PART S16

CAST-IN-PLACE CONCRETE PILES

CONTENTS

1. GENERAL

.1 This Part specifies the requirements for the installation of drilled, cast in place, reinforced concrete piles, which do not use permanent casing. It does not cover continuous flight auger piles (refer to Part S17 “Continuous Flight Auger Piles”).

.2 The Contractor is responsible for:

(a) providing the detailed design of the piles to achieve the specified Design Geotechnical Strength (unless a detailed design has been specified by the Principal);

(b) the installation of piles that achieve the Design Geotechnical Strength and design durability; and

(c) verifying that the Design Geotechnical Strength has been achieved in practice.

.3 Unless specified otherwise in the **Contract Specific Requirements** or on the drawings, piles must be designed and constructed in accordance with the methods specified in AS 2159 and AS5100.3.

.4 Documents referenced in this Part are listed below:

AS 2159	Piling – Design and Installation.
AS 5100.3	Bridge Design – Foundations and Soil Supporting Structures.

2. QUALITY REQUIREMENTS

.1 At a minimum, the Contractor’s Quality Plan must include the following documents, procedures and instructions:

(a) the concrete mix design(s), including test results for mix designs, verifying the ability to achieve specified requirements;

(b) details of proposed boring equipment to be used and evidence of its capacity to carry out the work;

(c) proposed recording forms to be used during construction and testing;

(d) methodology to ensure pile location and verticality tolerances are met;

(e) methodology for boring;

(f) safety requirements to ensure that fall protection is in place whenever an open excavation exists;

(g) where appropriate, the type of drilling mud and the means of maintaining head levels;

(h) methodology to monitor and prevent contamination by ingress of loose material, ground water or mud during pile construction;

(i) methodology for placing shaft concrete;

(j) method of cutting and breaking back of piles; and

(k) details of the proposed integrity test and load test methods, including the name and qualifications of any specialist sub-contractors and a method statement of how the test will be carried out and details of the record sheets proposed for monitoring results.

.2 If not provided beforehand, the documentation must be submitted at least 28 days prior to the commencement of piling works.

.3 Provision of the documentation listed in this Clause shall constitute a **HOLD POINT**.

3. MATERIALS

.1 Concrete must be in accordance with Part CC20 "Supply of Concrete". Reinforcement must be in accordance with Part CC05 "Steel Reinforcement". Longitudinal reinforcement must be supplied in full lengths.

4. PILE CONSTRUCTION

Excavation

.1 The Contractor must ensure that the method of construction prevents collapse, ingress of contaminants and material falling in from the surface. If temporary steel casing is used for this purpose, any holes bored prior to placing the casing in position must be drilled with a bit not more than 25 mm larger than the outside diameter of the casing.

.2 Services or adjacent structures must not be damaged by the piling operations. Where percussion equipment is used, the level of energy per blow of the drilling bit must be kept to the minimum consistent with effective boring, so as to minimise vibration, and avoid damage to adjacent piles, structures or services.

.3 At the completion of excavation and prior to placing concrete, a **HOLD POINT** shall apply.

Protection of Adjacent Piles

.4 The Contractor must ensure that the pile construction process does not result in damage to adjacent newly cast piles due to ground vibration. The following minimum requirements must also be met:

.5 Pile construction must not be commenced within 2.5 m clear distance of a newly cast pile until the concrete in the pile has attained a strength of 15 MPa;

.6 Piles more than 2.5 m clear distance from a newly cast pile may be installed by boring at any time providing there is no likelihood of damage to the newly cast piles; and

.7 Installation of piles by methods which involve driven temporary casing or result in significant vibration must not be carried out within the distance 2.5 m to 9.0 m until the concrete in the pile has set for 24 hours.

Concrete Placement

.8 Piles must be concreted within 24 hours of completion of the pile excavation. In the event that this is not achieved, the Contractor must ream the walls and the base of the pile to remove not less than 25 mm thickness of material and any other foundation material which has softened in that time.

.9 Concreting must be a continuous process from the toe level of the pile to the top of the pile such that no voids or debris are left in the shaft and the required concrete compaction is achieved without segregation of aggregate or ingress of contaminants. The surface of the concrete must be in intimate contact with the surrounding ground.

.10 The reinforcement must be firmly positioned so that it does not move during concrete placement and is fully surrounded by the specified cover of sound concrete.

.11 If temporary casting is being used and concrete is being placed below the water table, the minimum height of concrete within the casing must be adjusted to ensure that water is not permitted to enter from outside the casing. The soil pressure at the toe of the casing must be balanced by the mass of the concrete within the casing. The free surface of the concrete must be at least 1.5 m above the bottom of the casing.

.12 A minimum of 400 mm of sound concrete must be constructed above the final level of the pile. The space between the top of the pile and the ground surface must be filled with sand within 30 minutes of placing the shaft concrete. Piles must not be trimmed earlier than 24 hours after casting the concrete.

5. TOLERANCES

.1 All piles must be constructed in accordance with the tolerances in AS 2159.

6. TESTING OF PILES

Integrity Testing

.1 Integrity testing must be carried out on the piles in accordance with integrity test methods specified in AS 2159. Integrity testing equipment must be capable of checking cross-sectional irregularities in piles and identifying the location and characteristics of any significant anomalies such as voids or contaminants.

.2 Acceptance criteria, supervision and reporting of integrity testing must be in accordance with the requirements of AS 2159.

.3 Unless specified otherwise, integrity testing must be carried out on all piles.

Load testing

.4 The Contractor must carry out dynamic testing of piles to confirm that design pile capacity has been achieved. At least one dynamic load test must be performed for every 30 piles. Additional dynamic load testing must also be carried out on piles in the event that pile toe levels vary by more than 2 metres from the test pile.

.5 Testing must be carried out by use of a Pile Driving Analyser (PDA) and the data obtained from each pile must be analysed using CAPWAP, TNOWAVE or other approved equivalent software.

.6 Additional load testing requirements (including static load tests) may be specified in the Contract Specific Requirements or on the drawings.

.7 The test procedure and test reports must conform with the requirements of AS 2159, and two copies of a report showing the measured field parameters and the results of analysis to determine pile capacity must be provided.

.8 The measured ultimate capacity of test piles must be equal to or greater than the pile test load specified in the Contract Specific Requirements or on the drawings.

Test Results

.9 Submission of the test results shall constitute a **HOLD POINT**.

7. HOLD POINTS

.1 The following is a summary of Hold Points referenced in this Part:

CLAUSE REF.	HOLD POINT	RESPONSE TIME
2	Submission of Procedures	14 working days
4.1	At the completion of excavation	1 hour
6.	Submission of test results following the installation of a group of piles	6 hours

8. RECORDS

.1 The Contractor must provide continuous records for each pile. The data recorded must include the following:

(a) Diameter, length, location and type of pile and date of boring;

(b) Concrete batch details, properties and slump;

(c) All information regarding obstructions, delays and other interruptions to the sequence of work;

(d) Integrity testing results; and

(e) Where specified, results of ultimate resistance tests.