

KCS 11 30 15 : 2019

Horizontal Drain Works

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Foreword

- This standard was organized and integrated as the code by comparing and reviewing duplicate or contradictory content within the existing construction standards (design standards, standard specifications) due to the transition of the construction standards code system.
- This standard is established by integrating and organizing the parts that are related to horizontal drain work in existing Road Construction Standard Specifications, Expressway Construction Guide Specification, and Harbor and Fishing Ports Construction Standard Specifications. The history of the standards are as follows:

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Construction standards	Main contents	Establishment or revision (Month Year)
Road Construction Standard Specification	· Established by the Korean Society of Civil Engineers commissioned by the Ministry of Construction	Establishment (Dec. 1967)
Road Construction Standard Specifications	· The specifications were improved and revised to become general specifications of overall road work by reviewing the related existing specifications and guidelines that were used and being developed.	Revision (Dec. 1985)
Road Construction Standard Specifications	· The specifications were improved and revised to be better specifications by advancing and complying with the currently used specifications and guidelines, along with the introduction of new theories.	Revision (May 1990)
Road Construction Standard Specifications	· The specifications were revised to enhance the international competitiveness and to promote quality improvements of road works by reorganizing the system to cope with the openness of the construction market as a result of the launch of the World Trade Organization (WTO).	Revision (July 1996)

Construction standards	Main contents	Establishment or revision (Month Year)
Road Construction Standard Specifications	<ul style="list-style-type: none"> The specifications were re-organized to establish a system of national standards and to reflect the revision of contents and other standards, such as the Korean Industrial Standard (KS) and the Standard Specification of Concrete according to the Construction Standard Organization Guideline, and to improved and revise standards to address the problems. 	Revision (Nov. 2003)
Road Construction Standard Specifications	<ul style="list-style-type: none"> The specifications were revised to improve the problems produced during the road construction and to induce reliable constructions through consistency with other standards such as the KS, Standard Specification of Concretes , and Standard Specifications of Tunnels, ensuring the prevention of shoddy and faulty construction thorough quality control. 	Revision (Mar. 2009)
Road Construction Standard Specifications	<ul style="list-style-type: none"> The specifications were revised to reflect the recommendations from the Central Construction Technology Deliberation Committee and changed the standard specifications, specialized specifications, and design drawings. 	Revision (Sep. 2015)
Road Construction Standard Specifications	<ul style="list-style-type: none"> Partial revision, including overview, forest and tree protection materials, and general construction works. 	Revision (May 2016)
Standards Specifications of Harbor Construction	<ul style="list-style-type: none"> Establishment of the Standards Specifications for Harbor Construction 	Establishment (Dec. 1976)
Standards Specifications of Harbor Construction	<ul style="list-style-type: none"> Revision of the Standards Specifications for Harbor Construction 	Revision (Dec. 1977)
Standards Specifications of Harbor Construction	<ul style="list-style-type: none"> The specifications added various design conditions for harbor construction, and included general policies and standards of designs in relation to harbor facilities, counter facilities, and other facilities for harbor construction. 	Revision (Dec. 1986)
Standards Specifications of Harbor Construction	<ul style="list-style-type: none"> The standards were significantly revised to provide a basis to apply the re-estimation of deep-sea waves, the estimation of wind speeds, and load coefficient to improve the safety of harbor facility and equipment, including coastal maintenance facilities. 	Revision (Dec. 1996)
Standard Specifications of Harbor and Fishing Port Construction	<ul style="list-style-type: none"> The standards were completely revised to include preemptive countermeasure against climate changes and to reflect the changing port construction conditions. 	Revision (Nov. 2005)

Construction standards	Main contents	Establishment or revision (Month Year)
Standard Specifications of Harbor and Fishing Port Construction	· The specifications were significantly revised to reflect the modified contents in the upper technical standards and other fields standards, improving related specifications, such as mass concrete and cap concrete and other related specifications such as filter mats, ships, quay walls, and other attached facilities, and added specifications concerning marina facilities.	Revision (Dec. 2012)
KCS 11 30 05 : 2016	· Integrated and organized the code system due to the transition to the code system of construction standards.	Establishment (Jun. 2016)
KCS 11 30 05 : 2016	· Modified to satisfy the Korean Industrial Standards and Construction Standards.	Modification (Jul. 2018)



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- ⑤ Vertical perpendicular
- ⑥ Effective hole size (In case of separation purpose)

1.3 Reference

1.3.1 Related laws and regulations

No contents.

1.3.2 Related standards

(1) Horizontal

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(2) Geotextile

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- KS K ISO 9864 Geosynthetics – Test method of mass measurement per unit area of geotextile and related products
- KS K ISO 10319 Geosynthetics – Wide width tensile strength test
- KS K ISO 10320 Geotextile and related products – Site verification
- KS K ISO 10321 Geosynthetics – Joint / Seam strength tests: Wide-width tensile test method
- KS K ISO 11058 Geotextile and related products – Measurement of vertical permeability

- KS K ISO 12236 Geosynthetics – Static puncture test(CBR test)
- KS K ISO 12956 Geotextile and related products – Measurement of effective hole size
- KS K ISO 12958 Geotextile and related products – Measurement of horizontal permeability
- KS K ISO 13427 Geotextile and related products – Simulation of wear-out damage (sliding block test)
- KS K ISO 13431 Geotextile and related products – Test method of tensile creep

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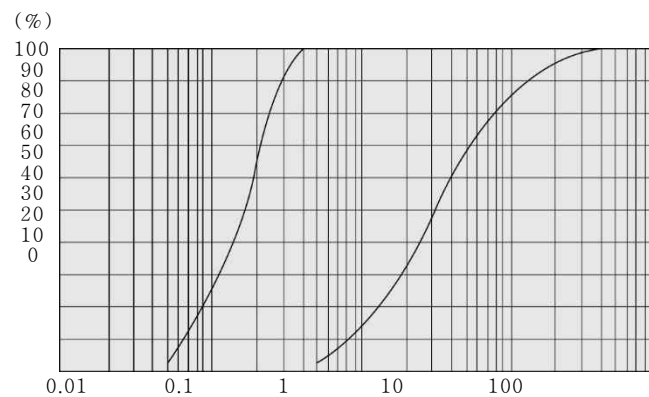
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- (5) If the tests conducted on the materials that are used for the construction of the drainage system shall be conducted taking into consideration degradation and permeability due to compaction.
- (6) The tests shall be conducted at the start of the construction to obtain the ground strength tests and permeability tests shall be conducted taking into consideration degradation and permeability due to compaction.

2.2 Laying material of geotextile mat

- (1) The geotextile mat shall be a product made of synthetic or natural fiber whose elasticity and durability are good.
- (2) The geotextile mat applied to site shall be selected for its suitability in consideration of the purpose, design conditions, and construction environment. The quality standards

and test specifications by purpose of geotextile mat for reinforcement are as follows:

Table 2.2-1 Quality standards of geotextile

Testing item	Purpose of geotextile	
	For improvement of bearing capacity via ground reinforcement (slip prevention)	For drainage and layer separation
Maximum tensile strain rate	Less than 30%	-

Tensile

Vertical permeability coefficient	
Seam	
Note 1) adjusted	

- (3) If geotextile strength is less than 10% of tensile strength, it is not used for reinforcement.
- (4) The geotextile is used for drainage and layer separation.
- (5) The geotextile is used for reinforcement.
- Table

Table 2.2-1 Quality standards of geotextile

Type	Test item	Test method	Test frequency (Measurement frequency)
Geotextile (soft ground mat)	Tensile strength	KS K ISO 10319	Every 20,000m ³ , according to manufacturer, according to product specifications
	Tensile strain rate		
	Vertical permeability coefficient	KS K ISO 11058	
	Seam strength	KS K ISO 10321	

- (1) Before the superstructure is constructed, the drainage layer shall be laid to satisfy both of the required thicknesses: one calculated by the cone bearing capacity of surface course, and the other calculated by the hydraulic gradient difference, which is required to determine the minimum drainage cross-section. There should be no disconnected sections due to non-uniform ground.
- (2) To lay the drainage layer, the stability of the construction equipment shall be ensured by adjusting the thickness of the horizontal drain layer or performing soil reinforcement.
- (3) Much attention shall be paid to the drainage layer construction according to the design requirements.
- (4) When the drainage layer is laid, the stability of the construction equipment shall be ensured by adjusting the thickness of the horizontal drain layer or performing soil reinforcement.
- (5) The horizontal drain layer shall be evenly laid to satisfy both of the required thicknesses: one calculated by the cone bearing capacity of surface course, and the other calculated by the hydraulic gradient difference, which is required to determine the minimum drainage cross-section. There should be no disconnected sections due to non-uniform ground.
- (6) If problems arise after investigating in the stability by construction equipment once the horizontal drain layer is laid, the stability of the construction equipment shall be ensured by adjusting the thickness of the horizontal drain layer or performing soil reinforcement.

- covering on the upper side of the horizontal drain layer.
- (7) The width of the horizontal drain layer shall have a sufficient margin from the side of the levee body to perform superior drainage functions even at the time of the final settlement in the embankment, laying the horizontal drain layer that is connected to the both ends of the levee body. The drainage function shall be maintained on a regular basis and shall not be degraded even at the time the embankment fully settled.

Table 3.1-1 Method via cone bearing capacity in the surface course

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3.2 Layi

- (1) The geotextile material shall be supplied to minimize the joint work at the site and to facilitate convenient handling and storage within specifications considering the purpose and construction convenience.
- (2) The geotextile material shall have a verification test in the presence of the construction supervisor at the frequency specified in the specifications immediately after delivery, and the quality test results shall be submitted to the construction supervisor.
- (3) The delivered mat shall not be exposed to sunlight or artificial light that radiates ultraviolet rays and should not have direct contact with the ground, and be stored to

maintain dryness until it is utilized in the site.

- (4) Projections, scrubs, and puddles on the ground surface shall be removed before the mat is laid to make the laid surface flat.
- (5) The mat shall be laid to have the main direction where the tensile strength is exhibited to be in parallel with the direction where the maximum tensile stress occurs in the ground (the direction of road width in the case of road construction).
- (6) The mat seam in the site shall be parallel with the maximum tensile strain direction. The seam yarn shall be polypropylene, polyester, polyamide, or Kevlar fiber materials, and shall be the same composition material as the rest of the mat as much as possible. With the appropriate overlapping, the mat maintains mechanical strength in such cases.
- (7) The mat shall not be degraded.
- (8) Soil contact material for the mats shall be resistant to the soil. The mats shall not be damaged or the edges shall not be damaged.
- (9) Soil specimens shall be taken at some points and tested to be less than 300m.
- (10) For the gravel or gravel characteristics of the site, the mat shall be suitable.
- (11) Low water content shall be maintained after obtaining the approval of the construction supervisor to prevent mat damage and excessive ground deformation.
- (12) The contractor shall fully prepare various tools and parts required for mat laying beforehand to allow work progress without interruptions.

