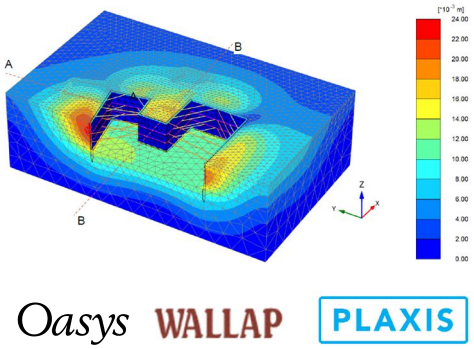

Oasys WALLAP PLAXIS

Report for

Sweet Group

Project Alliance, Hayes

Working platform design

Prepared by:
Sam Cabbani

Approved by:
Sebastian Draghici

Location:
Hayes Middx

Ref:
42442A1

Date:
7th September 2020

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FPS EXCELLENCE IN GEOTECHNICAL ENGINEERING

Document Verification

Rev.	Date	Prepared	Approved	Comments
C1	23.10.2019	S. Cabbani TMICE CIOB Estimating Director	S. Draghici, MSc Eng Technical Manager	Construction issue

Contents

Appendices

1 Design Brief

Enclosed is the working platform design for the piling works required at Project Alliance, Bulls Bridge, North Hyde Gardens, Hayes, Middx UB3 4QQ.

The client for the present document and piling works is Sweet Group.

The proposed method for the installation of the piles will be continuous flight auger (CFA) using a Soilmec rig SF65. The design is conducted per BRE 470:2004 Working platform for tracked plants.

2 Data Provided

The following documents have been used as the basis for the design:

Table 1. Documents used for pile design

Document type	No.	Revision	Date	Issued by	Comments
Drawing	S-00050	P01		HPF	
Site Investigation Report	3249			IGE	

3 Soil Assessment

3.1 Soil Properties

Soil properties have been chosen based upon the data provided in the IGE SI reports and our experience of the local conditions.

The subgrade for the piling mat identified within the boreholes is a layer of yellow sand or roadstone of pink angular limestone gravel, underlain by made ground generally comprised of sandy, gravelly clay fill soft to firm, extending to a depth between 0.1m and 2.50m.

The Made Ground is underlain by Gravel on this site, followed by London Clay Formation, described as firm to stiff brown/grey mottled clay.

Based on the findings of the soil investigation reports, for design purpose and as a conservative approach, the piling mat is checked for both cases, subgrade of soft clay with a cohesion value of 30kPa or granular material with a friction angle of 30°.

Table 2. Subgrade properties

Soil type	Bulk density kN/m³	Cohesion kN/m²	Soil friction angle [a] °
Sand/Silty Gravel of angular limestone	17	-	30
			-

[a] After Peck et al., 1974, *Foundation Engineering*, 2nd Edition

3.2 Ground Water Table

Groundwater was found at about 1.4mbgl as perched water above the London Clay formation.

During the piling works, the platform should be kept free of any surface water, to prevent the platform being submerged and undermining the stability.

4 Working platform design

4.1 Software and guidance

The software used for the working platform design is an in-house Excel spreadsheet based on the relations indicated in BRE 470.

The BRE 470 guidance of the design of working platform for tracked plants adopts a “punching” failure model, checked against two load cases. First load case is referring to the tracking or handling of the piling rig, whereas the second case is referring to the rig while working (penetrating/extracting).

The relations used and the full design of the piling platform may be found in Appendix 1. The load cases used in design are presented in detail in Appendix 2 to the present design summary.

4.2 Rig details

The piling rig intended to be used for the piling works is Soilmec SF65 and the technical specifications may be found in Appendix 3.

4.3 Results

The calculations indicate that a minimum 580mm thick piling mat (unreinforced) or 540mm (reinforced with a geogrid with a minimum tensile resistance T_{ult} = 30kN/m) is required to withstand the bearing pressures transmitted by the piling rig. The piling mat should be compacted in layers in accordance with the Highways Agency method for compaction of earthworks materials.

Platform material to conform to Type 1 or 6F1 type fill material. Other good quality granular material can be adopted but please note they must be:

- Free from organic material, contamination or substances hazardous to health
- Have less than 15% fines
- Free draining and durable
- Particle size should be less than 2/3 of the layers in which the mat is installed and not greater than 75mm

Since on some locations, soft clay may be found as subgrade, we recommend that a layer of Terram (with the role of separation) is placed beneath the platform material in such areas.

Load testing is needed to ensure the stability of the mat. The mat is to be tested by plate load tests, loaded up to the maximum design bearing pressure of 422kPa using a minimum plate diameter of 450mm.

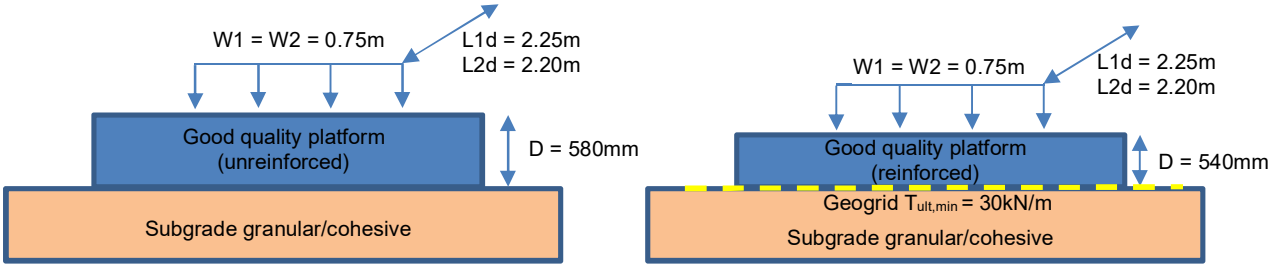

Figure 1 Proposal for piling platform

5 Disclaimer

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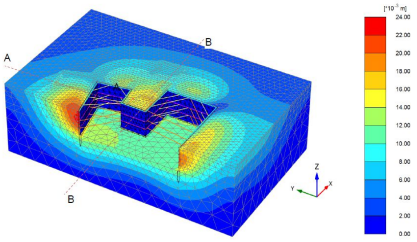
6 References

BRE Construction Division. (2004). *Working platforms for tracked plants: good practice guide to the design, installation, maintenance and repair of ground supported working platforms.*



Project name

North Hyde Gardens, Hayes UB3 4QQ

Piling platform design

Prepared by: Sam Cabbani

Approved by: Sebastian Draghici

Location: North Hyde Gardens, Hayes UB3 4QQ

Ref: 42442A1

Date: 07.10.2020

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Central Piling Technical Department

PILE MAT DESIGN - GRANULAR SUBGRADE

BRE 470 Approach

Version 2.0 - October 2017

42442A1 Project Alliance, Bulls Bridge, North Hyde Gardens, Hayes UB3 4QQ

Rig type: **SF65**

Rig track dimensions and bearing pressures:

Wd=Wk=	0.75	m	q1k=	249	kPa
L1d=L1k=	2.03	m	q2k=	189	kPa
L2d=L2k=	2.20	m			

Design values for ground properties:

Subgrade

Φ'sd=Φ'sk=	30	°
Nγs=	22.4	
γsd=γpd=	17	kN/m3

Working platform

Φ'pd=Φ'pk=	45	°
γpd=γpk=	22	kN/m3
Nγp=	272	(From table A1)
kptanδ=	20	(From table A2)
sc1=1+0.2[W/L]=	1.07	
sc1=1+0.2[W/L]=	1.07	
sγ1=1-0.3[W/L]=	0.89	
sγ2=1-0.3[W/L]=	0.90	
sp1=1+[W/L]=	1.37	
sp2=1+[W/L]=	1.34	

Table A1

Φ'd	Nγ
25°	10.9
30°	22.4
35°	48
40°	109
45°	272
50°	763

Table A2

Φ'd	kptanδ
35°	3.1
40°	5.5
45°	10

Check that subgrade cannot provide bearing resistance without a working platform

Rd=0.5 x γs x Wd x Nγs x sγ= 126.97 kPa

Design loading is calculated for two loading conditions.

case 1 loading: q1d=2 x q1k= 498 kPa

case 2 loading: q2d=1.5 x q2k= 283.5 kPa

Working platform is required for plant support

Check that platform material is stronger than subgrade

Platform material is stronger than subgrade

Check that platform material can provide required bearing resistance

q1d=1.6 x q1k= 398.4 kPa

q2d=1.2 x q2k= 226.8 kPa

0.5 x γ x Wd x Nγp x sγ = 1995 kPa

Platform material can provide the required bearing resistance

Calculate required thickness of platform

D1={Wd[q1d-(0.5 x γs x Nγs x sγ1)]/[γp x Kp x tanδ x sp1]}^0.5= 0.58 m

D2={Wd[q2d-(0.5 x γs x Nγs x sγ2)]/[γp x Kp x tanδ x sp2]}^0.5= 0.35 m

0.58 m piling mat thickness unreinforced

Use of geosynthetic reinforcement

T_{ult}=	30	kN/m
T_d=T_{ult}/2=	15	kN/m

Calculate required thickness of platform with geosynthetic reinforcement

D1={Wd[q1d-(0.5 x γs x Wd x Nγs x sγ1)-(2 x Td/Wd)]/[γp x Kp x tanδ x sp1]}^0.5=	0.54	m
D2={Wd[q2d-(0.5 x γs x Wd x Nγs x sγ2)-(2 x Td/Wd)]/[γp x Kp x tanδ x sp2]}^0.5=	0.27	m

0.54 m piling mat thickness reinforced (with geogrid Tult=30kN/m)

Checking conditions

q1d=1.25 x q1k=	311	kPa
q2d=1.05 x q2k=	198	kPa
Rd1=0.5 x γs x Nγs x sγ1 + (D^2/Wd) x γp x Kp x tanδ x sp1=	401	kPa
Rd2=0.5 x γs x Nγs x sγ2 + (D^2/Wd) x γp x Kp x tanδ x sp2=	398	kPa

Conditions are satisfied for designed thickness of platform

Summary

A 58**0mm unreinforced or 540mm reinforced piling mat** is required with aggregate size no greater than 75mm crushed concrete and should be installed in layers no thicker than 150mm which are vibro compacted and rolled by 5 ton equipment with a minimum of four passes.
This design is based on a subgrade of granular material. If subgrade is found to be different please contact Central Piling. Please note plate load testing is needed to ensure the stability of the mat.

Topsoil should be removed prior to placement of mat material and the made ground encountered will need to be vibrocompacted prior to it going down to improve its bearing capacity to that of a medium dense SAND.

SF-65

Hydraulic CFA
Rotary Rig

CFA

Hydraulic CFA Rotary Rig **SF-65**

soilmec
Drilling and Foundation Equipment

Rotary

Soilmec rotaries are designed and manufactured to meet the need of performance and high production rate on various applications, with the added benefit of increased component life and reliability.

Ease of transport and quick assembly

- Automatic sliding mast for compact transport configuration
- Crawlers can be retracted under 3 m wide.

Compact powerful engine

Soilmec installs large displacement engines, providing exceptional performance and reliability.

- High performance, availability and reliability by using tried-and-tested technology with high power-to volume-ratio.
- The modern electronic injection system ensures low fuel consumption and therefore low operating costs.
- Low noise emissions, smooth running characteristics and durability.
- Meets exhaust emission regulations EU Stage IIIB and US-EPA Tier 4i. Also available EU Stage IIIA and US-EPA Tier 3 diesel engine.

DMS control system

DMS is an innovative system, developed by Soilmec, which controls and monitors the operation of the machine. For ease of operation the system is controlled by a touch screen located in the cab. The system main function, is to enable the machine to perform different functions more efficiently.

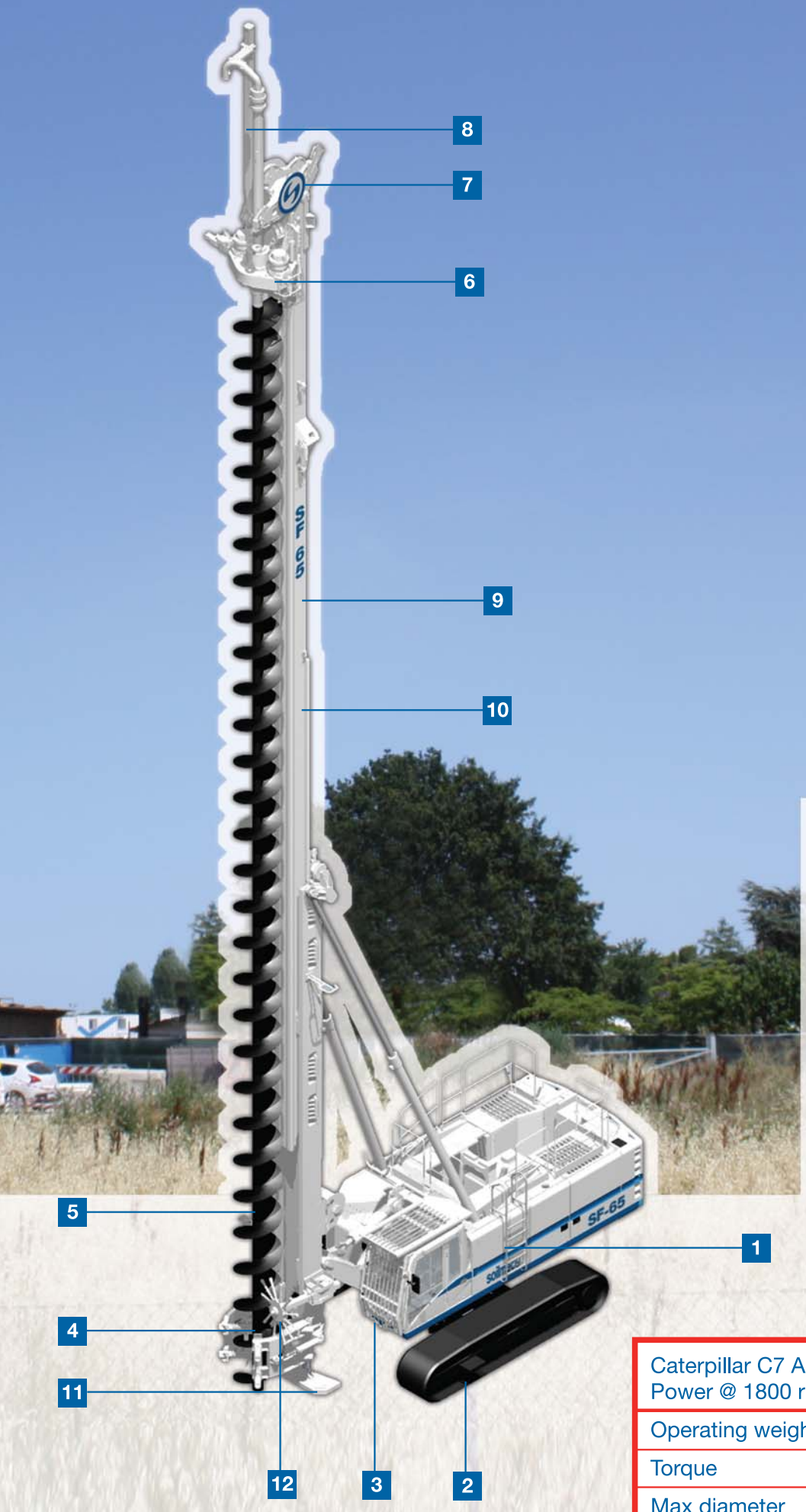
A dedicated power module electronic control system ensures the main pumps and diesel engine work at their most effective and productive levels.

Ergonomic design

The cab is designed to be spacious, quiet and comfortable for the operator, assuring high productivity throughout the working day. Controls are conveniently located for easy operation.

The Soilmec advantage

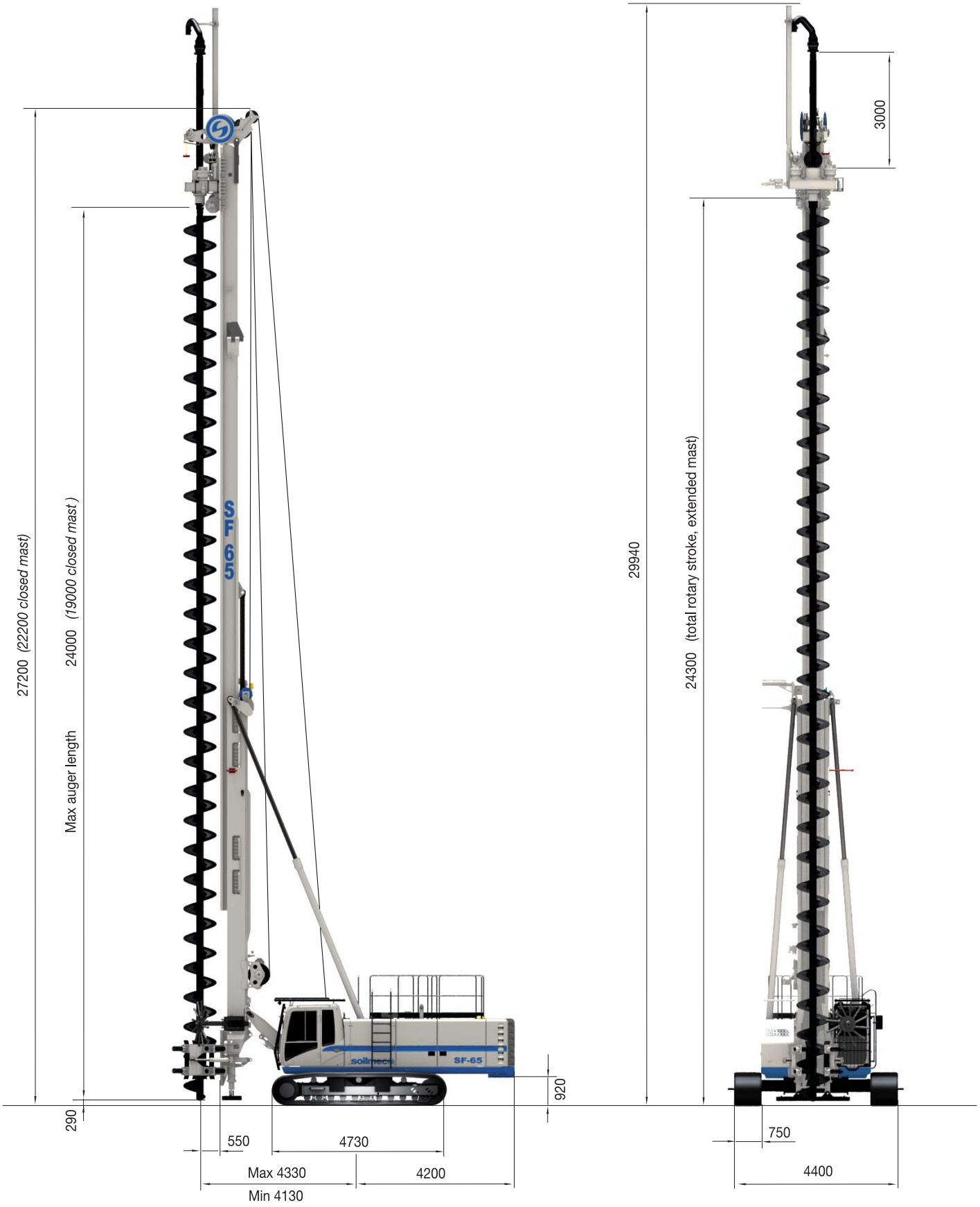
- Long life expectancy with a high residual value.
- Best price/performance ratio.
- Built with the customer in mind.



1 Turret
2 Undercarriage
3 Cab
4 Openable lower guide
5 Continuous flight auger
6 Rotary head
7 Cathead
8 Sleeve extension
9 Sliding mast
10 Mast
11 Foot element
12 Auger cleaner

Caterpillar C7 ACERT Power @ 1800 rpm	**205 kW**	*275 HP*
Operating weight	**53000 kg**	*117000 lb*
Torque	**150 kNm**	*110600 lbft*
Max diameter	**1000 mm**	*39.4 in*
Max depth	**24+3 m**	*79+10 ft*

CFA - CONTINUOUS FLIGHT AUGER



	Overall height fully extended mast	**29940 mm**	*1179 in*
	Overall height closed mast	**24940 mm**	*982 in*
	Operating weight (approx)	**53000 kg**	*117000 lb*
	**Rotary Drive**		
	- Torque (nominal)	**150 kNm**	*110600 lb$_f$ft*
	- Speed of rotation (max)	**31 rpm**	*26 rpm*
	**Main winch**	**controlled descent**	*controlled descent*
	- Line pull (1st layer)	**143 kN**	*32100 lbf*
	- Rope diameter	**22 mm**	*0.87 in*
	- Rope length	**40 m / 100 m**	*151 ft / 328 ft*
	- Line speed (max.)	**68 m/min**	*223 ft/min*
	**Auxiliary winch**	**controlled descent**	*controlled descent*
	- Line pull (1st layer)	**65 kN**	*14600 lbf*
	- Rope diameter	**18 mm**	*0.71 in*
	- Line speed (max.)	**67 m/min**	*220 ft/min*
	**Pull down winch**	**optional**	*optional*
	- Pull down force	**97 kN**	*21800 lbf*
	- Rope diameter	**16 mm**	*0.63 in*
	**Continuous Flight Auger**		
	- Auger cleaner	**star type**	*star type*
	- Max pile diameter	**1000 mm**	*39.4 in*
	- Max pile depth w/o auger extension	**24 m**	*79 ft*
	- Max pile depth with auger extension	**27 (24 + 3) m**	*89 (79 + 10) ft*
	- Max extraction force	**572 kN**	*128500 lbf*
	- Length of auger string	**24 m**	*79 ft*

Soilmec integrates high quality level components: Berco, Rexroth, Trasmital.

Standard equipment

- Emergency mode of operation for engine
- Engine diagnostic system
- Diagnostic panel for hydraulic functions
- Transport securing lugs on crawler units
- Access ladder on upper carriage
- On-board lighting set
- On-board tool set
- Electric refuelling pump
- 360° turret rotations
- Concrete pipe alongside the mast foot
- High-comfort operator's cab
- Protective roof grate *(FOPS compliant)*
- Air conditioning system
- Radio and CD player

Optional equipment

Base carrier

- Central lubrication system
- Biodegradable oil
- Pressurized air conditioning system
- Turret area guard

Drilling Equipment

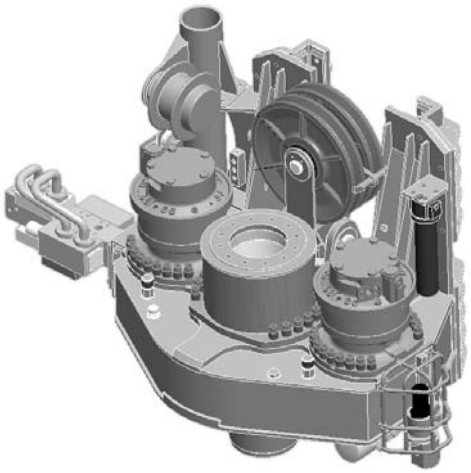
- Swivel for auxiliary rope
- Videocamera attachment

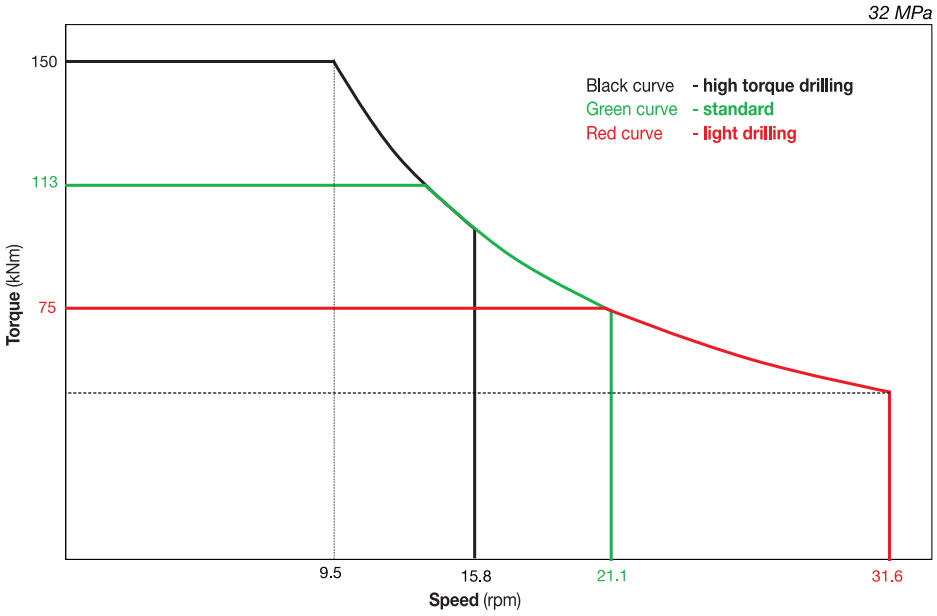
TECHNICAL DATA - BASE CARRIER

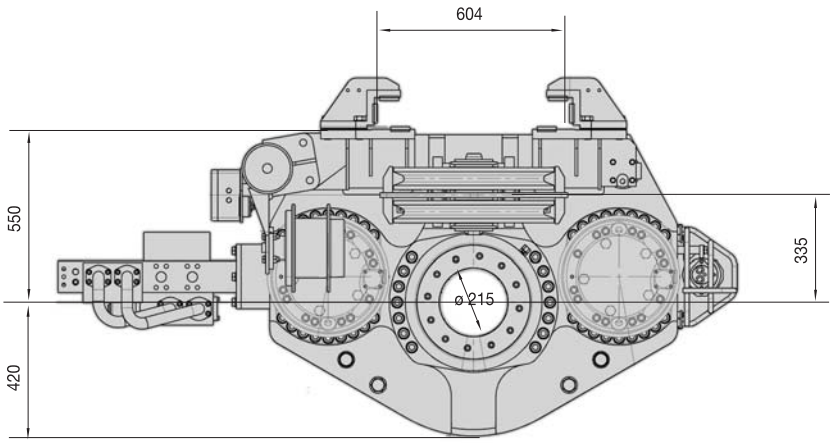
Engine	**CAT C7 ACERT**	*CAT C7 ACERT*
- Rated output ISO 3046-I	**205 kW @ 1800 rpm**	*275 HP @ 1800 rpm*
- Engine conforms to Exhaust emission Standard	**EU stage IIIA / US EPA Tier III**	*EU stage IIIA/ US EPA Tier III*
- Diesel tank capacity	**385 l**	*102 US gal*
- Sound pressure level in cabin (EN791 Annex A)	**75 dB (A)**	*75 dB (A)*
- Sound power level (2000/14EG u. EN791, Annex A)	**108 dB (A)**	*108 dB (A)*
Hydraulic system		
- Main pump	**468 l/min**	*124 US gal/min*
- Working pressure	**32 MPa**	*4640 psi*
Undercarriage (retractable crawler frames)		
- Track shoes width	**750 mm**	*29.5 in*
- Overall width of crawlers retracted	**2980 mm**	*117 in*
- Overall width of crawlers extended	**4440 mm**	*175 in*
- Overall length of crawlers	**4730 mm**	*186 in*
- Traction force	**294 kN**	*66070 lbf*
- Travel speed	**1,9 km/h**	*1.2 mph*

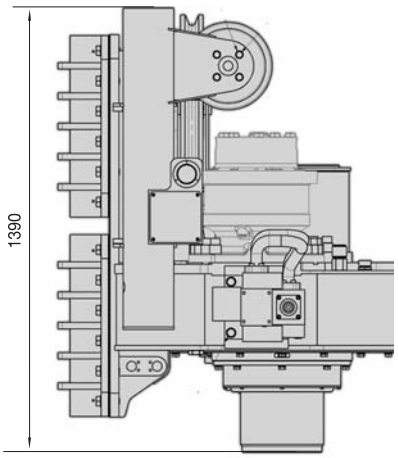
Soilmec integrates high quality level components: Berco, Rexroth, Trasmital.

Rotary RD-130G

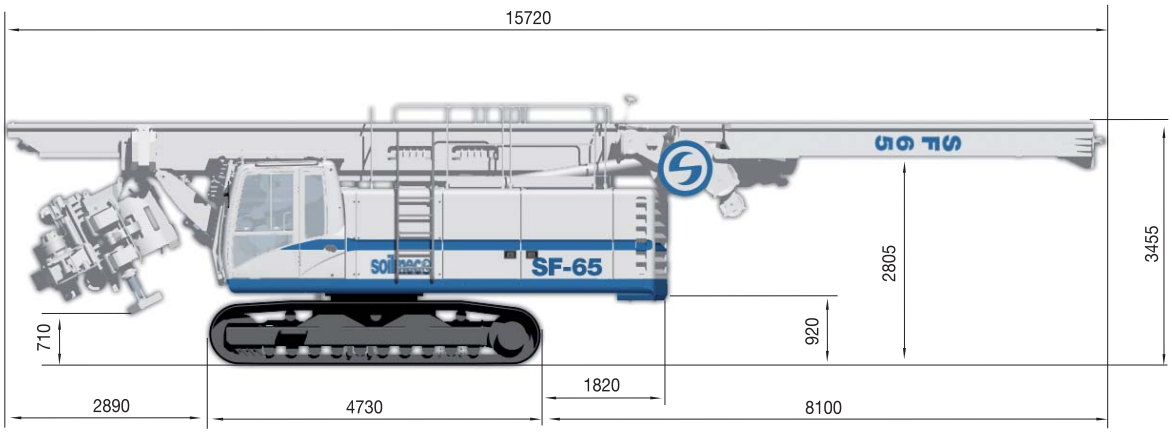








TRANSPORT DATA



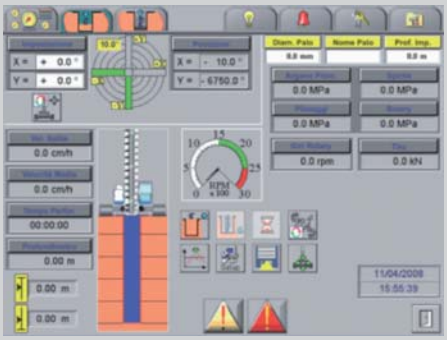
Transport	Weight	49000 kg	108000 lb

FOCUS - DMS

DMS
DRILLING MATE SYSTEM

Soilmec innovative DMS - Drilling Mate System - has been designed to incorporate:
- CAN OPEN bus system
- colour touch screen suitable for the drilling field

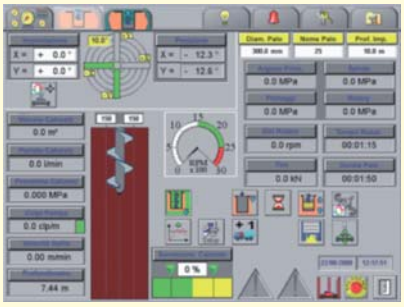
DMS consists of 3 items:
- **DMS**
- **DMS PC**
- **DMS MANAGER**



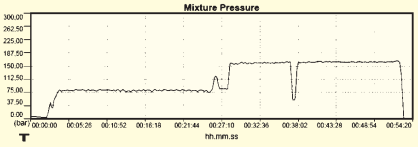
The CFA Soilmec rigs are equipped with the DRILLING MATE SYSTEM (DMS) operated through a 12" touch screen to control and monitoring the operating parameters as well as productive data.

The standard DMS equipment is composed of:
PLC
- controller for all electrically actuated functions
- fault checking and reporting
- monitor unit designed to display:
  - engine information and diagnostic capability
  - pump pressures
  - mast verticality
  - drilling depth
  - rotary speed and pressure
  - crowd pressure
  - graphics drilling charts

The following additional optional features are available:
- automatic turret hole centering
- automatic mast verticality
- recording of operating data on
- memory card



DMS PC software package to o analyze and print production data and job site daily reports



DMS MANAGER for remote control o and transmission of process and operating data and tele assistance

09/2012 - 500 - D - Litografia CILS Cesena

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The complete Soilmec network list is available on the webpage www.soilmec.it

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soilmec
Drilling and Foundation Equipment

Schedule of Piling Rig Component Weights, Dimensions, Forces and Pressures

Rig Manufacturer :	SOILMEC	Rig Type :	SF65
	Operation mode:	CFA	
Completed by: Steve Hadley	15/08/2017	Checked by:	0

Item	Mass (kg)	Moment arm (m)	Moment (kNm)
UPPER WORKS	13190	3.25	420.94
LOWER WORKS	25850	-0.25	-63.27
ROPE / KELLY / CHAIN SUSPENDED EQUIPMENT	10350	4.28	434.90
COUNTERWEIGHT	7450	-3.90	-285.03
OTHER	1190	2.89	33.74
TOTAL	58030	0.95	541.28

Tracks			
Track bearing length (m)	3.9		
Track pad width (m)	0.75		
Distance between centrelines of tracks (m)	3.74		
Front Foot Pads			
Pad Bearing Area (m^2)	2.00	Actual Dimensions	2000mm x 535mm
Pad Maximum Loading (kN)	680.00	Actual Shape	Rectangular
Pad Moment Arm (m)	3.45		
Rear Foot Pads			
Pad Bearing Area (m^2)	0.00	Actual Dimensions	None
Pad Maximum Loading (kN)	0.00	Actual Shape	None
Pad Moment Arm (m)	0.00		
Forces			
Maximum Extraction Force (kN)	572.00		
Maximum Penetration Force (kN)	97.00		
Maximum Auxillary Force (kN)	65.00	Auxillary Force Moment Arm (m)	4.70

Pressure Summary for Platform Design (unfactored)

MODE	BRE LOAD CASE (1 or 2)	Length (m)	Width (m)	UDL Pressure (kPa)
Standing	1	2.25	0.75	211
Travelling	1	2.25	0.75	211
Handling	1	2.03	0.75	249
Penetrating	2	2.46	0.75	123
Extracting	2	2.20	0.75	189
Other	NOT USED	N/A	0.75	N/A

MODE	WARNING MESSAGES	ERROR MESSAGES FOR FORCES		
Standing	None	Auxiliary Line Force OK	Extraction Force OK	Penetration Force OK
Travelling	None	Auxiliary Line Force OK	Extraction Force OK	Penetration Force OK
Handling	None	Auxiliary Line Force OK	Extraction Force OK	Penetration Force OK
Penetrating	None	Auxiliary Line Force OK	Extraction Force OK	Penetration Force OK
Extracting	None	Auxiliary Line Force OK	Extraction Force OK	Penetration Force OK
Other	None	Auxiliary Line Force OK	Extraction Force OK	Penetration Force OK

MODE	ERROR MESSAGES FOR FOOT PADS	
Standing	Front Foot Pad Force OK	Rear Foot Pad Force OK
Travelling	Front Foot Pad Force OK	Rear Foot Pad Force OK
Handling	Front Foot Pad Force OK	Rear Foot Pad Force OK
Penetrating	Front Foot Pad Force OK	Rear Foot Pad Force OK
Extracting	Front Foot Pad Force OK	Rear Foot Pad Force OK
Other	Front Foot Pad Force OK	Rear Foot Pad Force OK

Notes

Only for rig operation on level ground with a vertical mast, unless noted below !

Only for use where the rig is working on a ground supported platform !

Foot pad pressures are adjusted to equalise with the track pressures !

Rigs to be operated in accordance with manufacturer's & employer's instructions

600mm diameter, 2m2 plate for foot to be made available.