upper and lower layers, and the final stacking layer shall have a constant height.
- ⑦ In the stacking of stone materials or blocks, applying impact to the existing layer shall be avoided so as not to loosen the stacking layers.

(6) Sedimentation Facility and Flow-Inducing Facility

- ① A sedimentation facility, in accordance with the site conditions, shall be formed as a shallow cistern by excavation or inclination of about 4° shall be formed within the sedimentation site.
- ② A flow-inducing facility shall be built as a soil bank, and water channel

reinforcement works shall be performed on the surface of water flow collision.

- ③ The scope of installing flow-inducing facilities shall be determined in consideration of water flow directions during floods and the surrounding conditions so as not to disturb the water flow.
 - ④ The height of the soil bank shall be about 1.0 m higher than that of the superelevation.
- (7) A measuring instrument shall be installed around the debris flow prevention facilities in the areas where the possibility of debris flow is high according to the decisions made by the construction supervisor or a responsible engineering in the field of ground in order to recognize in advance the occurrence of debris flows.
- (8) A construction method that is not mentioned in the current standards shall be applied after obtaining approval from the construction supervisor.

3.4 Allowable Construction Error

Not applicable.

3.5 Repair and Reconstruction

Not applicable.

3.6 Site Quality Management

- (1) A plate bearing test shall be performed on the foundation ground to examine if the bearing capacity required by the design is secured. However, for bed rocks whose bearing capacity is higher than that of soft rock does not require the implementation of the tests for verifying the supporting force.