

KCS 11 50 15 : 2019

Precast pile

December 06, 2019
<http://www.kcsc.re.kr>

KC CODE



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 civil engineering work standard specification and LH professional specification related to precast piles, based on the existing road construction standard specification and highway bridge standard specification. The history of this standard and its revisions is as follows.

Construction Standard	Main Content	Enacted or Revised (Year.Month)
Road construction standard specification	• Established by the Korean Society of Civil Engineers at the request of the Ministry of Construction	Enacted (1967.12)
Road construction standard specification	• Supplemented and revised as a specification for general road construction by reviewing & developing the relevant specifications and guidelines in use	Revised (1985.12)
Road construction standard specification	• Supplemented and revised as a more substantial specification by introducing and developing new theories to conform to the relevant specifications and guidelines in use	Revised (1990.5)
Road construction standard specification	• Revised to improve the quality of road construction and strengthen international competitiveness by reorganizing the system to cope with the opening of the construction market following the launch of the WTO	Revised (1996.7)
Road construction standard specification	• Revised to reflect the revisions to other standards, such as KS and the concrete standard specification, reorganized and supplemented according to the construction standard maintenance guidelines to establish the system as a national standard	Revised (2003.11)
Road construction standard specification	• Revised to address problems in the road construction process, to harmonize with other standards such as KS, concrete and tunnel standard specifications, to prevent faulty construction, and to induce solid construction through thorough quality control	Revised (2009.3)

Construction Standard	Main Content	Enacted or Revised (Year.Month)
Road construction standard specification	<ul style="list-style-type: none"> Revised by changing the order of standard specifications, professional specifications, and design drawings, and reflecting the opinions of the central committee 	Revised (2015.9)
Road construction standard specification	<ul style="list-style-type: none"> Partial revision of general, tree protection materials, and general construction 	Revised (2016.5)
Highway bridge standard specification	<ul style="list-style-type: none"> Established highway bridge standard specification 	Enacted (1977.12)
Highway bridge standard specification	<ul style="list-style-type: none"> Revised to reflect the revisions to the concrete construction standard specification 	Revised (1983.12)
Highway bridge standard specification	<ul style="list-style-type: none"> Revised to reflect the latest domestic and international specifications and technological advancements 	Revised (1992.11)
Highway bridge standard specification	<ul style="list-style-type: none"> Content divided into design and construction, and maintenance included 	Enacted (1996.4)
Highway bridge standard specification	<ul style="list-style-type: none"> Reorganized into a new system to resolve conflicts among sectors 	Revised (1999.8)
Highway bridge standard specification	<ul style="list-style-type: none"> Added TMC steel standard and improved welding standard 	Revised (2005.2)
Highway bridge standard specification	<ul style="list-style-type: none"> Added new regulations for the construction of high performance materials such as rolled steel for bridge structures and high-strength concrete, and added quality control technologies for centrifugal concrete piles 	Revised (2013.2)
Highway bridge standard specification	<ul style="list-style-type: none"> For non-destructive inspection methods, ultrasonic inspection may be selected in addition to radiographic inspection 	Partially revised (2015.6)
KCS 11 50 15 : 2016	<ul style="list-style-type: none"> Integrated and maintained as code according to the changes to the construction standards code system 	Enacted (2016.6)
KCS 11 50 15 : 2016	<ul style="list-style-type: none"> Amended according to Korean Industry Standards and Construction Standards 	Amended (2018.7)

Table of Contents

1. General	1
1.1 Scope of application	1
1.2 Reference	1
1.2.1 Related laws and regulations	1
1.2.2 Related standards	1
1.3 Materials to submit	1
1.3.1 Construction plan	1
1.3.2 Construction drawing	2
1.3.3 Construction report	2
1.3.4 Daily work report (Pile construction work record)	3
1.3.5 Pile location map	3
1.3.6 Pile dynamic load test	3
1.3.7 Plans to operate pile driving/light driving equipment	3
1.3.8 Wave equation analysis of pile driving	3
1.4 General requirements	3
1.4.1 Installation tolerance	3
1.4.2 Pile	3
1.4.3 Welding and qualification of welders	4
2. Materials	4
2.1 H-shaped steel pile	4
2.2 Steel pipe pile	4
2.2.1 Steel pipe	4
2.2.2 Reinforcement	4
2.2.3 Sealing concrete	4
2.3 PS concrete pile	4
2.4 Equipment	4
2.4.1 Pile driving equipment	4
2.4.2 Lead	5
2.4.3 Follower pile	5

2.5 Other materials	5
2.6 Quality control test	5
3. Construction	5
3.1 General	5
3.1.1 Checking the conditions around the site	5
3.1.2 Checking the site ground conditions	6
3.1.3 Selecting the piling method	6
3.1.4 Selecting construction equipment	6
3.1.5 Test pile	6
3.1.6 Transport, storage, and inspection	7
3.1.7 Safety management	6
3.1.8 Checking the load capacity	6
3.1.9 Instrumentation management	7
3.2 Preparations for construction	7
3.2.1 Preliminary investigation and preparatory work	7
3.2.2 Equipment maintenance inspection	8
3.2.3 Preparations for construction	8
3.2.4 Pile erection	8
3.2.5 Field welding joint	9
3.2.6 Arranging pile heads	9
3.2.7 Construction record	9
3.3 Test pile	9
3.4 Driven pile	10
3.4.1 Pile driving	9
3.4.2 The end of pile driving	10
3.5 Inner excavation pile	11
3.5.1 Excavation and sinking	11
3.5.2 Processing excavated soil	11
3.5.3 Processing the fore-end	11
3.6 Pre-bored pile	11
3.6.1 Excavation	11
3.6.2 Processing excavated soil	11
3.6.3 Final light drive	12

3.7 Field quality management 12

3.8 Damaged piles 12

3.9 Coating 12





1. General

1.1 Scope of application

(1) This standard applies to the foundation work for structures that use precast piles.

1.2 Reference

1.2.1 Related laws and regulations

No content

1.2.2 Related standards

- KCS 11 50 40 Pile load test
- KCS 14 20 10 General concrete
- KCS 14 20 11 Reinforcement work
- KCS 14 20 53 Prestressed concrete
- KCS 14 31 20 Welding
- KS B 0896 Method of ultrasonic examination for welds of ferritic steel
- KS C IEC 60245-6 Rubber insulated cables of rated voltages up to and including 450/750 V – Part 6: Arc welding electrode cables
- KS C 9602 AC arc welding machines
- KS C 9607 Welding rod holder
- KS D 0213 Method for magnetic particle testing of ferromagnetic materials and classification of magnetic particle indication
- KS D 3508 Wire rods for core wire of arc covered electrode
- KS D 3566 Carbon steel tubes for general structural purposes
- KS D 7004 Covered electrodes for mild steel
- KS F 4306 Pretensioned spun high strength concrete piles
- KS F 4602 Steel pipe piles
- KS F 4603 Steel H piles

1.3 Materials to submit

1.3.1 Construction plan

- (1) Prepare the construction plan before starting construction, and if there are any changes in the construction conditions, modify the construction plan immediately.
- (2) The main content of the construction plan includes the following.
- ① The personnel and organization chart specifies the main personnel for various works and

includes a list of people in charge who are required under related laws and regulations.

- ② Prepare a work schedule that contains the entire process of the construction, including the construction process and temporary facilities for the foundation. If constructing several foundations, a floor plan that lists the order of construction is required.
- ③ Specify the basic plans, temporary facilities, and the main construction in terms of the construction method.
- ④ For machinery and temporary equipment for construction, specify the detailed plans and layout of the equipment.
- ⑤ In terms of quality control and inspection methods, prepare a plan that includes the targets, inspection method, and the number of inspections for not only the main body but also the major parts of temporary facilities.
- ⑥ When verifying the load capacity, establish a direct or indirect method to verify whether the load capacity is secured against the design load for the main body and major parts of temporary facilities.
- ⑦ In addition to the record of each work day, prepare construction records to easily understand the construction status of each foundation.
- ⑧ For environmental conservation measures, develop measures by considering the conditions of the foundation construction site and reviewing changes in the surrounding environment.
- ⑨ Develop safety measures to ensure safety by fully considering the conditions of the construction site.

1.3.2 Construction drawing

- (1) Submit construction drawings for each type of pile that include the following information.
 - ① H-shaped steel pile: Details including the dimensions, weight, welding, end processing, and welding of joints
 - ② Steel pipe pile: details including the dimensions, shape, end processing, welding of joints, and type of concrete
 - ③ P.S. concrete pile: Dimensions, PC steel wire arrangement, type of concrete, curing system, curing method, tensioning method, calculation sheet of working stress, and details of joints
 - ④ Reaction test pile: Tensile reinforcement and joints for pullout load

1.3.3 Construction report

- (1) Prepare a construction report that includes the construction plan and progress, a list of field workers, materials, consultation and adjustment of instructions, and the status of pile construction equipment.

1.3.4 Daily work report (Pile construction work record)

- (1) Prepare a daily report on all piles including the test piles.

1.3.5 Pile location map

- (1) Prepare a location map for the installed piles within 1 week after constructing the piles. The drawing shall show the design position and the actual position, and the error of both positions.

1.3.6 Pile dynamic load test plan

- (1) One week before the test, prepare a dynamic load test for pile driving/light driving test piles and main piles. This must include information on the qualifications and fields of expertise of the tester and reviewer, pile driving equipment verified by an independent testing institute, and calibration certificates for the load and displacement meters (within the last 2 years).

1.3.7 Plans to operate the pile driving/light driving equipment

- (1) Submit details and operation plans for all of the pile driving/light driving equipment, including hammers and cranes, to the construction supervisor for approval at least 1 week before pile driving or light driving.

1.3.8 Wave equation analysis of pile driving

- (1) Prepare the results of wave equation analysis for all of the pile driving/light driving equipment scheduled for construction and obtain the approval of the construction supervisor before starting construction.

1.4 General requirements**1.4.1 Installation tolerance**

- (1) The angular variation of vertical and inclined piles shall be less than $1/50$ of the pile length, and less than 150 mm over the entire length.
- (2) The fluctuation of the top of the pile shall be less than 150 mm.

1.4.2 Pile

- (1) Reject cracked, bent, and dent piles, in addition to piles under the required dimensions and piles damaged during pile driving/light driving. Remove such piles from the site and replace them with rigid piles. Cut off piles that have been damaged during pile driving/light driving and place them in their original position if approved by the construction supervisor. Otherwise, they should be pulled out and removed from the site.

1.4.3 Welding and qualification of welders

- (1) Subject to the applicable requirements of KCS 14 31 20.

2. Materials

2.1 H-shaped steel pile

- (1) Subject to the applicable requirements of KS F 4603 H-shaped steel pile.

2.2 Steel pipe pile

2.2.1 Steel pipe

- (1) Steel pipes should comply with the requirements of KS F 4602 and KS D 3566 steel pipe piles for foundations and KS D 3566 carbon steel pipes for general structures, and shall meet the specified diameter and thickness.
- (2) The steel pipe piles should be free of joints. However, if it is inevitably necessary, they may be joined as follows, and the details of the joints should be approved by the construction supervisor prior to construction.
 - ① If joining with a new pile, the length of the joint shall be at least 3.0 m, and the joint pile should be driven so that the long part becomes the end of the pile. However, if a joint is required at the pile head, join a pile at least 1.0 m long.
 - ② If joining with a recycled pile, the length of the joint of the recycled pile should be at least 5.0 m, and a non-destructive welding inspection (U.T) should be performed once per 1 joint.

2.2.2 Reinforcement

- (1) Subject to the applicable requirements of KCS 14 20 11.

2.2.3 Sealing concrete

- (1) Subject to the applicable requirements of KCS 14 20 10.

2.3 PS concrete pile

- (1) PS concrete piles shall conform to the requirements of KS F 4306 and KCS 14 20 53.

2.4 Equipment

2.4.1 Pile driving equipment

- (1) The pile driving equipment should not damage the piles. Data on the piles, ground survey, and the pile driving equipment in addition to the results of wave equation analysis of pile driving

must be submitted to the construction supervisor before starting the work.

- (2) The construction supervisor shall determine whether to use the pile driving equipment based on the results of wave equation analysis of pile driving, such as the estimated bearing capacity, the final penetration rate, and the size of the pile driving stress according to the penetration depth.

2.4.2 Lead

- (1) Use pile drive leads to support the piles and hammers in the proper position while pile driving.
- (2) Construct the leads so that the movement of the hammer is free while maintaining the alignment of the hammer and pile to ensure a concentrated blow for each strike.

2.4.3 Follower pile

- (1) Avoid the use of follower piles while pile driving. However, when it is difficult to hit the pile head directly, pile followers can be used with the approval of the construction supervisor.
- (2) When using follower piles, 1 out of every 10 piles should be piled directly as a long test pile to determine the bearing capacity.
- (3) If using follower piles, perform the dynamic load test under the same conditions as the construction conditions.

2.5 Other materials

- (1) The wire rods for the core wire of arc covered electrode and covered electrodes for mild steel shall conform to the applicable requirements of KS D 3508 and KS D 7004, respectively.
- (2) Welding cables, AC arc welding machines, and welding rod holders shall be in accordance with KS C IEC 60245-6, KS C 9602, and KS C 9607, respectively.

2.6 Quality control test

- (1) The test for H-shaped steel piles shall be in accordance with KS F 4603.
- (2) The test for steel pipe piles for foundations shall be in accordance with KS F 4602.
- (3) The test for pre-tensioned centrifugal high-strength concrete piles shall be in accordance with KS F 4306.
- (4) Welding materials shall comply with KS D 3508.

3. Construction

3.1 General

3.1.1 Checking the conditions around the site

- (1) Investigate the possibility of civil complaints due to ground vibration or noise caused by pile

driving around the construction site.

- (2) If there are concerns over possible civil complaints, establish measures to reduce vibration and noise or apply low vibration and low noise piling methods.

3.1.2 Checking the site ground conditions

- (1) If the pile driving method is applicable to the construction site, examine whether the pile can be penetrated to a substrate that can ensure a certain bearing capacity of the soil.
- (2) If there is a layer capable of supporting the load at the lower part of the intermediate dense layer and it is impossible to penetrate the intermediate dense layer using the pile driving method, consider pre-excitation or inner excavation pile methods.
- (3) If the piles are expected to bend or rise when the piles are densely constructed due to the ground conditions of the construction site, consider using the precast pile method.

3.1.3 Selecting the piling method

- (1) Apply the pile driving method if there are no problems with the conditions around the site and the ground conditions.
- (2) When it is impossible to apply the pile driving method due to the conditions around the site and the ground conditions, select one of the following precast pile methods or other suitable methods after considering the various site conditions.
 - ① Preboring driving method
 - ② Preboring light driving method (SIP, SDA method, etc.)
 - ③ Internal excavation (casing, etc.) light driving methods (DRA, PRD method, etc.)
 - ④ SIG (Super Injection Grout), RJP (Rodin Jet Pile), etc.
 - ⑤ Other low vibration • low noise methods

3.1.4 Selecting construction equipment

- (1) When selecting the construction equipment, consider the specifications of the piles, the load conditions, the environment of the work site, ground conditions, and the safety of the work. In addition, the construction equipment must satisfy the dimensions and functions specified in the design drawing.
- (2) Before the actual construction, perform test construction using a dynamic load tester to check the stress and energy applied to the pile and to confirm the bearing capacity in order to finally approve the hammer.

3.1.5 Test pile

- (1) Subject to the related standards of KCS 11 50 40.
- (2) Construct test piles near the foundation site before starting construction to verify the adequacy of

the design, identify the constructability, the influence of noise and vibration during construction, and the conditions to end installing piles, and obtain the required data for design change and construction management. However, you may omit the construction of test piles by confirming the constructability of the piles at the construction site through checking the construction documents.

3.1.6 Transport, storage, and inspection

- (1) Prevent damage to the piles while transporting, stacking, and storing the piles.
- (2) When the piles are imported to the site, inspect the appearance, shape, and dimensions of the piles according to KS F 4306, KS F 4602, and KS F 4603.

3.1.7 Safety management

- (1) Follow the relevant laws and regulations for safe construction.
- (2) The significance and safety of temporary facilities are as important as those of main structures, so conduct a safety review using the same procedure as when changing main structures if temporary facilities must be changed due to changes in the site conditions.
- (3) Since foundation works are performed underground or underwater, be sure to fully understand the construction method to ensure safety.

3.1.8 Checking the load capacity

- (1) Check the capacity of the foundation work and major temporary facilities through soil and measurement data during the construction process, or through actual load tests.

3.1.9 Instrumentation management

- (1) During construction, investigate environmental changes around the area by measuring the noise, vibration, groundwater level, water quality, ground settlement, and the displacement of structures.

3.2 Preparations for construction

3.2.1 Preliminary investigation and preparatory work

- (1) Investigate the status of underground utilities and obstacles on the ground before starting construction.
- (2) Conduct a ground survey before starting construction, and reconfirm that the selected piling method is appropriate for the ground conditions of the site.
- (3) If there are concerns that construction equipment may tilt during construction, improve the ground in advance by applying staging methods.
- (4) If driving piles on a barge, make sure that the barge does not move.

- (5) Avoid rock fills to facilitate the installation of piles.
- (6) Remove underground obstacles and protect and relocate underground utilities within the area of influence.

3.2.2 Equipment maintenance inspection

Perform a maintenance inspection on pile driving equipment (pile drivers), hammers, auxiliary machinery, and other equipment as follows before starting work, referring to the relevant instruction manual.

- (1) Inspect and perform maintenance on equipment before construction to ensure safe, accurate, and quick work.
- (2) For pile drivers, maintain the direction of the guide precisely to properly drive or press the piles in the intended direction, and prevent harmful vibration, movement and tilting while operating the pile drivers. If necessary, install fixing straps for the pile drivers.
- (3) For pile drivers using drop hammers, diesel hammers, or hydraulic hammers, you should be able to read the drop height of the hammers from a remote location.
- (4) If pre-excavating the ground with an auger, install an automatic recording device (ammeter, RPM, etc.) capable of recording the excavation resistance.

3.2.3 Preparations for construction

Before constructing the piles, prepare the following according to the details specified in the design documents and the construction plan.

(1) Work ground

Maintain the original ground in advance to withstand the contact pressure of the pile driver. Develop special safety measures if the original ground is soft, and for works on water.

(2) Temporary piling work

For temporary piling work in the field, prevent harmful deformation to the piles and determine the height of the piles by considering the bearing capacity of the original ground and the surrounding conditions.

(3) Measurement

To measure the center position of the pile and the height of the pile head, install a batter board to prevent displacement from site conditions.

(4) Inspection and maintenance of machinery and equipment

Inspect and repair the machines and equipment before starting construction so that the equipment can fully perform its functions, referring to the relevant instruction manuals.

3.2.4 Pile erection

Erect the piles accurately and safely according to the design drawing and construction plan.

- (1) Install the construction machine at a precise position on solid ground so that the pile can be correctly installed at the required location.
- (2) To erect the piles accurately and safely, install a batter board to facilitate marking the center line, and perform inspection from 2 orthogonal directions after erecting the piles.
- (3) The verticality or inclination of the piles shall be within 1/100, and the position on the plane after pile driving shall not deviate from the position on the design drawing by more than $D/4$ (D : the outer diameter of the pile) or 100 mm, whichever is the larger.

3.2.5 Field welding joint

- (1) When field joining piles, arc weld the joints by manual or semi-automatic welding.
- (2) For field welding, a welding construction engineer with knowledge and experience should be present to supervise, guide, and inspect the welding work.
- (3) The allowable error of joints shall be in accordance with KS F 4602 steel pipe piles for foundations, and the axial lines of the upper and lower piles shall be located on the same straight line.
- (4) After welding, inspect the designated locations, referring to each method specified in the design drawing. A qualified intermediate engineer or higher shall perform a non-destructive inspection at least once for every 25 welded joints of steel pipe piles according to KS B 0896 Method for Ultrasonic Examination for Welds of Ferritic Steel and at least once for every 20 welded joints of PS concrete according to KS D 0213 Method for Magnetic Particle Testing of Ferromagnetic Materials and Classification of Magnetic Particle Indication.
- (5) When field welding joints of piles, record the welding conditions, welding work, and inspection results.

3.2.6 Arranging pile heads

- (1) Arrange the pile heads according to the design drawing after driving the piles.
- (2) Do not damage the pile body while arranging the pile heads.
- (3) For steel pipe piles, cut and transport the scraps to the designated location. If the remaining length of the pile is more than 5 m, process and recycle it to join piles.

3.2.7 Construction record

- (1) Make a record for each pile at each stage of work according to a predetermined form.

3.3 Test pile

- (1) The purpose of driving test piles is to check the performance and suitability of pile driving equipment including hammers, to check if the design corresponds to the actual ground conditions, to determine the integrity of the pile materials, and to check the soil bearing capacity

of the piles considering the set-up effect.

- (2) If driving test piles, perform a dynamic load test to verify the suitability of the entire pile driving work.
- (3) Details of the dynamic load test shall be in accordance with KCS 11 50 40.
- (4) Select an appropriate location near the foundation site and use a test pile that is 1.0~2.0m longer than the designed pile length. In addition, if there are extreme changes in the substrate, construct several test piles for each foundation after obtaining approval from the construction supervisor.
- (5) If there is a need to change the pile length, thickness, quantity of piles, construction method, or foundation type as a result of constructing test piles, a professional engineer should review the required changes and obtain the approval of the construction supervisor before starting construction.
- (6) The contractor shall submit the results of the test piles to the construction supervisor within 7 days after completing the tests, and the construction supervisor shall approve the pile lengths to be used for construction.

3.4 Driven pile

3.4.1 Pile driving

- (1) When excavation is required before pile driving, perform construction in accordance with 3.5.1.
- (2) Install the construction equipment on solid ground at the correct location in order to install the piles at exactly the required positions.
- (3) When installing the piles, keep the angle between the leader and the wire below 30°, and do not turn the pile driver. In particular, do not drive while suspending a pile.
- (4) Determine the order of pile driving by considering the process, ground conditions, shape and arrangement of piles, construction method, construction machine, and surrounding conditions.
- (5) Prevent distortion and damage to the pile body while driving inclined piles, and perform the work after considering problems caused by the movement of the center of the machine.

3.4.2 Finishing pile driving

- (1) Since the depth of piling in the design is estimated based on drilling logs, there may be differences from the actual piling depth, so recalculate the depth according to the data confirmed in the construction data or the test pile results.
- (2) Set the total number of strikes and the impaction per strike at the end of piling limited by the type of pile within the range where there is no damage to the pile and hammer.
- (3) Estimation of axial bearing capacity using the dynamic formula should only be applied in construction management after confirming the reliability of the formula.

- (4) If the specified bearing capacity cannot be obtained even if the target depth is reached due to ups and downs in the substrate, or if it is difficult to drive the piles before reaching the target depth, develop countermeasures after carefully considering the design conditions and construction conditions.

3.5 Inner excavation pile

3.5.1 Excavation and sinking

- (1) When sinking a pile while excavating inside the pile cavity, check for changes in the soil properties or the sinking status of the pile to prevent disturbing the fore-end of the pile and the ground surrounding the pile, and make sure that the pile is sunk to the required depth.

3.5.2 Processing excavated soil

- (1) Slurry may be used depending on the excavation method, so take measures to prevent the discharged soil from causing environmental pollution, and review the disposal site in advance to prevent problems caused by the discharged soil.

3.5.3 Processing the fore-end

- (1) When the fore-end of the pile reaches the required depth, process the fore-end using the method specified in the design drawing.

3.6 Pre-bored pile

3.6.1 Excavation

- (1) The diameter of the excavation hole to insert the piles shall be vertical and at least 100 mm larger than the diameter of the pile, and casings should be used if there are concerns that the hollow wall may collapse during excavation, or for soil that is likely to collapse. Determine the final excavation depth to satisfy the required bearing capacity, which shall be verified based on the test pile data.

3.6.2 Processing excavated soil

- (1) Remove the discharged soil immediately after excavation to prevent it from entering the hollow wall in order to clearly identify the position of the pile during the next excavation and to prevent it from being an obstacle to measure the final penetration.
- (2) Slurry may be used depending on the excavation method, so take measures to prevent the discharged soil from causing environmental pollution, and review the disposal site in advance to prevent problems caused by the discharged soil.

3.6.3 Final light drive

- (1) After excavation, check the verticality of the pile placed in the hole with a level, then strike it with a light-blow hammer to prevent damage to the head and so that the fore-end of the pile reaches more than the excavated depth. If the groundwater flow velocity is high, mix the cement pool with rich concrete or use accelerating agents. Determine the appropriate course of action by performing tests. If the fore-end of the pile reaches the required depth, process the fore-end according to the method specified in the design drawing.

3.7 Field quality management

- (1) During construction, the contractor shall immediately report to the construction supervisor and receive instructions in the following cases.
 - ① When it is impossible to drive (or bury) to the required position
 - ② When it is impossible to obtain the required bearing capacity
 - ③ When you anticipate slopes or failure during construction
- (2) The contractor shall perform the proper joint tests according to the type of pile, submit the results for confirmation, then move on to the next process.
- (3) If it is reflected in the design, or if there is a need to confirm the bearing capacity of the completed pile due to severe changes in the ground layer, perform load tests according to the design drawing and KCS 11 50 40.

3.8 Damaged piles

- (1) The pile construction method shall not exert excessive or unnecessary force such as to cause cracks, fractures, and other deformations of the pile.
- (2) When the construction supervisor determines that excessive force is applied to adjust the position of the pile, stop the work immediately.
- (3) For piles damaged due to defects inside the pile or improper driving methods and piles that deviate from the location specified in the design drawing, implement the following measures at the expense of the contractor after obtaining approval from the construction supervisor.
 - ① Install an additional reinforcing pile near the design location next to the damaged pile.
 - ② Expand the foundation to the extent of the deviation from the outside of the pile center line.

3.9 Coating

- (1) Apply anti-corrosion measures to the surface of steel piles exposed to the surface or water surface using the methods specified in the design drawing to prevent corrosion. The coating range should be from 2 m below the low-water level or the surface to the exposed upper part.

