

KS

KOREAN INDUSTRIAL STANDARD

Standard Practice for Execution of Spun Concrete Piles

KS F 7001: 2002

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Standard Practice for Execution of Spun Concrete Piles

1. Scope

This standard specifies the standard practice for execution of spun concrete piles (hereinafter to be called "piles.").

Remarks: Piles in this standard refers to those specified in **KS F 4301**, **KS F 4303** and **KS F 4306** or others whose quality is equivalent to these.

2. Normative References

The following standards contain provisions which, through reference in this text, constitute provisions of the standard. The most recent editions of the standards indicated below should be applied.

KS B 0515 Standard qualification procedure for semi-automatic welding technique

KS B 0885 Standard qualification procedure for welding technique

KS D 7004 Covered electrodes for mild steel

KS D 7104 Flux cored wires for gas shielded and self-shielded metal arc welding of mild steel, high strength steel and low temperature service steel

KS D 4301 Centrifugal reinforced concrete piles

KS F 4303 Pretensioned spun concrete piles

KS F 4306 Pretensioned spun high strength concrete piles

3. Definition

For the purpose of this standard, the following terms and definitions apply.

- a) Construction Supervisor** Person who is responsible for supervising the process of construction to ensure that the construction is executed according to the conditions provided in the relevant drawings.
- b) Construction Manager** Person who is responsible for managing the process of construction as a representative of the client of construction to complete the work.
- c) Pile Work Manager** Person who is responsible for managing of the work to complete the pile work.
- d) Leader** A pole to which the hammer and elevator rail for auger activation system at the pile driver.
- e) Cap** A steel protection hole used to evenly distribute the striking force of hammer to the pile.
- f) Cushion** A buffer inserted between the cap and the head of pile.
- g) Earth Auger** Digging jig attached with plate with spiral shape around the outer area of the axis.

- h) **Load** A digging jig attached with a mixing bar and a mixing drum on the outer area of the axis.
- i) **Blade** A spiral-shaped blade of earth auger
- j) **Beat** A digging jig attached to the earth auger and on the front tip of the load.
- k) **Press System** A pressing system to press piles with the reaction force from the weight of the pile driver.
- l) **Idle Beating** The work of beating by a ram, disconnecting fuel supply at the beginning of the driving diesel hammer.
- m) **Eccentric Beating** The condition when beating is not evenly distributed to the piles due to eccentricity of the center of the beating force or wearing of the cushion.
- n) **Friction Cutter** A cylindrical metal object attached to the edge of the piles to allow easy driving of pile by reducing friction during the work.
- o) **Driving Fluid** A type of fluid used to prevent collapse of holes wall during driving.
- p) **Fixing Fluid around Piles** A type of fluid mixed between water and cement used to fill the holes on the wall and cracks around the piles and to secure soil resistance when friction resistance around the piles and horizontal force are effected to the piles after it is hardened.
- q) **Hardening Fluid** A type of fluid mixed between water and cement used to fix the edge of the pile to the ground and to secure the vertical supporting power after it is hardened.

4. Handling of Piles

4.1 Unloading

For stacking or unloading of piles, they shall be supported at two points. Special care is required so that damage of crack may not occur on the piles.

4.2 Transportation

Strong support materials shall be provided at a proper location so that piles may not be damaged during transportation. Use wire ropes so that the piles may not be scattered and wedges shall be used so that piles may not be scattered. When piles are stacked to more than two layers, support materials shall be placed to the same vertical area.

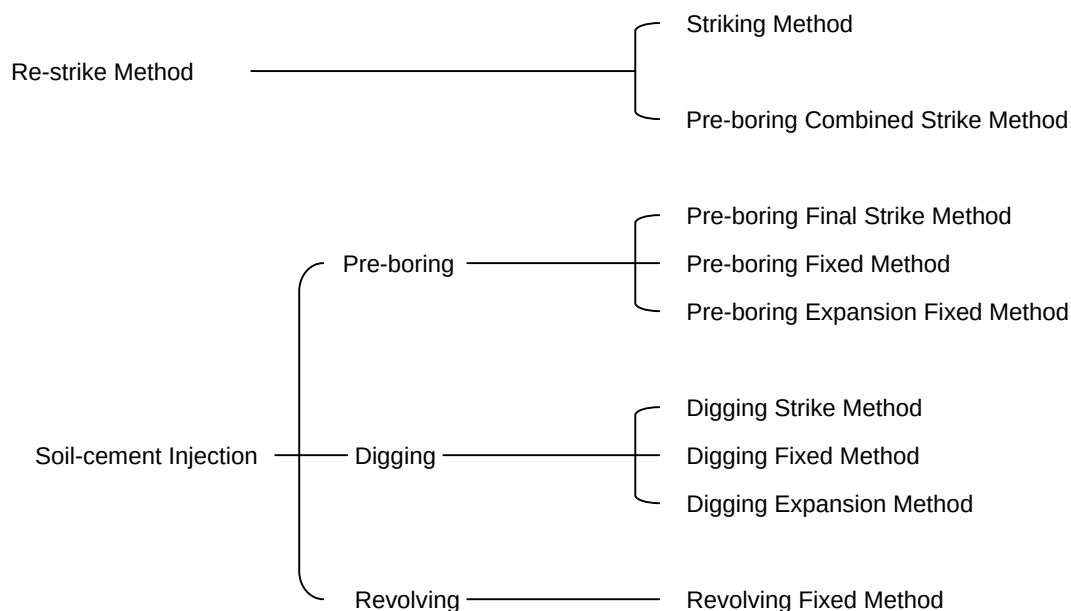
4.3 Incoming to the Site and Temporary Storage Place

Incoming of piles to the site and storing of piles on a temporary storage place shall be decided according to the following:

- a) Unload the piles to the area where work may not be interfered around the driving stand.
- b) When piles are stacked on the site, the area shall be flat. Place supports on the location where piles are supported and arrange piles in one layer.

5. Pile Driving Method

Piles shall be driven according to the following methods.



- Remarks**
1. Strike Method: A type of pile-striking method to penetrate piles into the soil by striking them with hammers.
 2. Pre-boring Combined Strike Method: A type of pile-striking method to penetrate piles into the soil by driving the soil with earth auger, erecting the piles in the holes and striking them with hammers.
 3. Pre-boring Final Strike Method: A type of pile-striking method to penetrate piles into the soil by injecting driving fluid into the support level with earth auger, erecting the piles in the holes and striking them with hammers.
 4. Pre-boring Fixed Strike Method: This is also called "cement milk method." This is a type of piling method to penetrate piles into the soil by inserting the piles with pressure or light strike into the driven holes filled with fixing fluid and pile fixing fluid.
 5. Pre-boring Expansion Fixed Method: A type of piling method to penetrate piles into the soil by revolving or scuttling piles by erecting a bulb greater than the diameter of a pile.
 6. Digging Strike Method: A type of piling method to penetrate piles into the soil by driving piles to the support level by digging the soil on the edge of the pile with earth auger inserted in the pile and striking it with a hammer.
 7. Digging Fixed Method: A type of piling method to penetrate piles into the soil by making a bulb after driving piles to the support level by digging the soil on the edge of the pile with earth auger inserted in the pile.

8. Digging Expansion Fixed Method: A type of piling method to penetrate piles into the soil by making a bulb bigger than the diameter of a pile.
9. Revolving Fixed Method: A type of piling method to penetrate piles into the soil by digging out the digging water with the use of special metal on the edge of a pile and the load inserted in the pile and by revolving the metal.

6. Equipments and Systems

6.1 Driver

Driver shall be according to the following.

- a) Driver shall be strong enough to resist the weight and workload without giving vibration, movement or slope during the work.
- b) Leader shall maintain vertical position throughout the work. When used for sloped-pile, a leader shall be capable of maintaining the angle correctly.

6.2 Hammer

To select proper hammers, their structure and performance shall be thoroughly investigated.

6.3 Cap and Cushion

Cap and cushion shall be according to the following.

- a) Cap shall be capable of evenly distributing striking force of a hammer to piles.
- b) Cushion shall have proper materials to protect the head of piles and evenly distribute the strike force to the piles.

6.4 Driving Support Equipment

A driving support equipment is used to install the head of piles to the lower area of the construction earth layer. It shall have capacity to endure each work.

6.5 Auger Activation System

Auger activation system shall be capable of revolving earth auger and load and digging.

6.6 Earth Auger and Load

Earth auger and load shall be capable of discharging digging fluid and fixing fluid. It shall be strong enough so that it may not be bent during work.

6.7 Beat

Beat shall have functions and structure necessary for the digging, enduring all type of work.

6.8 Pressure System

Pressure system shall have proper weight and structure that can place piles to the desired depth and direction.

6.9 Revolving Pressure System

Revolving pressure system shall be capable of revolving and pressing the metal on the edge of the pile, without creating stress against piles.

6.10 Revolving Cap

Revolving cap shall resist when vertically hung on the pile and revolved.

6.11 Other Equipments

Other equipments used for piling work are as follows:

a) Mixer

Mixer shall be capable of evenly distributing fixing fluid after digging. It shall be capable of continually supplying during work.

b) Ground Pump

Ground pump shall have proper capacity to discharge during work.

c) Air Compressor

Air compressor shall have proper capacity to discharge during work.

d) Welder

Welder shall have capacity to weld the joint of piles and necessary safety systems.

e) Electrical System

Electrical system shall have proper capacity to supply electric power necessary for the equipments and systems used for the work.

f) Water Supply System

Water supply system shall have capacity to continually supply water to the mixer.

g) Ammeter

Ammeter shall have function to record the current value loaded to the motor of the auger activation system.

7. Test Pile

Piles used for the test shall be according to the following.

- a) Drive a test pile to obtain information related to the length and work. Test method and items shall be according to the design drawing. When no record exists, follow directions by the supervisor.
- b) Piles used for the test may be used that are planned ahead. Equipments and systems that are planned ahead may be used.

8. Work

8.1 Preparation

8.1.1 Work Plan

Work plans shall be prepared based on the design drawings before commencement of construction.

8.1.2 Checking of Ground Conditions

To obtain information related to foundation design and construction, ground survey may be conducted ahead.

Based on the results from the ground survey, matters related to ground conditions shall be checked.

8.1.3 Site Investigation

Before commencement of pile work, the following shall be thoroughly reviewed.

- a) Investigation on the shipping route for equipment
- b) Relation between the size of site and adjacent structures
- c) Investigation on the obstacles on the ground and air
- d) Ground conditions on the site
- e) Disposal of spoil surplus soil and mud
- f) Consideration on the environment

8.1.4 Selection of Equipments

To select equipments for construction, ground, site conditions, construction method and design bearing force shall be considered.

8.1.5 Inspection of Equipment

To conduct pile work according to the design until the commencement of work, safety shall be ensured through maintenance and inspection of equipments.

8.2 Handling of Piles During Work

Since piles may be damaged when they were hung and slide over the ground structures, special care shall be exercised. When piles are erected, special care shall be exercised to prevent them from any adverse effect.

8.3 Piling Work

8.3.1 Re-strike Method

1) Erecting

- 1.1) After a pile is erected, place a cap and hammer on it and ensure that each axis is aligned to the direction of re-strike.
- 1.2) Use cushion materials on the top of the pile. To erect a pile, always check its position and replace with a new one when defected.

2) Re-strike Work

- 2.1) When pile is to be driven by pressured hammer or drop, allow little height of hammer drop. Observe the driving of pile and light strike the pile for several times before commencement of pile-work.

2.2) For diesel hammer, secure the desired direction and do several times of test strike before commencement of actual strike.

2.3) When piling work for 1 pc of pile started, it is recommended to completely finish the piling work.

2.4) During the work, care shall be taken so that the direction of the drop of hammer along with the cap and axis of pile can be aligned to one line.

2.5) During the strike, care shall be taken for the slope of the pile. Prevent the pile from horizontal vibration and eccentric strike, striking to the desired direction. However, when pile slopes during strike, do not forcefully correct the slope, but try to adjust the slope of leader and do not give eccentric strike to the head of the pile. Care shall be take to prevent eccentricity on the pile

2.6) When a pile is to be driven in the soft soil and hard soil, or when a long pile is to be driven, care shall be taken so that extreme tensile stress may not occur on the pile.

3) Securing of Supporting Force

3.1) Strike may be stopped when desired drive and amount of rebound are obtained with specific strike energy.

3.2) If the position of the head of the pile is higher than the pile after stop of the strike, or when desired supporting force is not obtained from the specific location, measures shall be taken after consultation with the supervisor.

b) Pre-boring Combined Striking Method

1) Digging

1.1) Diameter of the digging hole shall be less than the outside diameter of pile.

1.2) Take two points of plank cores to the direction perpendicular to the center of the pile so that the center of the earth auger during digging may not cross each other.

1.3) Digging shall be conducted without scattering the surrounding ground and the ground on the edge. The core of the digging shall be decided by the supervisor.

1.4) When collapse of the hole wall of the digging is expected, necessary measure such as the use of auxiliary method shall be taken.

2) Erection Driving and Strike Driving

2.1) Erection driving of a pile shall be conducted by maintaining vertical angle in the digging hole, without making excessive correction.

2.2) During the initial period of piling, allow little dropping height to secure perpendicular angle. For piling by the strike of hammer, care shall be taken since cracks may occur by excessive tensile stress due to body of pile excessively struck.

3) Securing of Supporting Force

3.1) Stop of piling shall be according to the instruction of striking method.

8.3.2 Embedding Method

8.3.2.1 Pre-boring

a) General Requirements