

# Federation of Piling Specialists Testing Datasheet No 1



## Guidance for the Principal Contractor

It is an essential requirement that the specialist testing contractor is allowed to work in a safe way and fully in accordance with their own procedures.

### 1. Static Load Testing of Piles

#### Introduction

The piling work on this site may require one or more pile maintained load tests. These tests can be of two types:

- **Preliminary Test:** This is a test carried out on an expendable pile in advance of the main piling work. The pile is usually tested until it fails and the results are used to refine the design of the subsequent working piles.
- **Working (or Proof) Test:** This is a test carried out on a working pile and the test load is usually limited to 50% over the design load to avoid overstressing the pile or the ground. This test is to check that the piles are capable of bearing the loads imposed on them.

The test piles (and reaction piles/anchorages, if any) will be installed by the piling contractor. The loading test will be carried out by a specialist testing contractor. After installation, any concrete cast-in-situ piles are left for a minimum period of 7 days or until the concrete has gained sufficient strength.

#### Pile Protection between Installation and Testing

Between installation and testing, the test pile and reaction piles/anchorages must be protected from damage and interference, specifically:

- Reaction piles are normally reinforced with prestressing bars which protrude from the piles to allow connection to the test beams. The bars are formed from high grade steel which can be damaged by heat or bending. The test area must therefore be **barriered off** from plant movement and no hot work allowed in the vicinity. In the unfortunate event of a bar being bent, it must never be straightened, but the piling contractor should be informed so that they can re-end the bar. This may require the breaking down of the pile.
- No excavations must take place around reaction piles/anchorages as these have been designed assuming ground level remains undisturbed. Excavations or loosening of the ground can cause these to pull out, stopping the test. A repeat test will severely disrupt your program!

#### Testing

The testing contractor will need road access from the public highway to the test location for the lorries which contain test beams and the data-logging cabin. The lorries will need to be able to park adjacent to the test pile to enable the data cables to run from the data cabin to the test assembly without interference. The lorries will also need to be able to park a safe distance from the test area.

The area around the test must be made suitable for the technician to safely work, i.e. levelled, hard-cored and without trip hazards or excavations.

An exclusion zone will need to be established around the area of the test, clearly marked and signed. This zone then becomes a **restricted** area.

During the test, no work that could cause vibration should be carried out adjacent to the test as the measurements being made may be affected.

The Principal Contractor can usually mitigate the disruptive effects of complying with the above requirements by careful selection of the location of the pile(s) to be tested.

### **Overnight Working Attendance**

The Engineer's Specification for the load testing normally requires the load to be maintained and measurements made continuously from the commencement to the completion of the test over a period of about 20 hours. This will invariably mean that monitoring will continue overnight. The testing contractor's risk assessment addresses the issue of lone working, however the Principal Contractor will need to also make the following provision outside of normal working hours;

- General site illumination.
- Access and egress will need to be maintained and security provided where appropriate.
- Although the technician will provide his own food and drink which he can consume in the data cabin, access to toilet and washing facilities must be provided in accordance with the Health and Safety at Work Regulations.
- An emergency contact number should be provided to the technician.

The testing contractor will normally try to commence the test before lunchtime so that the "6 hour hold" which comes about 12 hours into the test is reached before midnight, thus minimising the work needed overnight.

## **2. Dynamic and Rapid Load Testing of Piles**

### **Introduction**

The test pile will be installed by the piling contractor. These tests do not require reaction piles/anchorages. The loading test will be carried out by a specialist testing contractor. After installation, any concrete cast-in-situ piles are left for a minimum period of 7 days or until the concrete has gained sufficient strength.

### **Pile Protection between Installation and Testing**

Between installation and testing, the test pile must be protected from damage and interference.

### **Testing**

The testing contractor will need road access from the public highway to the test location for the lorries which contain the testing equipment. The lorries will also need to be able to park a safe distance from the test area. Craneage or piling rigs will also need safe access to the test location.

The area around the test must be made suitable for the technician to safely work, i.e. levelled, hard-cored and without trip hazards or excavations.

An exclusion zone will need to be established around the area of the test, clearly marked and signed. This zone then becomes a **restricted** area.

During the test, no work that could cause vibration should be carried out adjacent to the test.

The Principal Contractor can usually mitigate the disruptive effects of complying with the above requirements by careful selection of the location of the pile(s) to be tested.

### **Overnight Working Attendance**

These tests will not normally be carried out at night.

### **3. Integrity Testing**

It is normal practice to carry out a test on the integrity of the piles after they have been trimmed to cut-off level. To enable this test to be carried out, the Principal Contractor should note that:

- The pile need to be trimmed down to cut-off level.
- A safe access needs to be provided for the test technician to gain access to the head of the pile.
- The pile cap/ground beam excavation must be clear of any standing water.
- The pile cap or ground beam reinforcement must not be in place.
- Although a thin layer of blinding can be in place around the pile, it must neither cover the pile nor be greater than 75mm thick.

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## Testing Datasheet No 2

### Pile Testing - Interpretation

#### Pile Load Testing

Normally the specialist testing contractor undertakes the load test, takes measurements and then reports the factual data.

The pile designer (whether piling contractor, Engineer, or another party) then interprets the factual data within the context of the design as they should have full knowledge of all the relevant information.

This note is applicable to those interpreting all types of pile load test (including static, dynamic and rapid tests).

#### Competence requirement for persons interpreting a Pile Load Test

There are no formal academic qualifications available for interpreting the results from a pile load test, but the following attributes should be demonstrable by any person carrying out such an interpretation;

1. The person must be able to demonstrate competence in the testing method and an understanding of the limitations of the method in relation to the intended use of any results obtained.
2. The person must be able to evaluate the results within the context of the design.
3. The person must be able to communicate findings obtained from the test to a third party who is possibly not competent in pile testing.

#### Pile Integrity Testing

Normally the specialist testing contractor undertakes the test, takes measurements and then reports the factual data with an assessment of the results.

The piling contractor should also carry out an assessment of the results and act upon any anomalies.

This note is applicable to those interpreting all types of pile integrity test (including sonic echo, transient dynamic response and cross hole sonic logging).

#### Competence requirement for persons interpreting a Pile Integrity Test

There are no formal academic qualifications available for interpreting the results from a pile integrity test, but the following attributes should be demonstrable by any person carrying out such an interpretation;

1. The person must be able to demonstrate competence in the testing method and an understanding of the limitations of the method in relation to the intended use of any results obtained.
2. The person must be able to demonstrate an understanding of their own company procedures.
3. The person must be able to evaluate the results within the context of the design.
4. The person must be able to communicate findings obtained from the test to a third party who is possibly not competent in pile testing.

## Testing Datasheet No 3

### Training Programme for Pile Testing Technicians

Any company undertaking pile testing should have a training scheme in place in a form similar to that below. This is to be substantiated by company training records.

<b>Trainee Pile Testing Technician</b>  <b>Name:</b> .....  <b>Training Programme</b>	<b>Person responsible for arrangements</b>
<b>Induction</b>	
Company Policies & Procedures	
Company - General Site Rules	
Company Reporting Routes	
Roles and Responsibilities	
Environmental Awareness Training	
Spill Kit & Fire Extinguisher Training	
1 Day Construction Site Safety Awareness Training	
CSCS Touch Screen Awareness Study	
CSCS Touch Screen Test	
Safe use and wearing of PPE & Safety Harnesses	
Slinger / Signaller	
Manual Handling	
Safe Use of Equipment Briefing / Familiarisation	
<b>Site Experience</b>	
Accompanied Pile Testing	
Pile Testing unaccompanied	
<b>Reviews / Reports</b>	
Initial	
Interim	
Issue of company competence card	
<b>Records</b>	
Log book	

Note: not all of these are applicable for every type of pile test

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## Testing Datasheet No 4

### The Purpose of the Pile Load Test

To encourage an appropriate strategy for pile load testing it is recommended that the pile designer informs the pile tester the type and purpose of the specified pile load test. This could be one or more of the following;

- To be a preliminary or expendable test pile (with or without an extended CRP test at the end)
- To be a proof load test on a working pile
- To measure test pile load-settlement behaviour at the Design Verification Load
- To measure test pile load-settlement behaviour at a load different to the Design Verification Load
- To measure the ultimate capacity of the test pile
- To predict the ultimate capacity of the test pile
- To check workmanship of the test pile
- To investigate the integrity of the test pile

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## Testing Datasheet No 5

### Pile Load Testing - What each test type should realistically achieve

#### Static

1. The test is carried out to a specified method of applying a static load incrementally to the test pile head and measuring the pile head deflection under the applied load.
2. Static load testing will give information about the deflection versus time and load versus deflection characteristics of the pile.
3. The test results should be presented graphically in the form of load and deflection versus time and load versus deflection. The results should also be presented in tabular form.
4. The load versus deflection curve will provide the pile designer with data to assess the suitability of the pile to support the structure.
5. If the pile fails to meet the specified performance criteria during the test the data can be analysed to indicate the mode of failure.

#### Dynamic

1. The test is carried out to a specified method of applying a dynamic load to the head of the pile using a pile hammer or drop weight. The resulting pile head forces and displacements are measured (or derived from other parameters) versus time and this data is subsequently analysed.
2. If carried out on a driven pile during driving the test will provide information on pile hammer performance, pile driving stresses and the bearing characteristics of the pile during and at the end of driving.
3. If carried out on a driven pile by restriking the pile, at some time after initial driving or on a cast in place pile, the test will give information about expected pile performance under static load.
4. The test results should include the measured (or derived) force and velocity versus time graph, the computed static load versus deflection (and if required the load distribution along the pile shaft and pile end bearing). All test results should be presented graphically and numerically.
5. Depending upon site factors the test can be used on its own or in conjunction with static load testing to assess the suitability of the pile to support the structure for which it was designed.
6. The test also provides information that can be used to interpret pile integrity.

#### Rapid

1. The rapid load test is carried out to a specified method of applying a load to the pile head utilizing a reaction system and a rapid-burning fuel. The resulting pile head forces and displacements are measured versus time and are subsequently analysed using computer software.
2. The test results should include the measured force and velocity versus time graph, and if required the computed static load versus deflection. All test results should be presented graphically and numerically.

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## Testing Datasheet No 6

### Pile Load Testing – Basic information to be provided to the Testing Contractor

#### **General**

Full site address  
Site location map  
Contract identification number  
Principal contractor name  
Engineer's name  
Client/Employer's name  
Number of pile tests  
Type of pile test  
Testing specification  
Any particular site restrictions and site specific safety rules  
Details of site induction(s)  
Piling contractor's office and site contact details  
24 hour piling contractor's contact details

#### **Pile Information**

Identification (number and location)  
Pile diameter or width  
Piling technique  
Ground conditions  
Specified Working Load (SWL)  
Design Verification Load (DVL)  
Unfactored Negative Shaft Friction Load (NSF)  
Peak Test Load  
Design Factor of Safety  
Platform level at pile position  
Pile cut-off-level  
Test pile head level  
Vertical test pile or raking, tested in compression, tension, or laterally  
Pile length in ground  
Level of pile toe  
Dimensions of any permanent casing or cast-in steel members  
Whether test pile incorporates any instrumentation  
Details of reaction arrangement  
Bar size provided in any reaction piles  
Test pile cap details  
Date and time of casting concrete pile cap

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## Testing Datasheet No 7

### Pile Load Testing – Test Cap

#### General

Dimensions for the test cap should be agreed with the testing contractor prior to its construction. The test cap must be designed and constructed so that it;

- Is concentric with the centre of pile (with a stated allowable tolerance)
- Is able to safely transfer all the vertical and any other induced forces from the cap into the pile
- Comprises a continuous uniform section without any inclusions.

The design and/or the method statement should made be available to the Principal Contractor or Engineer upon request.

If not constructed integral with the pile then the ICE Specification for Piling and Embedded Retaining Walls requires concrete test cubes to be taken from the concrete used to cast the cap.

#### Dynamic Testing

Specifically for a dynamic load test the cap must also be designed to withstand bursting under impact.

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## Testing Datasheet No 8

### Pile Load Testing – Working Platform

#### Why it is important to adequately maintain the working platform until the end of all piling activities

- The working platform provides access for all piling plant, labour and testing activities
- The working platform must be designed, constructed, maintained and repaired so as to always provide the safe access for all piling plant, labour and testing equipment
- The working platform must have a specified design life, which is to begin before the piling contractor starts work on site, and must not end at least until all piling works (including pile construction, load testing, investigation of any non-conformances and the repair or replacement of any piling works) are completed
- The FPS Working Platform Certificate, or similar, is to be used
- If the working platform is to be constructed or removed in phases whilst any piling works are still ongoing, then the extent of these works shall be clearly described to, and agreed with, the piling contractor
- Note that pile load testing will require safe access to the test pile position for lorries, craneage and labour, both for erection of the test and for the dismantling of the test afterwards.

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## Testing Datasheet No 9

### PILE STATIC LOAD TESTING – LONE WORKING

#### Procedures for Lone Working during Static Pile Load Tests

- 1 Pile maintained load testing usually requires the imposition and maintenance of a load on a pile while its settlement or other characteristics are monitored. The loading and unloading can typically take 12 to 24 hours, however longer test periods are sometimes necessary. Part of the load test therefore may occur overnight.
- 2 During night-time work, the Principal Contractor's responsibilities for safety and security must be maintained, including: welfare facilities, site and personal security, lighting (both area and task), pedestrian walkways to the working area and emergency preparedness.
- 3 Should the pile test behave in an unpredictable manner suggesting failure of the ground, structural failure of the pile itself or failure of the loading system, the test should be terminated and no change in loading applied until a proper engineering assessment has been carried out. The test technician should not attempt to correct the test equipment whilst alone.
- 4 During any period where a lone worker is to be employed, the testing contractor must provide a lone worker risk assessment to the piling contractor, including procedures to cover for possible injury or ill health.
- 5 Prior to carrying out any work alone, the technician must exchange contact phone numbers with the piling contractor's supervisor. Similarly the piling contractor's supervisor must exchange contact numbers with the Principal Contractor's site manager.

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## Testing Datasheet No 10

### Pile Integrity Testing - A Good Practice Guide

- 1 Pile integrity testing is normally carried out after the piling contractor has left site. It is important therefore that the piling contractor provides the Principal Contractor with a specified contact person who will arrange for testing to be carried out when requested.
- 2 The contract documentation will normally specify how many visits to site are allowed to carry out the integrity testing or the minimum number of piles to be tested at each visit. This aspect can be usefully addressed during the pre-start or subsequent progress meetings.
- 3 It is good practice for the Principal Contractor to be provided with guidance on the preparation of piles for testing, specifically that:
  - The pile needs to be trimmed down to sound concrete.
  - Safe access needs to be provided for the test technician to gain access to the head of each pile.
  - The pile cap/ground beam excavations must be clear of any standing water.
  - The pile cap or ground beam reinforcement must **not** be in place.
  - Although a thin layer of blinding can be in place around the pile, it must neither cover the pile nor be greater than 75mm thick.
- 4 Where the integrity test results indicate there is an anomaly in the pile, the Principal Contractor should be advised at the earliest opportunity so that potential problems can be promptly addressed. It should be noted that anomalies identified at the time of testing may be re-evaluated after processing of the data. Hence, sufficient time in the Principal Contractor's programme should be allowed for dealing with any potential anomalies.

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## Testing Datasheet No 11

### Pile Integrity Testing – Basic information to be provided to the Testing Contractor

#### **General**

Full site address  
Site location map  
Contract identification number  
Principal contractor name  
Engineer's name  
Client/Employer's name  
Number of pile tests  
Type of pile test  
Any particular site restrictions and site specific safety rules  
Details of site induction(s)  
Piling contractor's office and site contact details

#### **Pile Information**

Identification (numbers and locations)  
Pile diameter or width  
Piling technique  
Ground conditions  
Platform levels  
Cut-off levels  
As-built pile lengths in ground for every pile to be tested  
As-built levels of pile bases  
As-built toe levels of pile reinforcement  
Dimensions of any permanent casing or cast-in steel members  
Details of any flared heads or enlarged pile bases

The following information may be requested after the test;

- concrete overbreak or undersupply
- records of construction or concreting sequence

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## Testing Datasheet No 12

### **Pile Integrity Testing - why it is important to allow enough time between pile integrity testing and pile cap construction**

- Pile integrity testing is an important part of the pile construction process
- There is a small risk that the pile might be damaged after construction, either by the ground itself or by the following site activities
- When pile damage or an anomaly has been identified, it is important that the appropriate measures are then carried out;
  1. the integrity test result must be reviewed by a competent person
  2. the pile construction record must be reviewed and compared to the pile integrity test result
  3. if after data processing there is still doubt regarding the pile quality, an inspection must be made, normally requiring excavating around the pile or coring through the pile
  4. if a problem is found to exist, remedial measures will then need to be designed, approved and installed
- Hence, it is important that the site programme is designed to allow the time for reporting the pile test results and for any subsequent checks and remedial actions, if any, to be carried out

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## Testing Datasheet No 13

### Pile Integrity Testing - terminology

Different testing contractors use slightly different terminology for the assessment of piles. Terminology similar to that below is recommended;

<b>Assessment by the testing contractor</b>	<b>Description</b>	<b>Site actions required to be carried out by the main contractor</b>
OK	Pile acoustically satisfactory	None - proceed
Trim and re-test	Anomaly identified at pile head	Trim pile to sound concrete and schedule a new integrity test with the testing contractor
Review	Acoustic review needed after detailed analysis or upon receipt of further information	Contact piling contractor Piles to be left alone unless agreed with piling contractor

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## Testing Datasheet No 14

### Pile Integrity Testing using Cross Hole Sonic Logging

#### Criteria for Evaluating Data

Cross Hole Sonic Logging evaluates the concrete quality in piles by passing an acoustic signal between a transmitter lowered into an access tube and a receiver lowered into a second tube.

The most common criteria for evaluating the data are the First Arrival Time (FAT) and the signal energy. Quantitative evaluation of concrete piles using the limits below is recommended;

<b>Evaluation</b>	<b>Increase in FAT</b>		<b>Reduction in signal energy</b>
<b>Good</b>	0 to 10%	and	< 6 dB
<b>Questionable</b>	11 to 20%	or	6 to 9 dB
<b>Flaw</b>	21 to 30%	or	9 to 12 dB
<b>Defect</b>	> 31%	or	> 12 dB

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## Testing Datasheet No 15

### Pile Testing - Safety

Specific hazards for pile testing may include but are not limited to the following;

#### 1. Load Testing

- Manual handling of items of test equipment.
- The forces induced in the test equipment during testing can be very large indeed. Thus a clearly marked and signed exclusion zone must be created around the test area and access restricted.
- During the test the following substances may be used: batteries, oxygen free nitrogen, petrol/diesel and hydraulic oil. The appropriate COSHH sheets are to be made available upon request.
- Working at height during erection and dismantling of the test equipment.
- The area around the test must be made suitable for the technician to safely work, i.e. levelled, hard-cored and without trip hazards.
- Safe and maintained access to the test area for lorries and plant.
- Lifting operations.
- Use of Working Platform Certificate for the platform within and around the test area.
- No excavations must take place around the test area.
- Specific arrangements for lone working.

#### 2. Integrity Testing

- A safe access needs to be provided for the test technician to gain access to the head of the pile.
- The pile cap/ground beam excavation must be clear of any standing water.
- The pile cap or ground beam reinforcement must not be in place otherwise there will not be safe access for the technician and protruding tie wire can cause injuries.

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