KCS 11 10 10 : 2016

Geotechnical Investigation During Construction

Enacted on June 30, 2016
http://www.kcsc.re.kr

국토교통부

Interim Measure under the Enactment and Revision of the Construction Code

This standard shall be applied from the time of its publication. For the on-going design consultancy service or construction works, the existing standard can be used if deemed necessary by the head of the Client or Employer.

Foreword

- To address needs 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 the newly enacted Construction Standard Code.
- This code was enacted as a code with reference to the existing Construction Work Slope Surface Standard Specification, Road Work Standard Specification, and Tunnel Standard Specification by integrating the parts of the Architectural Work Standard Specification, Utility Tunnel Standard Specification, and Harbor and Fishing Port Standard Specification related to ground surveys. Major matters related to the enactment and revision of this code are as follows:

Construction Code	Main Contents	**Enactment · Revision (Month, Year)**
Construction Work Slope Surface Standard Specification	• Scattered, redundant, or conflicting slope surface-related standards that were not clearly described were systematically integrated	Enactment (2006.4)
Construction Work Slope Surface Standard Specification	• Revised to cover various on-site conditions and new technologies due to the government's prioritization of low carbon emission green growth	Revision (2011.12)
Road Work Standard Specification	• Enacted by the Ministry of Construction by entrusting to Korean Society of Civil Engineering	Enactment (1967.12)
Road Work Standard Specification	• All specifications and guidelines being used were reviewed to address correlations and revised, and were improved to prepare the specifications for general road works.	Revision (1985.12)
Road Work Standard Specification	• Compensated and revised to prepare more detailed specifications, by introducing new theories to all specifications and guidelines being used.	Revision (1990.5)
Road Work Standard Specification	• Revised to improve road work quality and increase international competitiveness by modifying the systems in response to the opening of the construction market following the initiation of the WTO system.	Revision (1996.7)
Road Work Standard Specification	• Reconstructed and compensated according to construction standard maintenance guidelines to reflect the revision of other standards including Korean Industrial Standards (KS) and Concrete Standard Specification, and to establish the system as a national specification.	Revision (2003.11)
Road Work Standard	• Revised to address problems found in road work procedures;	Revision

Construction Code	Main Contents	Enactment · Revision (Month, Year)
Specification	to harmonize with other standards, including Korean Industrial Standards (KS), Concrete Standard Specification, and Tunnel Standard Specification; to prevent faulty construction works; and to induce solid construction works through thorough quality control.	(2009.3)
Road Work Standard Specification	• Revised to change the sequence of standard specification, specialized specification, and design drawings, and to reflect the opinions of the Central Construction Technology Deliberation Committee.	Revision (2015.9)
Road Work Standard Specification	• Partially revised in terms of general matters, tree protection materials, general construction works, etc.	Revision (2016.5)
Tunnel Construction Standard Specification and Explanation	• General design methods and standards related to survey, design, and construction works for tunnels constructed in mountainous areas	Enactment (1975.3)
Tunnel Construction Standard Specification	• Route plan and construction plan added to Survey section • Main text and explanation for load and timbering added to Design section • Safe hygiene and mechanical excavation added to Construction section • Modernization of construction methods and styles • Inclined shaft and vertical shaft newly added • Standards of NATM method newly added	Revision (1985.12)
Tunnel Standard Specification	• Revised as a general specification; explanation omitted • Korean terms and writing style applied	Revision (1996.5)
Tunnel Standard Specification	• Tunnel design standard and tunnel standard specification separated, rearranged, and supplemented	Revision (1999.4)
Tunnel Standard Specification	• Latest design and construction technologies and new materials updated • Standards compensated for environment-friendly tunnel construction • Construction management reinforced to prevent disasters including tunnel collapse during construction	Revision (2009.1)
Tunnel Standard Specification	• Technologies updated to improve technological advancement and environment-friendliness and secure quality • Prevention of collapse at excavation sites and social issues reflected • Correction of conflicts with other standards • Research accomplishments updated and relevant civil complaints resolved	Revision (2015.2)
KCS 11 10 10 : 2016	• Integrated and maintained as code according to changes in the construction standard code system.	Enactment (2016.6)

Enactment : June 30, 2016
Evaluation : Central Construction Technology Evaluation Committee
Amendment : (Month Day, Year)
Advisory & Review : Construction Standards Committee, Korea Construction Standards Center
Division Concerned : Technology Standard Division, Ministry of Land, Infrastructure and Transport
Relevant Organization (Writing Agency) : (Korea Geotechnical Society)

Table of Contents

Geotechnical Investigation During Construction

1. General

1.1 Scope of Application

(1) The code is applied to the geotechnical investigation that is performed to provide the various data needed to verify and compensate the results of the geotechnical investigation that had been performed in the design stage, or to perform design changes for the safe and economical construction of civil structures, architectural structures, and other man-made structures, including roads, railways, dams, rivers, bridges, tunnels, breakwaters, bank protection, nuclear power plants as well as auxiliary facilities assisting the functions (complexes, water pipes and sewage, landscaping works, etc.)

(2) The geotechnical investigation during construction may also be performed in cases where deformation or damage of a structure occurs during construction, or where the safety of the structure is affected by a change in the surrounding environment, in order to identify the causes and prepare countermeasures.

1.2 Implementation Guidelines

(1) The implementation should basically conform to KDS 11 10 10.

(2) The geotechnical investigation during construction should be performed by considering the on-site conditions. If necessary, the geotechnical investigation should be reported to and approved by the Owner/Client.

1.3 Planning

(1) The planning should basically conform to KDS 11 10 10.

(2) Planning of the geotechnical investigation during construction should be performed after considering the on-site conditions. If necessary, the plan should be reported to and approved by the Owner/Client.

1.4 Content and Results

(1) The geotechnical investigation during construction should basically conform to KDS 11 10 10.

(2) The geotechnical investigation during construction should be performed based on the result of the geotechnical investigation from the design stage, and include the drilling, geophysical exploration, field and laboratory tests.

(3) A specially required geotechnical investigation should be performed after reporting to and getting an approval from the Owner/Client.

2. Investigations and Tests

2.1 Geological Surface Investigations

(1) The geological surface investigation in the construction stage is performed to determine the topography, site condition, engineering characteristics of the slope surface, characterization of geotechnical properties, groundwater conditions, vegetation conditions, existence of fractured fault zones, any sign of landslide, whether the site is located in the area where collapses have occurred frequently in the past or whether the area is composed of weak rocks.

(2) The surface geological survey may be performed using simple tools, such as rock hammer, clinocompass, profile gauge, altimeter, drawings, and field log, or by employing other methods such as geophysical exploration, geochemical exploration, and drilling. More than one of these methods can be performed together depending on purposes and characteristics of the investigation.

(3) Face mapping investigating general conditions of the slope such as shape and size of the slope surface, geological conditions, and groundwater conditions of discontinuous surface should be performed as a basic item of geological surface investigation. However, face mapping may be omitted at the discretion of the Geotechnical Engineer of Record for a soil slope or a rock slope having a height less than 5 m.

(4) Survey Items

① Although the survey items of the geological surface investigation are expressed qualitatively, the orientations of discontinuous surfaces and the relevant data should be comprehensively considered as the fundamental data for evaluating slope stability.

② The frequently-used items of the geological surface investigation include the slope surface sketch, overall geological structure, strikes and dips of discontinuous surfaces (faults, joints, dykes, folds, etc.), orientation and persistence of geological structures, degree and characteristics of weathering, and availability of groundwater.

③ The findings of the survey on the discontinuous surfaces include the spacing and strength of discontinuous surfaces, joint continuity, joint roughness, joint aperture, joint orientation, joint filling, and number of joint sets. The engineering characteristics of the joints existing in the rock mass should be investigated and expressed in such a way that they are they are quantitative and qualitative to evaluate the stability of the rock slope.

④ If the result of the investigation shows that the sloping method and the reinforcing and protecting methods cannot be applied due to the potential development of discontinuous surfaces such as faults and fractured zones, the methods may be changed after submitting to the construction supervisor a report on the unstable slope including investigation results, stability analysis, alternative construction methods, and evaluation statement, and obtaining the approval from the construction supervisor.

2.2 Drilling

(1) A drilling is performed to investigate the subsurface profile and groundwater level and to take samples for additional tests.

(2) When drillings are done in an urban area, an underground obstruction map should be obtained from a relevant authority and referred to. The drilling should be performed by consulting with the relevant authorities after verifying the presence of underground obstructions by performing pit excavations or geophysical explorations.

(3) In the excavation of TBM tunnel, horizontal pilot boring should be performed ahead of the tunnel face to verify the ground conditions and prepare an excavation plan.

(4) An additional drilling should be performed if unstable topographical and geological features, such as fault zones, fracture zones, differential weathering zones, and talus, are present.

2.3 Geophysical Exploration and Logging

(1) A geophysical exploration may be performed to investigate the geological structure and ground conditions, and exploration methods should be determined after considering the field conditions and ground conditions.

(2) The methods of geophysical exploration performed to investigate characteristics of subsurface strata and geological anomalies (fault zones, fracture zones, differential weathering zones, etc.) include seismic wave exploration method, electrical resistivity

exploration method, etc.. For seismic design, a downhole test, MASW, SASW, or a cross-hole test may be performed. In such cases, density logging should be performed to measure the continuous density values of the layers.

2.4 Field Test

(1) An field test is performed to investigate the onsite ground characteristics.

(2) The test items and test frequency should be determined by considering various aspects, such as project characteristics and site conditions.

2.5 Laboratory Test

(1) Soil and rock tests should be performed in accordance with the test methods specified in Korean Standards (KS F). Internationally recognized test methods can be used for tests that are not specified in KS F.

(2) The test items and test frequency should be determined by considering various aspects, such as project characteristics and site conditions.

2.6 Tunnel Face (Excavation Face) Observation Survey

(1) A tunnel face observation survey is performed on each excavation face to verify the ground conditions investigated during the design stage and to investigate the suitability of the support pattern by predicting the geological condition changes ahead.

(2) In a tunnel face observation survey, a tunnel face map and a profile view should be prepared with photographs of the tunnel face.

(3) A tunnel face observer should be a person who has majored in geotechnical engineering or geology-related fields, or a person with equivalent or more qualifications or experiences. A tunnel face observer should provide the geotechnical information needed for tunnel construction by performing rock mass classifications and preparing a tunnel geological map based on the observations.

2.7 Exploration Ahead of Tunnel Face (Excavation Face)

(1) An exploration ahead of tunnel face is performed when the ground conditions ahead tunnel drilling are not uncertain.

(2) A pilot tunnel should be excavated if the ground conditions need to be visually examined or

if a field test should be performed.

(3) In a pilot tunnel survey, the geological and ground characteristics of the pilot tunnel should be investigated and a geological map of the pilot tunnel should be prepared for reference in the comprehensive analysis.

2.8 Other

Other geotechnical investigations required during construction that are not mentioned in the present code may be performed by obtaining the approval from the Owner/Client and by referring to the relevant codes.