KCS 11 50 30 : 2019

Special Foundation

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국토교통부

Foreword

• In accordance with the change to the construction standards code system, the duplications and conflicts between existing construction standards (design standards, standard specifications) were compared and reviewed and then integrated into this standard as a standard code.

• This standard was established by integrating the parts of the existing building construction standard specification relating to special foundations. The history of this standard and its revisions is as follows.

Construction Standard	Main Content	Enacted or Revised (Year.Month)
Building construction standard specification	• Prepared and established by the Architectural Institute of Korea at the request of the Ministry of Construction	Enacted (1967.12)
Building construction standard specification	• Complemented and revised to reflect new materials and construction methods	Revised (1978.12)
Building construction standard specification	• Complemented and revised to reflect new materials and construction methods	Revised (1985.12)
Building construction standard specification	• Complemented and revised to reflect new materials and construction methods	Revised (1989.8)
Building construction standard specification	• Integrated accumulated experience and knowledge, analyzed and organized related literature and data at home and abroad, and systematized new materials and technologies according to domestic technology levels	Fully revised (1994.8)
Building construction standard specification	• Systematized chapters and clauses into a code system, changed classifications to match the operating system of the Ministry of Construction and Transportation, and revised the specification to make it more realistic and practical	Revised (1999.5)
Building construction standard specification	• Consolidated 29 chapters to 24 chapters by analyzing the specifications system of other countries, as well as descriptions by citing Korean Industrial Standards of other relevant standards according to the principle of preparing performance specifications	Revised (2006.4)
Building construction standard specification	• Revised to introduce and apply new technologies and construction methods related to green growth in the architectural field	Revised (2013.7)

Construction Standard	Main Content	Enacted or Revised (Year.Month)
Building construction standard specification	• Revised quality standard for asphalt primers in waterproofing work (Measures to resolve difference from KS standards)	Partially revised (2015.12)
KCS 11 50 30 : 2016	• Integrated and maintained as code in accordance with the changes to the construction standards code system	Enacted (2016.6)
KCS 11 50 30 : 2016	• Amended according to Korean Industry Standards and Construction Standards	Amended (2018.7)

Table of Contents

1. General

1.1 Scope of application

(1) This standard applies to the construction of diaphragm walls, prepacked concrete piles, PIP piles and similar piles, composite piles, and other special piles, which can be classified as special foundations.

1.2 Reference

1.2.1 Related laws and regulations

No content

1.2.2 Related standards

- KCS 11 50 10 Cast-In-Place concrete pile
- KCS 11 50 15 Precast pile
- KS D 3504 Steel bars for reinforced concrete
- KS L 5201 Portland cement

1.3 Materials to submit

(1) Construction plan

① Before starting construction, perform a detailed survey of the surrounding environment, such as the status of the ground or groundwater according to the ground survey, the influence of seawater, and the use of nearby wells, then prepare a construction plan and obtain approval from the construction supervisor. The minimum thickness of the diaphragm wall shall be 0.6~1.5 m or more, depending on the stress analysis of the structure.

② Review matters related to piping, heaving, and boiling.

③ Conduct surveys on the ground, groundwater, existing structures, underground utilities, and the surrounding conditions.

④ To ensure safe and smooth construction, changes in the design and construction method proposed by the construction supervisor should be accepted if necessary.

⑤ When there are existing water pipes and gas pipes which may cause damage or interfere with the construction, take measures according to the instructions of the construction supervisor after consulting with the relevant agencies.

⑥ Dispose of excavated materials by cutting the ground according to the instructions of the construction supervisor.

⑦ In principle, guide walls shall be designed to prevent the collapse of surface soil due to the weight of excavators.

⑧ For construction machinery and equipment, consider the following.

A. Select construction machines according to the ground conditions, excavation depth, and other field conditions.

B. The equipment to manufacture and recycle the drilling fluid shall fulfill the performance and capacity requirements to make the drilling fluid.

2. Materials

(1) The concrete to be placed shall be in accordance with the construction specification. Unless otherwise specified, apply the following.

① Use Portland cement according to KS L 5201. The cement-type solidification agent and admixture shall be in accordance with the construction specifications.

② The standard aggregate size shall be 13 ~ 25 ㎜.

③ The standard air content shall be (4.5 ± l.5)%.

④ The unit quantity of cement shall be at least 350 ㎏/㎥ and the water-cement ratio shall be less than 50%.

⑤ The standard slump value shall be 18 ~ 21 ㎝.

⑥ The target strength shall be at least 125% of the design strength.

⑦ The mixing ratio of the swelling agent, AE agent, or water reducing admixture shall follow the manufacturer's specifications.

(2) Use deformed steel which conforms to KS D 3504.

(3) For the slurry, use natural bentonite powder, 90% of which is finer than 0.850 ㎜ in size, and less than 10% of which is finer than 0.075 ㎜.

(4) For bentonite slurry mixed in water, the bentonite powder shall be in a stable floating condition, with a specific gravity of 1.04 ~ 1.36.

(5) In the construction of prepacked concrete piles, the materials, mixing, and size of coarse aggregate of the grouting (pouring) mortar shall comply with construction specifications.

(6) Other materials shall be in accordance with relevant specifications.

3. Construction

3.1 Diaphragm wall

3.1.1 General

(1) This applies to diaphragm walls which form a retaining wall by putting rebars or reinforced steel into the hole after excavating or drilling the ground of the construction site. When this wall forms a part of a building, follow the construction specifications.

3.1.2 Equipment

(1) Select excavation and slurry equipment that satisfy the following requirements.

① The equipment shall be capable of removing foreign substances including gravel and boulders from a deep trench, and shall be arranged to facilitate the free vertical passage of slurry in the trench and to prevent suction or pressure.

② The inspection tools or equipment for deep trenches shall be capable of confirming that the excavated materials have been removed and that the trench has been excavated according to the dimensions specified in the approved construction drawing.

③ The slurry mixer shall be capable of maintaining the bentonite and water in a stable floating state through mechanical agitation, and the bentonite slurry shall be conveyed to the trench by temporary pipes or other suitable methods.

④ Prepare equipment capable of circulating and agitating the slurry across the entire depth of the trench, and do not agitate the slurry with compressed air.

⑤ Use slurry recovery equipment to remove harmful materials in the slurry in order to use clean slurry in the trench, and recirculate the recovered slurry into the trench in a continuous manner.

⑥ Monitor and adjust the slurry to maintain the powder in a floating state.

(2) In performing excavation, consider the following based on the plan.

① Excavate a vertical hole. The maximum tolerance shall be less than 1.0%.

② Dig exactly to the required depth.

③ Prevent the collapse of the surrounding ground while digging.

④ Always measure while digging and prevent the collapse of the digging hole.

⑤ Make sure that the connections are made correctly in order to cut off water.

3.1.3 Construction management

(1) If using drilling fluids such as bentonite, select a suitable combination to excavate the ground. Manage its performance during use. Do not use deteriorated drilling fluids.

(2) After completing excavation, check the depth and remove slime from the bottom.

(3) If it is difficult or impossible to excavate to a certain depth, examine the cause and consult with the construction supervisor to develop proper countermeasures.

(4) For tremie concrete, consider the following.

① Construct the slurry trench wall by completely replacing the bentonite slurry with tremie concrete.

② When placing concrete with rebars or reinforced steel, prevent the rebars or reinforced steel from moving. In addition, maintain a minimum concrete cover of 100 ㎜ between the reinforcing mesh and the side of the trench.

③ For underwater concrete placement, use a tremie pipe and keep the fore-end buried more

than 2m in the concrete. Prevent leaks from the connections.

④ Place concrete through a tremie pipe by natural flow or by pumping. The tremie pipe must be equipped with a valve on the bottom to prevent the slurry from being mixed with the concrete in the tremie pipe.

⑤ After excavating the panel, start tremie concrete placement from the bottom of the panel within 12 hours and continue the process without interruption until completion.

⑥ After completing the diaphragm wall, precisely remove the mixed part such as bentonite on the top, if necessary, and then place concrete.

⑦ If an accident occurs while placing concrete, consult with the construction supervisor and take appropriate measures.

(5) Consider the following when inserting rebars or reinforced steel.

① Make sure that the dimensions of the rebars or reinforced steel are accurate and prevent bending or deformation while inserting.

② When installing the rebars or reinforced steel, remove any soil or foreign substances on the members, prevent deformation and damage, and install them in a location that does not damage the excavated wall.

③ When using rebars or reinforced steel, make sure that the upper and lower rebars or reinforced steel are integrated.

④ Since rebars for connecting walls and slabs cannot be used as structural members when they are bent and stretched back, use buried plates with holes formed at the position for connecting rebars and apply methods such as inserting into holes when arranging the slab rebars.

(6) Embed the wall sufficiently below the foundation level to prevent ground loss due to piping under the wall or lateral movement of the wall.

(7) Be prepared to detect, protect, maintain, relocate, and repair facilities and structures near the slurry wall.

(8) Excavate the slurry wall with panels that have the width and depth specified in the approved detailed drawing, and reduce the length of the panels when excavating near facilities that are sensitive to ground settlement.

(9) Fill the wall panels with slurry to the extent specified in the detailed construction drawings until the tremie concrete is completely placed.

(10) Be careful not to damage nearby roads during construction and make sure that the drilling fluid in the digging hole does not flow into underground utilities.

(11) Perform the inspections, tests, and measurements required to construct the cast-in-place diaphragm wall and store the records.

3.2 Prepacked concrete piles

(1) The arrangement, thickness, joint method, covering depth, and steel frame of the rebars used for the piles shall be in accordance with the construction specifications.

(2) Fix the intersection of the main reinforcement and hoop or spiral reinforcement with binding wire and perform spot welding within every 1 m of the main reinforcement.

(3) Do not mix soil and sand when injecting coarse aggregate or mortar, and use casings if necessary.

(4) After excavation, insert the rebars or steel frame, then insert the mortar injection pipe and fill the gaps with gravel.

(5) Waterproof the joints of the mortar injection pipe and keep the end of the pipe below the surface of the grouting mortar at all times. Prevent water from entering the pipe.

(6) After filling the hole with gravel, inject mortar from the bottom using the injection pipe. If there is no water on the gravel before injecting mortar, pour water so that the gravel is submerged. After injecting mortar, put coarse aggregate over the pile head to a thickness of at least 500 ㎜, press it with a steel plate, and remove it after the mortar hardens.

(7) Complete injecting mortar to each pile without interruption.

(8) When injecting mortar, keep the filling rate under 1 m per minute.

(9) Obtain approval from the construction supervisor for the auger, mortar mixer, mortar pump, and mortar injection pipe.

(10) Other construction methods and equipment shall follow the construction specifications.

3.3 PIP piles and similar piles

(1) The assembly of rebars shall follow the specifications for reinforced concrete work.

(2) Carefully control the relationship between the injection speed and the auger hoisting speed to prevent voids at the bottom of the auger, and consider the water and earth pressure at the end of the auger and inject at a pressure equivalent to this. Do not perform the work at an excessively high or low pressure.

(3) Quickly insert the rebars after injecting mortar to prevent damage to the rebars and the wall around the hole.

(4) Other construction methods and equipment shall follow the construction specifications.

3.4 Composite pile

(1) Precast concrete piles shall conform to KCS 11 50 15.

(2) Steel piles shall conform to KCS 11 50 15.

(3) Cast-in-place concrete piles shall conform to KCS 11 50 10.

(4) Make sure that the joints are firmly connected. The dimensions and shape shall follow the construction specification.

(5) Place the center of the upper and lower piles in a straight line.

3.5 Other special piles

(1) Construct according to the construction method specified in the construction specification.