

## VIBRO-COMBI-PILE / TERRA-COMBI-PILE



### Characteristics of the piling system

Cast-in-situ, soil displacing, vibration free concrete pile, with a prefabricated concrete core.

#### Construction

##### Description:

1. A steel auxiliary tube, with a footplate, is installed at ground level.
2. The tube is installed by driving from the top.
3. When the desired level is reached the prefab concrete core will be driven in the tube, after checking that the tube is dry and free of soil.
4. The tube is filled with cement grout. (At the Terra-combi-pile a bentonite casing will be made in the slack undercoats above the grout body for reduction of the negative friction).
5. The tube is withdrawn by means of driving out with a piling hammer Terracon's standard method) vibratory block or (ring) vibrator.
6. The pile is finished and the pile-driving frame can move on.

#### Materials

1. Details of the pile-driving frame.
  - a. Junttan PM 25, PM 30, IHC F3500, CX 700 GLS, Woltman 900 HPDR or Sennebogen S6100XLR.
  - b. Heaviest component from around 0.30 to 1.5 MN, depending on frame type.
  - c. Method of transport to site: low loader.
  - d. Additional equipment required: shovel for horizontal transport on site, an auxiliary crane or concrete pump is sometimes used with difficult to access pile locations.
  - e. Method of transport on site, self propelled piling machine.
  - f. Maximal accessible gradient: 1:7.

#### 2. Capacity of driving equipment

Hydraulic drop hammer (Junttan HHK 5A, 6A en 9A) and hydro hammers (IHC S35, S70 of S90) with driving energy up to around 100 to 120 kNm.

#### 3. Vibration level

This system cannot be regarded as vibration free.

#### 4. Noise level

Maximum around 105 to 107 dB(A) at 10 m<sup>1</sup>. The frequency of the noise is relatively high.

#### Properties

##### 1. Diameters

The diameter of the square section prefabricated concrete core is compatible with the dimensions of the drilling auxiliary tube. Sufficient space needs to be left around the core for a cement grout casing 50-100 mm thick.

##### 2. Available pile lengths

Pile length is dependent on installation method, where the slenderness of the prefabricated core must be taken into account. AS a general rule the maximal length is around 80 to 90 times the diameter of the prefabricated element. Executed projects with lengths to abt. 40 metres by Terracon.



### Load bearing capacity/deformation behaviour

#### 1. Geotechnical load bearing capacity

##### a. Piling classification factors in accordance with NEN 9997-1

- Pile tip  $\alpha_p \beta = 0,7 = 1.0$  with the standard tube/foot plate dimensions. A lower factor must be applied in the case of relatively large foot plate dimensions, in accordance with standard NEN 6743.

Where cement grout casing is used,  $= 1,0$ .

##### • Skin friction

$a_s = 0.012$  where the tube is withdrawn using vibration.

$a_s = 0.014$  where the tube is withdrawn using a driving block Standard Terracon method.

##### b. Supplementary requirements for load bearing calculations: not applicable.

##### c. Deformation under load: similar to type 1 in NEN 9997-1

##### d. Loading spectrum: up to around 2000-4000 kN pressure (calculated value).

#### 2. What is regarded as the pile level?

Foot plate level.

#### 3. Methods of increasing geotechnical load bearing capacity Application of cement casing (injection).

##### a. Negative skin friction can be reduced by omitting the casing of the prefabricated core in the area of the compressible ground strata.

Negative skin friction can be reduced more.

##### b. To apply a bentonite casing over the top of the core (Terra-combi-paal).

#### Potential applications

##### 1a. Application with large variation in ground conditions Good applicable.

##### 1b. Application with weak soils strata

There is no possibility of a discontinuous pile shaft thanks to the use of a prefab pile core.

#### 2. Possible rake

Supplementary measures will be required with piles with substantial rake, because of the need to centre the core.

#### 3. Application in restricted space: not possible

#### 4. Minimum centres for insertion

Dependent of the implementation manner. The rules for cast-in-situ piles apply.

#### 5. Minimum distance between adjacent piles for purposes of insertion

Dependent on the materials used, the situation and the installation method.

As a general rule, 0.6 m<sup>1</sup> mm

#### 6. Installation in open water

This system can in principle be used in open water. The level of the top of the cement grout casing is then at bottom level while the prefabricated core can be installed at a higher level.

#### 7. Suitability in open water.

Suitable for use as a tension piling as the result of the presence of the prestressed core. The Vibro-Combi-Pile and Terracon-Combi-pile is ideal for recessed installation, with the prefab pile core provided with internal ribbing to achieve a hechting aan onderwaterbeton te bewerkstelligen.

#### 8. Supplementary requirements/observations.

Not applicable

### Quality and safety

Terracon have in place a certificated quality and safety system to NEN-EN-ISO 9001:2015 and SCC Petrochemical and Safety Awareness Certificate 3".

The piles are manufactured in accordance with the projectspecific quality and safety plan, which includes an inspection plan.



TERRACON FUNDERINGSTECHNIEK B.V.

Vierlinghstraat 17 | 4251 LC Werkendam |

Postbus 49 | 4250 DA Werkendam |

T: 0183 40 13 11 | E: info@terracon.nl |

I: www.terracon.nl |