Base Load Power Hub (BLPH)

Topside – Load Out Manual including Ballast Sequence

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1 INTRODUCTION

1.1 PROJECT OVERVIEW

Crosswind, a Shell and Eneco joint venture, was awarded the tender to develop the offshore Hollandse Kust Noord (HKN) wind farm, located 18.5km off the coast of Netherlands near the town of Egmond aan Zee. The consortium plans to have HKN operational in 2023 with an installed capacity of 759MW generating at least 3.3TWh per year. This is sufficient renewable power to supply more than 1 million Dutch households with green electricity.

Offshore wind farms produce intermittent electricity and balancing these dips and peaks and integrating this electricity into the national energy system requires new technologies. For this reason, the offshore wind farm will include several new technologies that could be implemented at full-scale in the future. The new technologies being explored include a floating solar park, a short-duration battery storage as well as long-term storage via green hydrogen produced by water electrolysis and subsequently consumed in a fuel cell. The combination of these individual measures, herein referred to as the Base Load Power Hub (BLPH) will ensure a continuous power supply regardless of the wind situation.

1.1.1 Project Location

The Hollandse Kust Noord (HKN) wind farm is located 18.5km off the coast of the Netherlands near the town of Egmond aan Zee.

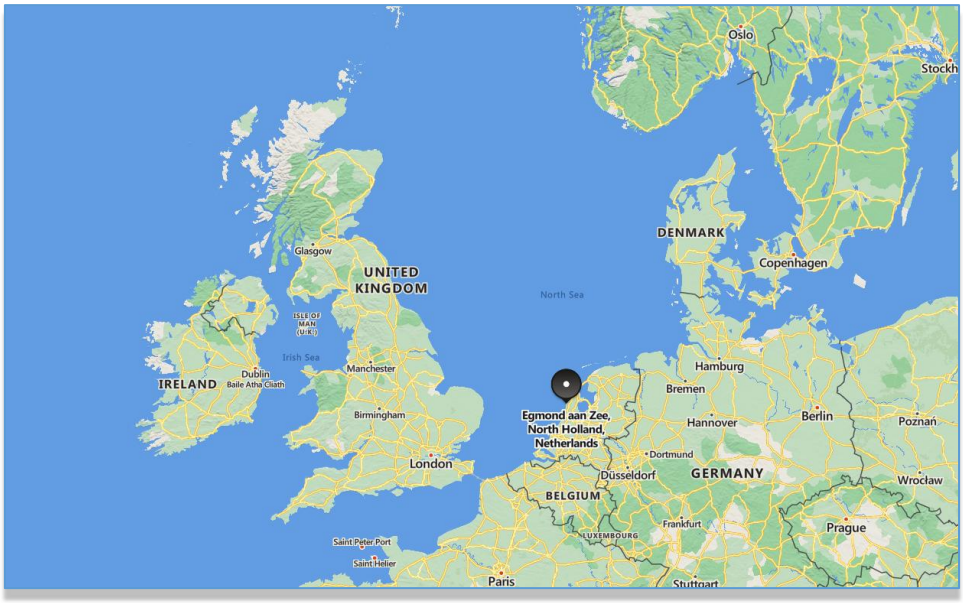


Figure 1.1 HOLLANDSE KUST NOORD WIND PARK Location Map

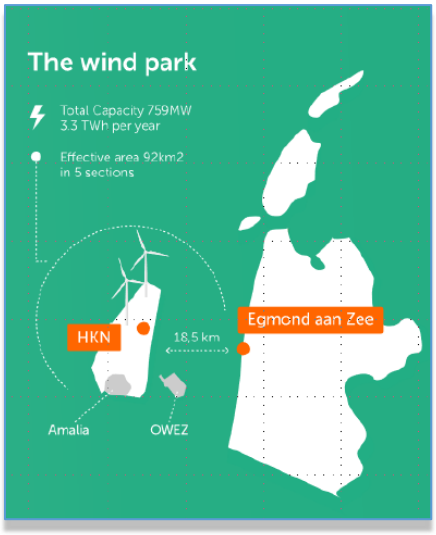


Figure 1.2 - Wind Park Details

The wind farm consist of No. 69 x 11.5MW wind turbine generators each to be installed on a dedicated monopile structure. A 70th monopile located on coordinates E 590719.1, N 5841602.3 is reserved for installing the platform accommodating the BLPH. The monopile structure was designed and installed by Van Oord Offshore Wind (VooW) and therefore not part of the BLPH scope.

1.1.2 Project Concept

All components included in the BLPH will be integrated onshore on a topsides and installed in an offshore location within the boundaries of the HKN wind farm. At its simplest, the BLPH will store energy during periods of high electricity generation from renewable sources (a wind turbine generator and the floating solar PV farm) and release it during periods of low generation. In practice. It is expected that the energy stored will supplement generation from renewable sources to ensure that at least 1.0MW of power is exported to the electrical grid regardless of wind/solar availability.

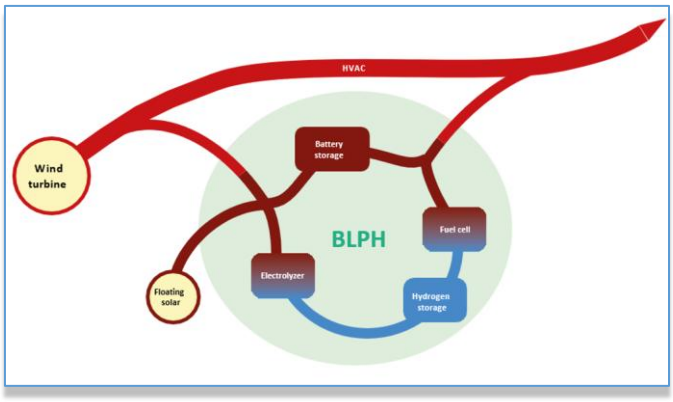


Figure 1.3 – BLPH Concept

Electricity in the BLPH will be stored in the form of electrons in a battery energy storage system (BESS) as well as converted into green hydrogen via water electrolysis. When the power output from the connecting wind turbine drops to below 1 MWe, the BLPH will return its stored energy to supplement the remaining power output. This will be by discharging the BESS, while stored hydrogen will be converted back into electricity using a fuel cell to extend the discharge duration.

The purpose of the BLPH s to function as a testbed for the integration of energy storage technologies with renewable generation. It is expected that equipment installed on the BLPH will operate as Normally Unmanned Installation for at least two (2) years with no or minimal maintenance and it will have its own independent control room with the ability to communicate with Crosswind's control room.

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2 SCOPE

2.1 PURPOSE

This document deals with the loadout procedure to be followed relevant to the CW BLPH topside.

The loadout operation has been scheduled for June 2025.

The document focuses on the main aspects of the activities: procedures, methods, responsibilities, safety criteria, site characteristics, mooring calculations and description of all the equipment's involved.

A dedicated HIRA (Hazard Identification and Risk Assessment) will be held to ensure a correct evaluation of the risks together with all parties involved (Rosetti, CW, MWS, SPMT owner, BARGE owner).

This document, along with the associated documents, is intended to provide the procedure and guideline for the execution of the operations. The Loadout operation will be under the command of the Loadout Manager but, however, Loadout Manager may make amendments on site or exercise his best judgment, in consultation with the Marine Warranty Surveyor and Company representative, as the case may require, dealing with situations that may be encountered during the operation.

2.2 GENERAL

The site where the operation will take place is the Piomboni Yard, located in Via del Marchesato n°37 - 48122 Marina di Ravenna - Ravenna, Italy.

BLPH Topside, after construction completion, will be moved supported below the main rows of the module; the loadout of topside will be carried out by means of suitable number of SPMT positioned under the steel beams; for details about Trailer configuration see Appendix "H".

During the movement of the structure from yard to the barge final location, the barge will be ballasted / deballasted to compensate the weight and moment transferring so as to maintain the barge deck leveled with yard capping beam.

Loading of the Topside will be performed moving the structure with 3 rows of SPMT positioned under the BLPH main beams, for details about hydraulic configuration of SPMT and acting loads see Appendix "H".

The whole operation shall be considered subdivided in several steps, corresponding to different positions of the SPMT compared to barge stern: for each step of the sequence the proper ballast plan shall be calculated so that the stern will be maintained at same level of capping beam, where the moving structure weight is considered as a set concentrated forces corresponding to the SPMT axle loads.

3 REFERENCES

3.1 CODES AND STANDARDS

Doc. No.	Description
/1/ BS EN ISO 19900	General requirements for offshore structures - 2019
/2/ BS EN ISO 19901-1	Specific requirements for offshore structures - Part 1: Metocean design and operating considerations - 2015
/3/ BS EN ISO 19901-2	Seismic design procedures and criteria
/4/ BS EN ISO 19901-3	Specific requirements for offshore structures – Part 3: Topsides structure - 2014
/5/ BS EN ISO 19901-5	Specific requirements for offshore structures – Part 5: Weight Management - 2021
/6/ BS EN ISO 19901-6	Specific requirements for offshore structures – Part 6: Marine Operations – 2009
/7/ BS EN ISO 19902	Petroleum and natural gas industries - Fixed steel offshore structures – 2020
/8/ EN 1991-1-3:2003 & A1:2015	EN, Eurocode 1 – Actions on Structures – Part 1-3: General actions – Snow loads - Incorporating corrigenda December 2004 and March 2009, December 2015.
/9/ EN 1993-1-1	Design of steel structures – Part 1-1: General rules and rules for buildings
/10/ API RP 2A-WSD	Recommended practice for planning, designing and constructing fixed offshore platforms – Working stress design – 22nd edition – 2014
/11/ DNV-ST-N001	DNV - Marine operation and marine warranty - 2021
/12/ DNV-ST-0145	DNV, Offshore substations
/13/ DNV-RP-C201	DNV, Buckling Strength of Plated Structures, October 2010.
/14/ DNV-RP-C205	DNV - Environmental conditions and environmental loads - September 2019, amended September 2021.
/15/ DNV-OS-C101	Design of offshore steel structures, general- LRFD method, 2021

3.2 COMPANY SPECIFICATIONS

Doc. No.	Description
/16/ DEP 37.19.00.12	Gen - Offshore Topsides Structures

/17/ DEP 37.19.00.30	Gen - Fixed Steel Offshore Structures (Adoption of IOGP S-631-11, Amendments / Supplements to ISO 19902:2020).
/18/ DEP 37.81.10.19	Gen - Marine Operations Requirements – Loadout, Transportation and Installation of Offshore Structures (Amendments / Supplements to ISO 19901-6)
/19/ DEP 37.91.10.11	Mobile Mooring Systems (Amendments / Supplements to API RP 2SK, API RP 2SM AND API RP 2I)

3.3 PROJECT DOCUMENTS

Doc. No.	Description
/20/ 123A90-DDL-MD-RE-01006	Monthly Weight Report
/21/ 123A90-DDL-ST-SP-90017	Structural Design Basis
/22/ 123A90-DDL-ST-SP-90018	Structural Material Specification for Topside & TP
/23/ 123A90-DDL-ST-SP-90118	Structural Material Specification for Flange & Bolts
/24/ 123A90-DDL-ST-TN-90119	Evaluating ISO and DNV approaches
/25/ 123A90-DDL-TI-SP-99014	Specification for TP, Topside and Caissons Transportation and Installation
/26/ 123A90-DDL-ST-RE-90001	Topside loadout analysis
/27/ 123A90-DDL-TI-RE-99001	Topside Gr&SF report
/28/ 123A90-DDL-TI-DD-99021	Topside – Grillage Assembly
/29/ 123A90-DDL-TI-DD-99023	Topside – Grillage – Plan and Section
/30/ 123A90-DDL-TI-RE-99012	Topside – Yard Checklist
/31/	Topside – internal seafastening report

3.4 SOFTWARE

Doc. No.	Description
/32/ MOSES	Hydrostatic and Hydrodynamic Analysis Software for Offshore Installation and Platform Design– BENTLEY Inc, v.12

4 DEFINITIONS AND ABBREVIATIONS

COMPANY or Client (CPY)	Crosswind
CONTRACTOR (CTR)	ROSETTI MARINO S.p.A.
PROJECT	HOLLANDSE KUST NOORD WIND PARK Project
TRANSPORT CONTRACTOR	OCEAN
ALS	Accidental Limit State
BESS	BATTERY ENERGY STORAGE SYSTEM
BG	Box Girder
BLPH	Base Load Power Hub
CF	Caisson Frame
CL	Concentrated Load
CoG	Centre of Gravity
CTV	Crew Transfer Vessel
CW	CrossWind
DAF	Dynamic Amplification Factor
DFF	Damage Fatigue Factors
DLB	Ductility Level Blast
DNV	Det Norske Veritas
DOP	Dropped Object Protection
El.	Elevation
EPCI	Engineering Procurement Construction and Installation
FEED	Front End Engineering Design
HAT	Highest Astronomical Tide
HKN	Hollandse Kust Noord
ICCP	Impressed Current Corrosion Protection
LAT	Lowest Astronomical Tide
LRFD	Load and Resistance Factor Design
MSL	Mean Sea Level
NTE	Not-to-Exceed

OD	Outside Diameter
PAU	Pre-Assembled Unit (H2 Vessels)
PBY	Piomboni Yard Ravenna
PG	Plate Girder
SCE	Safety Critical Equipment
SHL	Static Hook Load
T&I	Transport & Installation
ToS	Top of Steel
TP	Transition Piece
UC	Unity Check
UDL	Uniformly Distributed Load
VIV	Vortex Induced Vibration
VOOW	Van Oord Offshore Wind
WTG	Wind Turbine Generator
W2W	Walk to Work

Table 4.1 - Definitions and Abbreviations

5 PLATFORM DESCRIPTION

The BLPH comprises of two main deck levels with overall deck plan dimensions of 40 m x 16 m, excluding external walkways, laydown areas and stairs, with an overall deck height of 7 m between decks. There are currently 6 hydrogen storage vessels which lie horizontally, aligned North - South, within the PAU structure located above the upper deck.

The Topsides layout is shown in Figure 5.1.

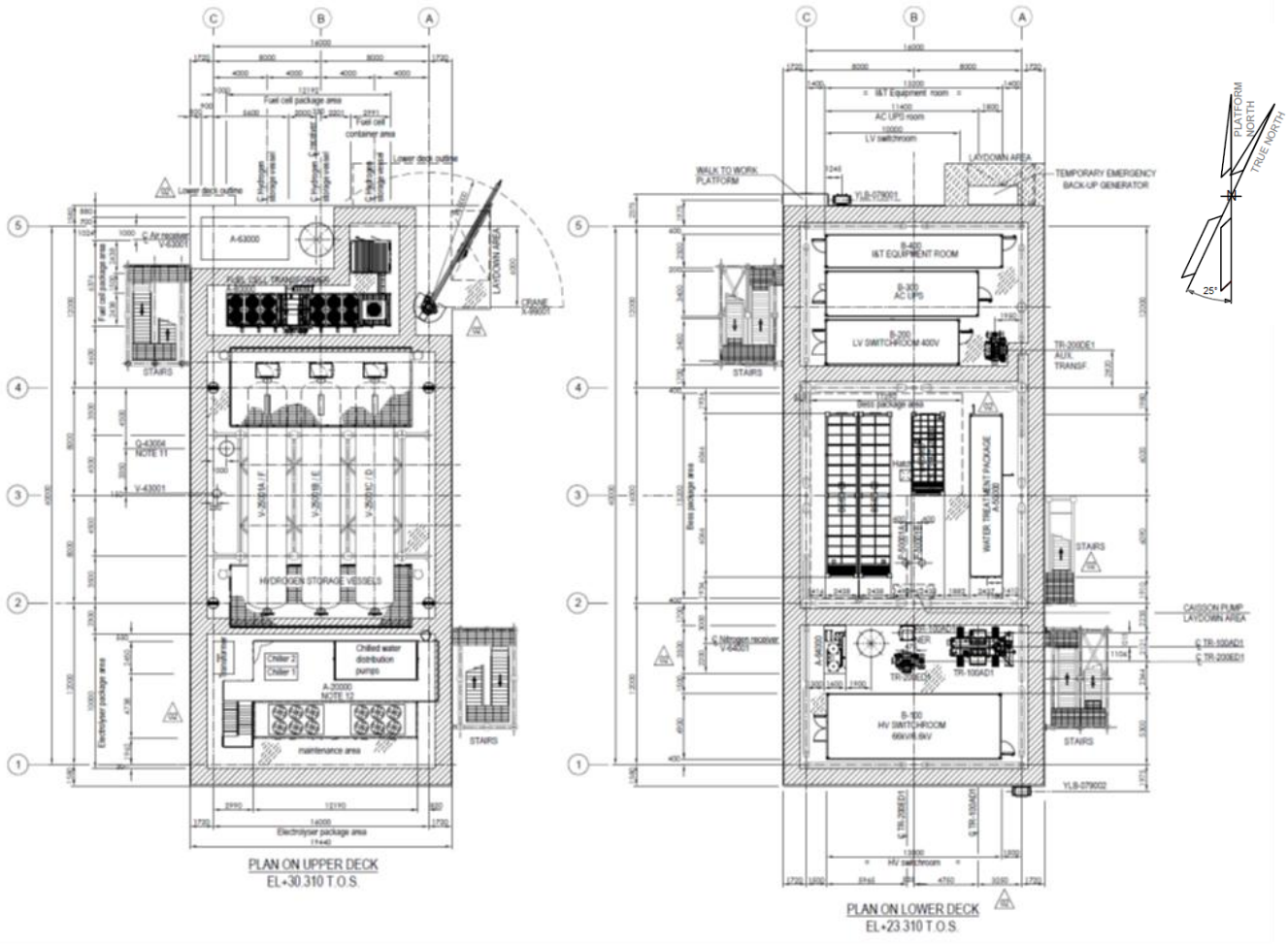


Figure 5.1 - Base Load Power Hub Plot Plan

5.1 COG POSITION

CoG position is taken from ref. /20/,. According to the last issued WCR revision, Topside has the following CoG and weight position (from A1 and LAT) relevant to loadout condition:

- Loadout Expected Weight 1802 ton;

- X_G = 19.70 m;
- Y_G = 7.90 m;
- Z_G = 29.30 m.

BLPH loadout scheme with CoG position is shown in the next figure. Refer to Appendix N for details about the load application.

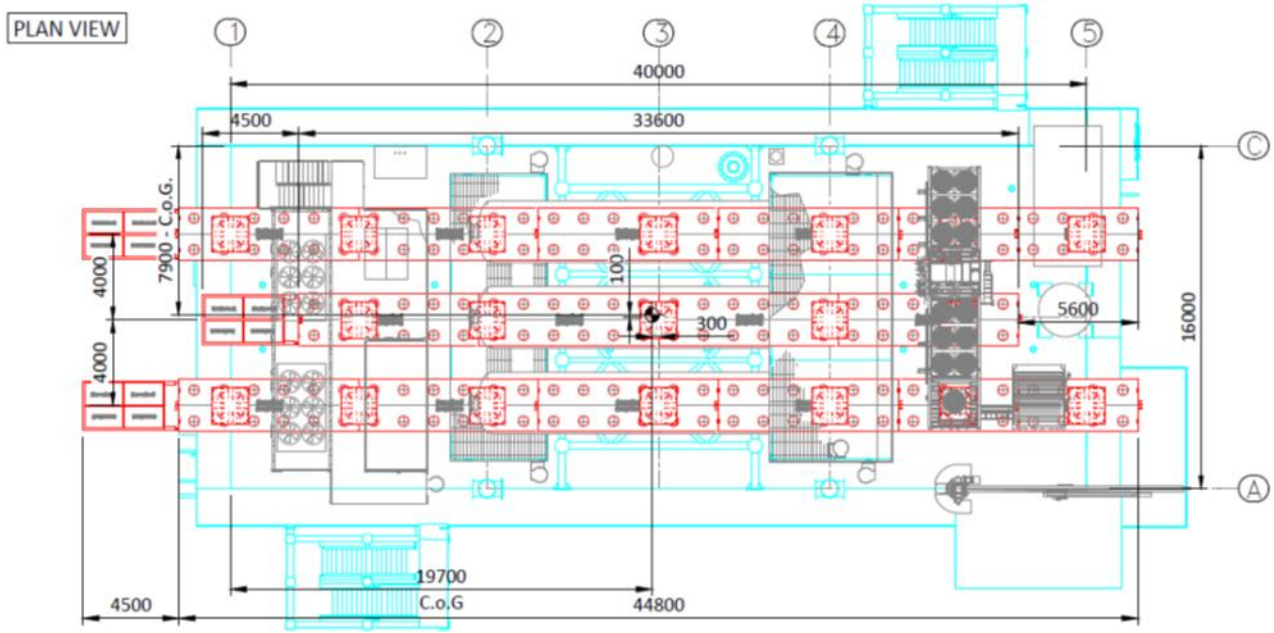


Figure 5.2 – BLPH SPMTs arrangement

Before loadout operation, the final physical weighing operation will be performed in order to confirm the expected Weight and CoG. In case of the discrepancy in terms of weight and CoG position will be significant, the SPMT loads and ballasting sequence will be updated accordingly.

6 SITE MAIN DATA

6.1 YARD GENERAL DATA

For the detailed plan view of YPB, refer to Appendix "B", where significant drawing is shown.

The area dedicated to erection and loadout activities of the Topside is located in the North side of YPB and the waterfront overlooks an internal harbour area of Marina di Ravenna.

The location is free from the influence of waves and currents and the main variations in terms of water level are only dependent on tide variation. Before loadout operation, Rosetti Marino will inform Ravenna Harbor Authority to avoid traffic near loadout involved area during loadout operation.

The elevation of quay capping beam above M.S.L. is 1,75 m, tide tables relevant to Ravenna Harbor (see Appendix "L" for details) show that maximum water level excursion is less than +/- 0,4 m around M.S.L.

The following Picture shows YPB location:



Figure 6.1 – Yard Piomboni Location

6.2 TOPSIDE LOCATION IN YARD

The area dedicated to erection and loadout activities of the Topside is located in YPB as shown in Fig. 6.2. For detailed drawings, refer to Appendix "B".

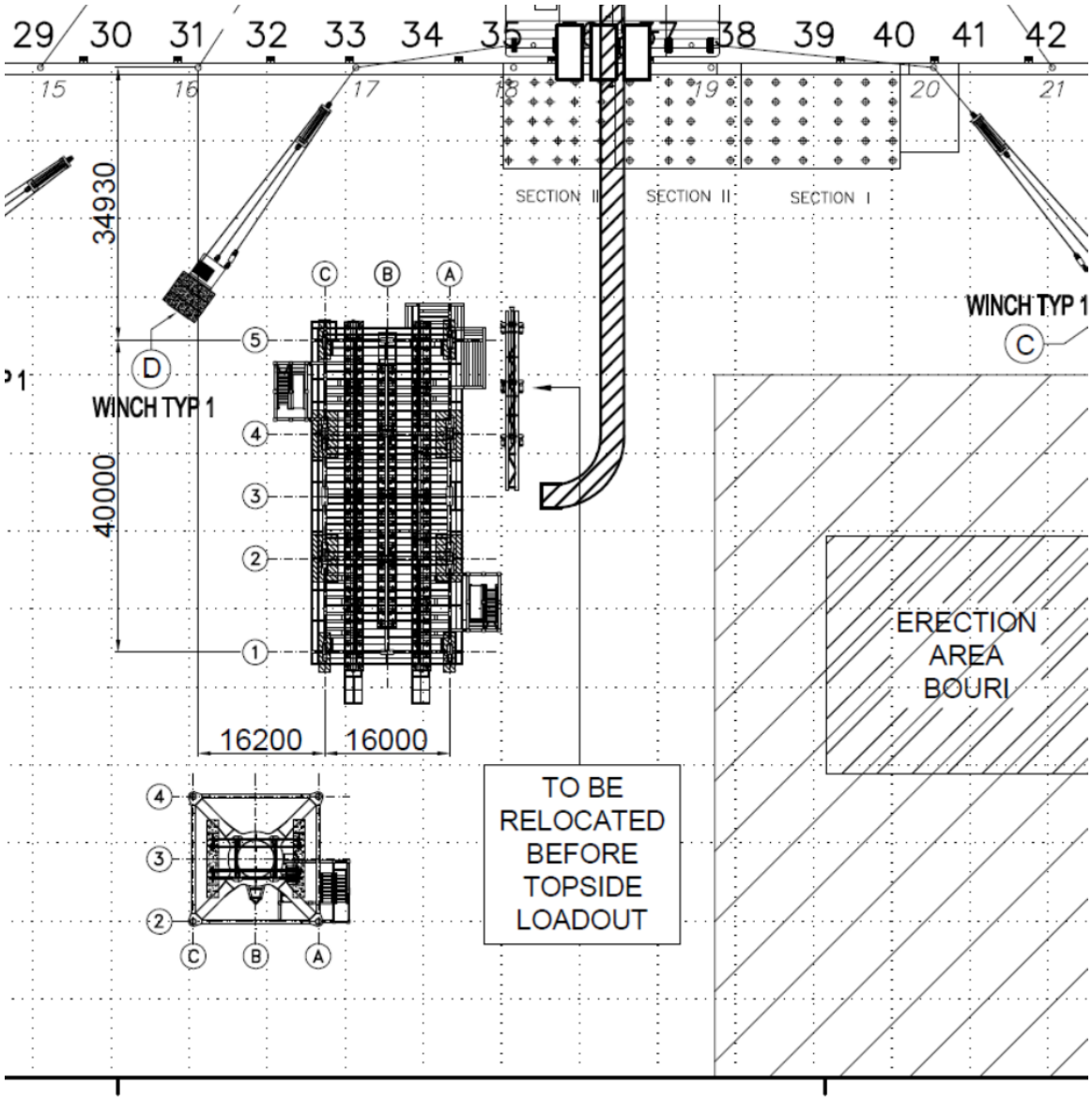


Figure 6.2 – Topside position on PBY

6.3 YARD CONCRETE SLAB LOCATED ON PILES

Close to the quay there is a reinforced area named "SKIDWAY 2" made by concrete slab on piles with a total length equal to 50,9 m which can support load out of heavy structures without overstressing sheet pile and tie rods; in this part of quay the loadout of Topside will be performed.

The calculation report, relevant to piled slab and according to Italian Regulation, has been approved by "Comune di Ravenna" and "Autorità Portuale di Ravenna" which are the Italian Authority appointed to give the permission.

The complete slab piles Technical Report is included into Appendix "D". For details about yard/quay loads during Topside load-out see Appendix "N".

6.4 YARD BOLLARDS LOCATION AND DETAILS

Bollards position along quayside is shown in Appendix "B".

Bollards Capacity and a summary of Yard Piomboni Technical Report are shown in Appendix "D".

6.5 HYDROGRAPHICAL SURVEY AND TIDE DATA

The elevation of Quay Capping Beam above Mean Sea level (M.S.L.) is 1,75 m., tide tables relevant to Ravenna Harbor (see Appendix "L" for details) show that maximum water level excursion is less than +/- 0,4 m around M.S.L. However, during the week prior loadout, tide readings will be taken at yard quay in order to calibrate tide table.

A Seabed survey has been updated on February 2019, this survey shows the water depth in front of YPB reported to M.S.L. See Appendix "I" and water depth data.

6.6 BARGE MOORED PARALLEL TO QUAY – AFTER LOADOUT

After Loadout operation VERVECE (with towing ballast arrangement) will be moored along YPB quay in a dedicated zone defined by Quay Lines "27" and "45" (about 130 m long).

As per seabed Survey, in this area the minimum water depth is 7,17 m; this value is relevant to a little area located near Line 36. The barge max draft after loadout will be approx. 2,60 m (as per towing ballast arrangement defined in drawing shown in Appendix "A"). So that the minimum clearance between keel and seabed will be approx. 4,00 m (= 7,17 – 2,60 – 0,4) considering low tide condition in correspondence of the above-described little area.

According to Ref. /03/ this value is widely allowable since the minimum required value under keel clearance is 1,0 m.

The following figure shows a zoom of the minimum seabed depth zone relevant to YPB quay dedicated to post loadout mooring operations:

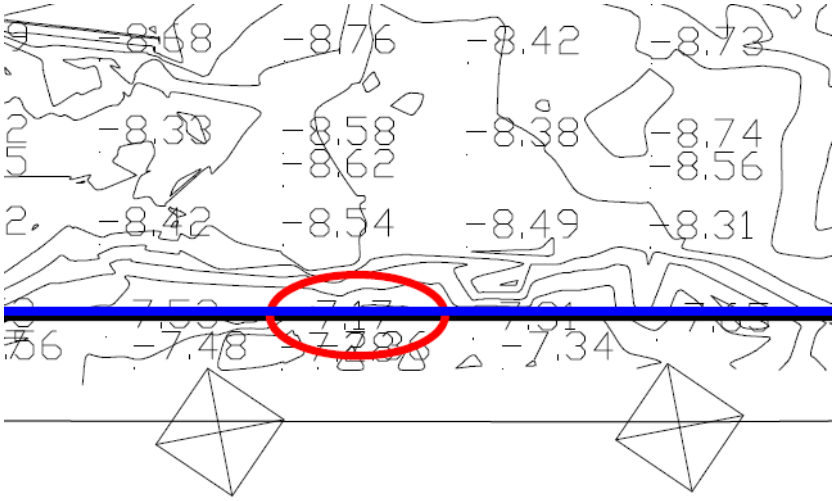


Figure 6.3 – Post-Loadout Area Minimum Seabed Depth - Zoom on Critical Zone

6.7 BARGE MOORED PERPENDICULAR TO QUAY – LOADOUT CONDITION

During topside loadout operation the barge deck and the yard capping beam shall be aligned independently of tide level variation and/or Topside Weight transfer on VERVECE barge. To ensure the alignment described above, the ballasting operations will be performed consequently.

The Cargo Barge will be moored perpendicular to Quay (stern at quay side) during loadout operation with a draft of about 4,35 m considering the M.S.L (-1,75 m from Yard Level).

During load out, the barge should be even keel; trim 0 / +50 cm. (stern to bow) is the tolerance admitted. For this reason, change of trim, which will be constantly monitored by means of optical levels, will not affect minimum clearance (trim tolerance = 0 cm at stern side and + 50 cm at bow side).

The minimum sea depth is 7,34 m in a little zone next to the barge stern, therefore the minimum under keel clearance is 3.90 m during loadout operation. According to Ref. /11/ this value is widely allowable since the minimum required value under keel clearance is 1,0 m.

The following picture shows a detail of bathymetry and minimum seabed depth in the loadout involved area). For detailed bathymetric plan see Appendix "I".

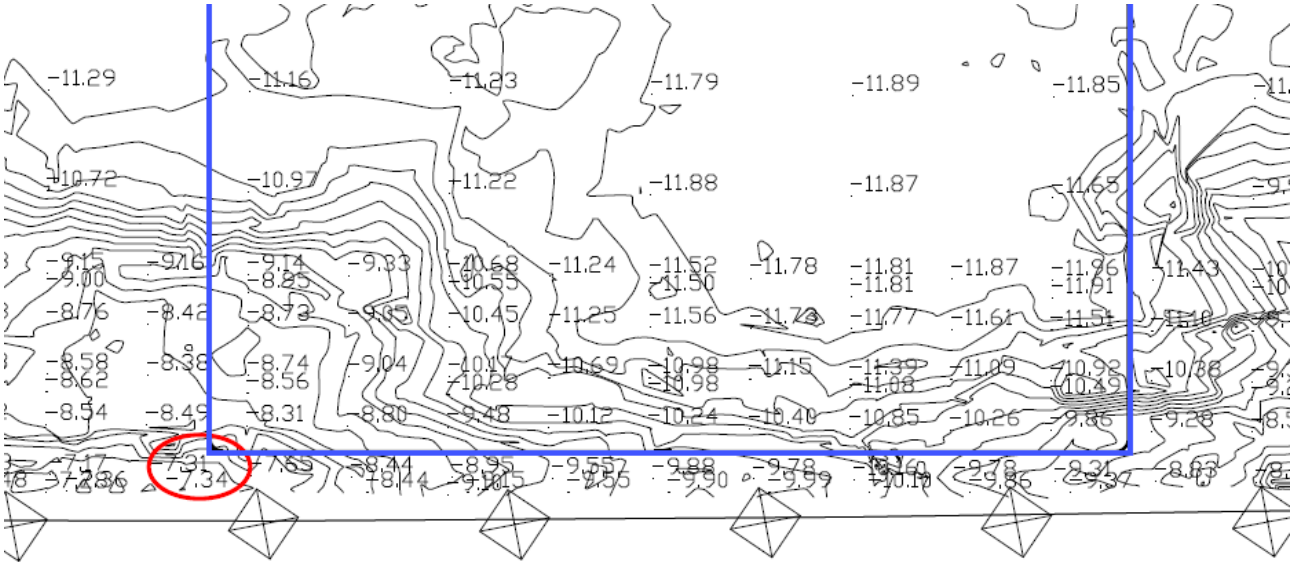


Figure 6.4 – Loadout Area Minimum Seabed Depth - Zoom on Critical Zone

6.8 WEATHER FORECASTING ARRANGMENT FOR THE YARD

Weather forecast for load out operation will be obtained from website www.ilmeteo.it and www.windfinder.com, during the week prior loadout operation weather forecast will be checked.

7 ENVIRONMENTAL LIMITS

7.1 TIDE

See section 6.5. max excursion +40cm/-40cm considered.

7.2 WAVE

Not present being in a closed basin. Marine traffic will be limited and wind wave negligible having limitation on max wind speed.

7.3 WIND

The loadout activities will be performed with good weather conditions and favorable weather forecast. The maximum wind speed should not exceed 10 m/s during loadout. Prior to start the load out the wind speed will be checked by means of an anemometer (hand anemometer available on yard).

The maximum wind speed assumed for mooring design is:

- 22,6 m/s for mooring after loadout (barge moored parallel to quay); The wind Speed of 22,6 m/s is the reference wind for 10 years return period storm (1-minute) according to Italian Code, the following table shows the main input and output data:

UNRESTRICTED MOORING OPERATION -DESIGN WIND SPEED			
References	**#1 - 0013/ND Guidelines for Loadouts Rev.6** **#2 - NTC 2008** **#3 - Circolare Esplicativa 02-02-2009**		
INPUT DATA			
Return Period Storm	Tr=	10 years	Ref. 1 - Chapter 10.8
Reference Wind Speed (50 year	v_{ref0}=	25 m/s	Ref. 2 - Table 3.3.1
Coefficient α_R	α_R=	0,90 -	Ref. 3 - Chapter C3.3.2
OUTPUT DATA			
Design Wind Speed (T_r years)	v_{ref10}=	**22,6** m/s	

Table 7.1 – Wind Speed Design – Post Loadout Condition

- 10 m/s for mooring during load out (barge moored perpendicular to Quay).

LOADOUT OPERATION -DESIGN WIND SPEED			
References	**DNV-GL-N001**		
INPUT DATA			
Max Forecast / operational Wind Speed	v_{ope}=	10 m/s	
Planned Operation Period	T=	48 h	
Wind speed 10 return period	v_{10}=	22.6 m/s	
Alpha Factor	Alfa=	0.67 -	Table 2-15
OUTPUT DATA			
Design Wind Speed	v_{des}=	**14.9** m/s	

Table 7.2 – Wind Speed Design – Post Loadout Condition

For details relevant to Mooring Design see Chapter 8.

8 MOORING SYSTEM

The mooring system consists of the following items:

- Yard Winches;
- Polypropylene Mooring Lines;
- Connection Devices (link plate, tackles, shackles …)

The scope of mooring is to secure the Cargo Barge to the YPB Quay during loadout and post loadout activities. The mooring analysis has been performed considering two different barge conditions:

1. Barge Moored Perpendicular to Quay with Stern at Quay Side (Loadout Condition);
2. Barge Moored Parallel to Quay with Starboard at Quay Side (Post Loadout Condition).

8.1 WINCHES MAIN FEATURES

Yard winches will be employed to stretch mooring ropes. Each winch will be supplied with a double tackle with 6 or 8 reeves in order to increase the maximum pulling capacity.

The yard winches, linked with mooring lines, will be configured with suitable additional ballast: each winch will be equipped with a proper number of concrete blocks.

The additional ballast required will be defined taking into account the maximum load on mooring line and a sliding factor of 1/3 between yard surface and bottom side of winch skid. The following formula defines the minimum additional ballast required:

$B = 3 \times W_L$ = Minimum Additional Ballast Required (winch self-weight conservatively not considered) where W_L = Winch Load. The assumption of sliding factor equal to 0,33 between yard surface and winch steel skid has been confirmed by lots of rollups and mooring operations developed at Rosetti Marino YPB during several years where this sliding factor has been considered to calculate additional ballast to be placed on winch skid.

The load cell installed on winch line will be calibrated in order to give the total winch load (factor 8 for 7 ton winch and factor 4 for 20 ton winch).

8.1.1 Winch 7 Ton Capacity

This type of winch has a capacity equal to 7 Ton and it is arranged with a double tackle with 8 reeves so that the maximum capacity of the system (winch + tackle) is equal to 56 Ton.

In correspondence of winch fixed point a load cell will be installed in order to monitor the acting load on a dedicated digital display.

The following figure shows the typical winch arrangement for loadout operation:

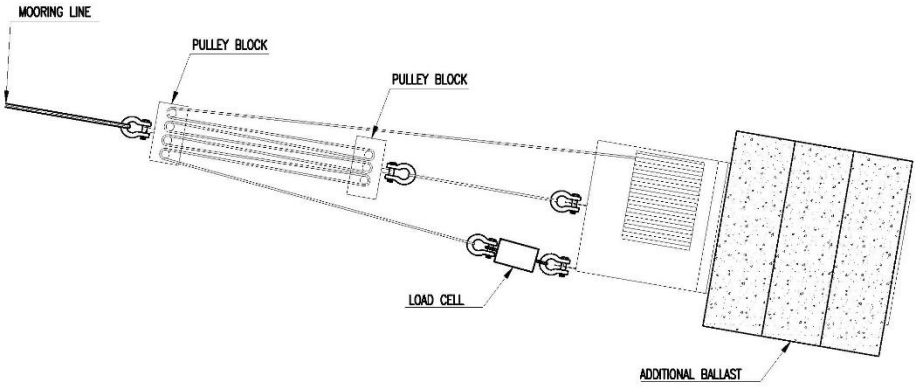


Figure 8.1 – Winch 7 Ton Typical Arrangement

8.1.2 Winch 20 Ton Capacity

This type of winch has a capacity equal to 20 Ton and it is arranged with a double tackle with 6 reeves (but only 4 reeves used) so that the maximum capacity of the system (winch + tackle) is equal to 80 Ton.

In correspondence of winch fixed point a load cell will be installed in order to monitor the acting load on a dedicated digital display.

The following figure shows the typical winch arrangement for loadout operation:

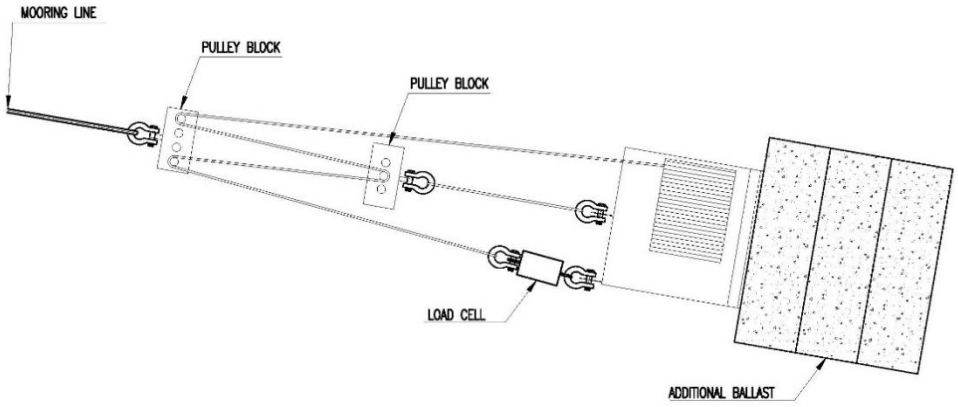


Figure 8.2 – Winch 20 Ton Typical Arrangement

8.2 WIND EXPOSED AREAS

An analysis relevant to wind exposed areas is necessary in order to evaluate the acting loads on mooring lines due to wind pressure applied on barge, Topsides and Grillage.

8.2.1 Lateral View

The following picture shows the Lateral Exposed areas for the main items relevant to loadout condition and post loadout condition.

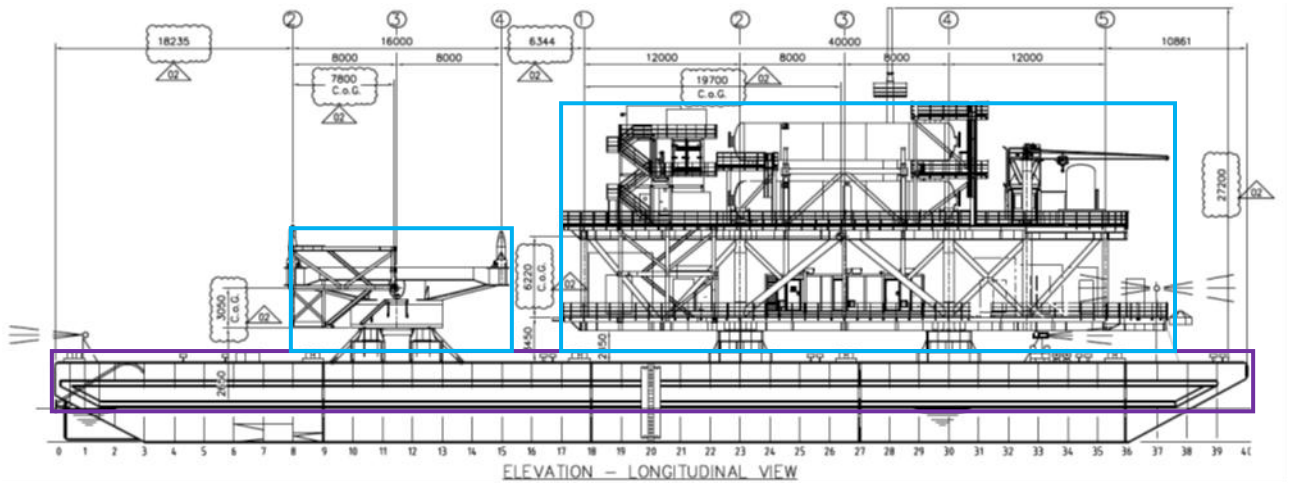


Figure 8.3 – Wind Lateral Exposed Area

The following list summarizes the main data relevant to Exposed Areas shown above:

1. Cargo Barge (Violet) : Exposed area equal to 190 m^2 (considering Low Tide Condition) with a Center of Exposed Area located at 45.7 m from Barge Stern;
2. TP, Topside & Grillages (Blue): BLPH Exposed Area equal to 650 m^2 with a Center of Exposed Area located at 60.5 m from Barge Stern, TP Exposed Area equal to 140 m^2 with a Center of Exposed Area located at 25 m from Barge Stern, CF covered by the above numbers.

8.2.2 Front View

The following picture shows the Exposed areas for the main items relevant to loadout condition and post loadout condition:

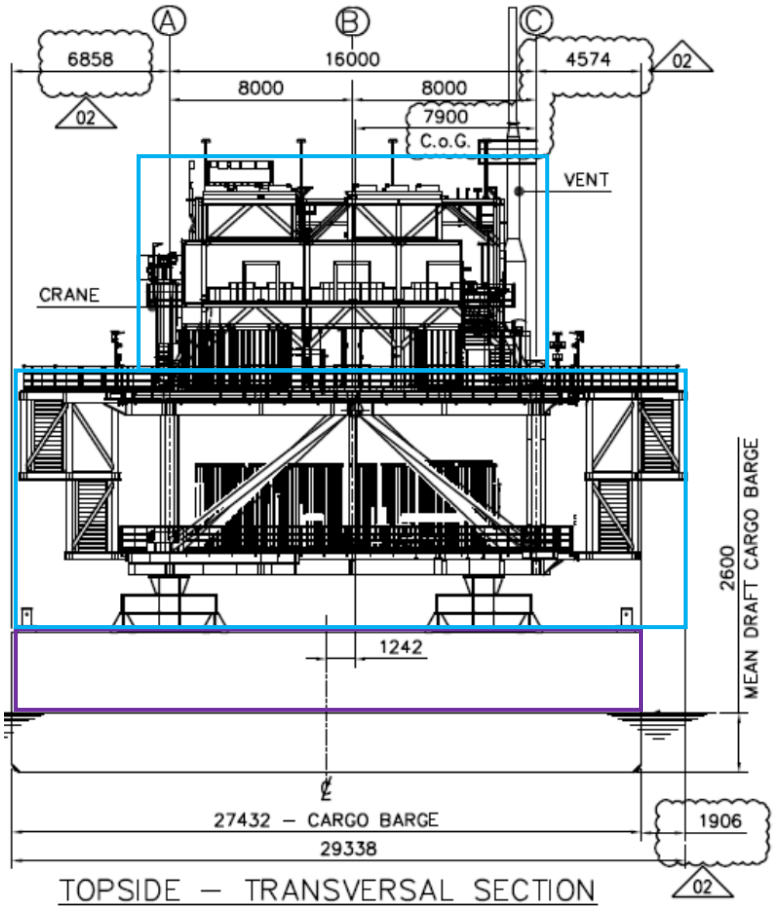


Figure 8.4 – Wind Front Exposed Area

The following list summarizes the main data relevant to Exposed Areas considered for this condition:

1. Cargo barge (Violet): Exposed area equal to 80 m^2 (considering towing ballast arrangement) with a Center of Exposed Area located on Barge Centre Line;
2. Topside (Blue): Exposed Area equal to 340 m^2 with a Center of Exposed Area located on Barge Centre Line;

8.3 MOORING FORCES CALCULATION

The following chapters show the calculation relevant to wind forces acting on exposed items and the resultant forces acting on mooring lines as per designed mooring arrangement.

These calculations have been developed for loadout and post loadout conditions considering the appropriate design wind speed and the different mooring lines arrangement.

8.3.1 Barge Perpendicular to quay

As mentioned in par. 7.3, load out activities will be performed with good weather conditions and a favorable weather forecast. The maximum wind speed should not exceed 10 m/s; conservatively the mooring design has been developed considering forces originated by wind speed of 13,3 m/s as per Table 7.2.

Since no significant effects due to the current or waves are present in the area involved during operations, they have been considered negligible.

The mooring system is designed in order to prevent movements of the barge due to the action of the wind.

WIND CALCULATION According to API RP 2A - WSD 21th Ed.					
INPUT DATA					
Mass Density of air	p	=	1.2198	kg/m^3	Chpt. 2.3.2.c
Design Wind Speed	u	=	13.3	m/s	
Contingency Factor	CF	=	1	-	Applied to Wind Pressure
AUX OUTPUT DATA					
Wind pressure	W_p	=	107.89	N/m^2	
OBJECTS DATA					
OBJECTS	Shape Coeff		Area [m^2]	C.E.A. Location [m]	Result Wind Force [KN]
BLPH + GRILLAGE & SF	1		620	61.7	67
CARGO BARGE (LOW TIDE COND)	1		190	45.7	20
TP + GRILLAGE & SF	1		160	26	17
OUTPUT DATA					
Cargo Centre of Exposed Area	CEA	=	52.68	m	From Barge Stern
Total Wind Force	F	=	11	TON	Acting on CEA
Project:			PERPENDICULAR TO QUAY - LATERAL WIND		
Author:					

Table 8.1 – Wind Force

The longitudinal force hasn't been considered because it is negligible for loadout condition.

MOORING LINES LOADS

The following figure shows the mooring arrangement relevant to loadout condition and the mooring lines loads due to wind force calculated in the previous chapter:

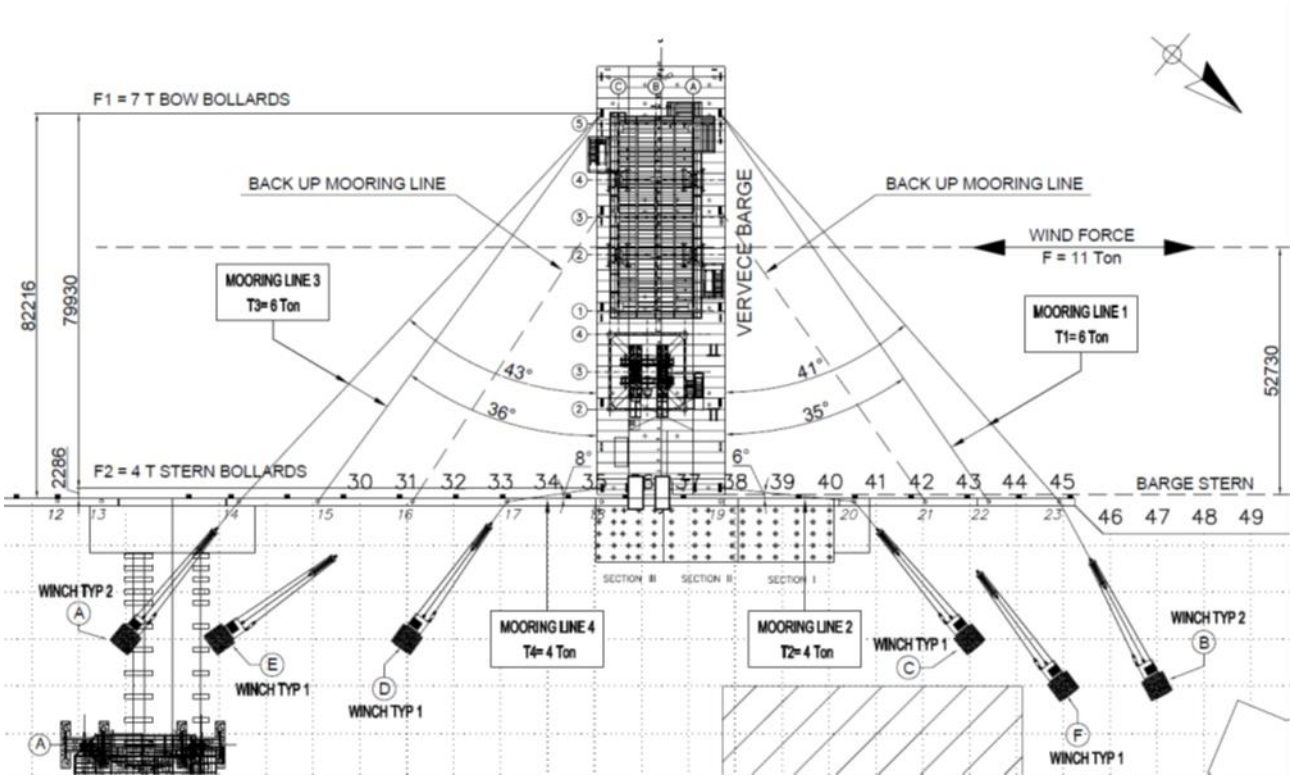


Figure 8.5 – Mooring Lines Loads –Loadout Condition

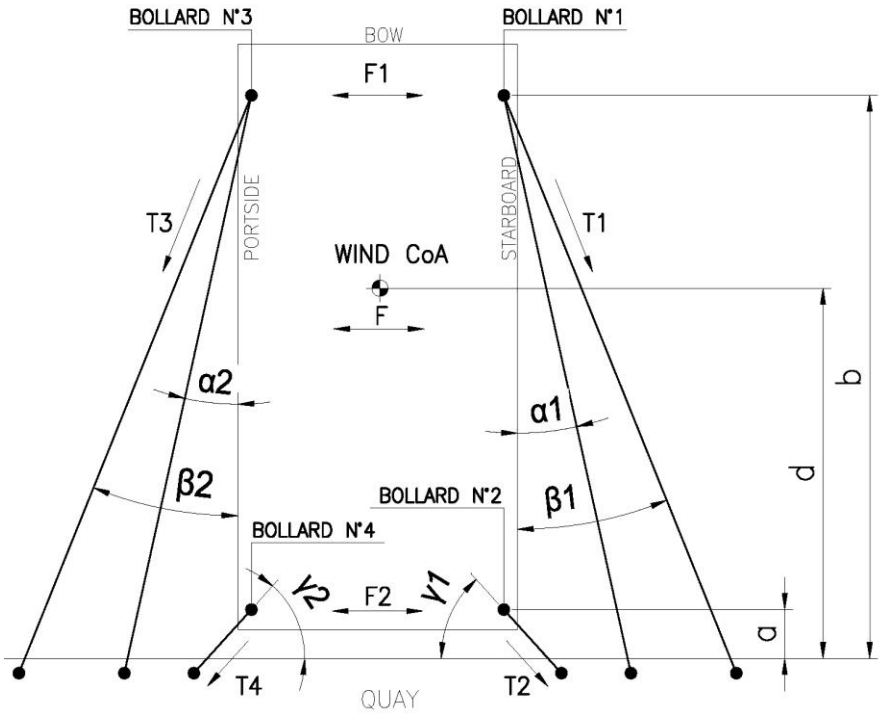
The mooring lines loads have been calculated considering the isostatic system composed of two restraints (barge stern and bow bollard) and a concentrated force applied to Centre of exposed area.

For details about mooring contingency see Chapter 10.4.

For further details relevant to Mooring Arrangement and involved equipment see Appendix "E" and "F".

The following spreadsheet shows the calculation relevant to mooring lines tension as per defined mooring configuration:

BARGE PERPENDICULAR TO QUAY MOORING LINES TENSION ANALYSIS					
INPUT DATA					
Wind CoA position (from Quay)		d	=	52.7	m
Wind Force (Applied on Wind CoA)		F	=	11	Ton
Barge Bollards 1 & 3 position (from Quay)		b	=	82.2	m
Barge Bollards 2 & 4 position (from Quay)		a	=	2.2	m
BOW SIDE	Starboard External Mooring Angle	β1	=	41	deg
	Starboard Internal Mooring Angle	α1	=	35	deg
	Portside External Mooring Angle	β2	=	43	deg
	Portside Internal Mooring Angle	α2	=	36	deg
STERN SIDE	Starboard Mooring Angle	γ1	=	6	deg
	Portside Mooring Angle	γ2	=	8	deg
RESULTS					
Horizontal Force on Barge Bollards 1 and 3		F1	=	**7**	Ton
Horizontal Force on Barge Bollards 2 and 4		F2	=	**4**	Ton
BOW SIDE	Starboard Mooring Triangle Tension	T1	=	**6**	Ton
	Portside Mooring Triangle Tension	T3	=	**5**	Ton
STERN SIDE	Starboard Mooring Line Tension	T2	=	**4**	Ton
	Portside Mooring Line Tension	T4	=	**4**	Ton



Author:

Table 8.2 – Mooring Lines Loads – Barge perpendicular to quay

8.3.2 Barge Parallel to quay

As mentioned in par. 7.3, post load mooring has been considered as unrestricted weather condition therefore the design wind speed has been evaluated considering 10 years return period storm. Consequently, the mooring design has been developed considering forces originated by wind speed of 22.6 m/s.

Since no significant effects due to the current or waves are present in the area involved during operations, they have been considered negligible.

The mooring system is designed in order to prevent movements of the barge due to the action of the wind.

WIND CALCULATION According to API RP 2A - WSD 21th Ed.					
INPUT DATA					
Mass Density of air	p	=	1.2198	kg/m^3	Chpt. 2.3.2.c
Design Wind Speed	u	=	22.6	m/s	
Contingency Factor	CF	=	1	-	Applied to Wind Pressure
AUX OUTPUT DATA					
Wind pressure	W_p	=	311.51	N/m^2	
OBJECTS DATA					
OBJECTS	Shape Coeff		Area [m^2]	C.E.A. Location [m]	Result Wind Force [KN]
BLPH + GRILLAGE & SF	1		650	60.5	202
CARGO BARGE	1		40	45	12
TP + GRILLAGE & SF	1		140	25	44
OUTPUT DATA					
Cargo Centre of Exposed Area	CEA	=	53.77	m	From Barge Stern
Total Wind Force	F	=	26	TON	Acting on CEA
Project:			BARGE PARALLEL TO QUAY - LATERAL WIND		
Author:					

Table 8.3 – Wind Speed Force – Lateral Force – Post Loadout Condition

WIND CALCULATION According to API RP 2A - WSD 21th Ed.					
INPUT DATA					
Mass Density of air	p	=	1.2198	kg/m^3	Chpt. 2.3.2.c
Design Wind Speed	u	=	22.6	m/s	
Contingency Factor	CF	=	1	-	Applied to Wind Pressure
AUX OUTPUT DATA					
Wind pressure	W_p	=	311.51	N/m^2	
OBJECTS DATA					
OBJECTS	Shape Coeff		Area [m^2]	C.E.A. Location [m]	Result Wind Force [KN]
TOPSIDE + GRILLAGE & SF	1		340	0	106
CARGO BARGE (HIGH TIDE CONI	1		80	0	25
OUTPUT DATA					
Cargo Centre of Exposed Area	CEA	=	0.00	m	-
Total Wind Force	F	=	13	TON	Acting on CEA
Project:			BARGE PARALLEL TO QUAY - FRONT WIND		
Author:					

Table 8.4 – Wind Speed Force – Frontal Force – Post Loadout Condition

MOORING LINES LOADS

The following figure shows the mooring arrangement relevant to post loadout condition (starboard at quay side) and the mooring lines loads due to wind action force calculated in the previous chapter:

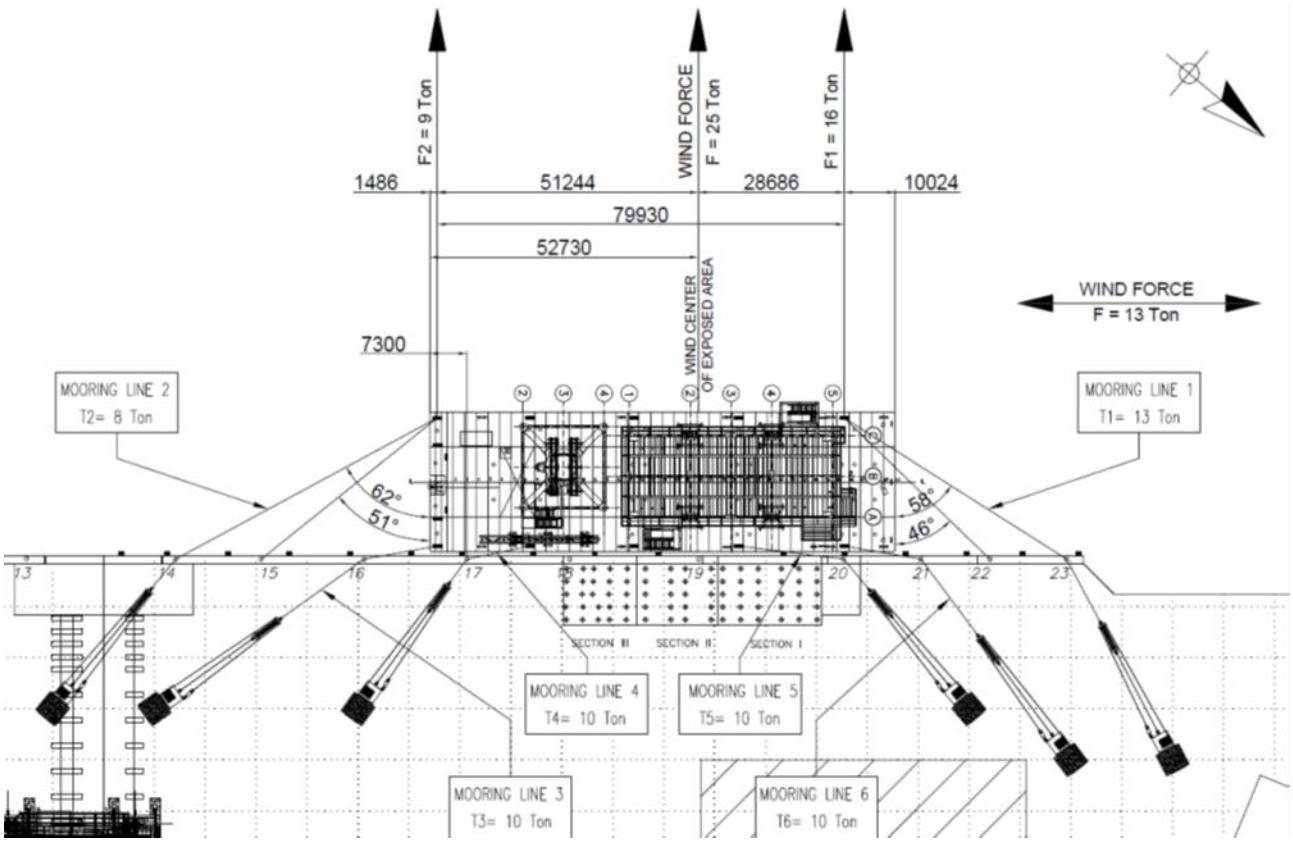


Figure 8.6 – Mooring Lines Loads –Post Loadout Condition

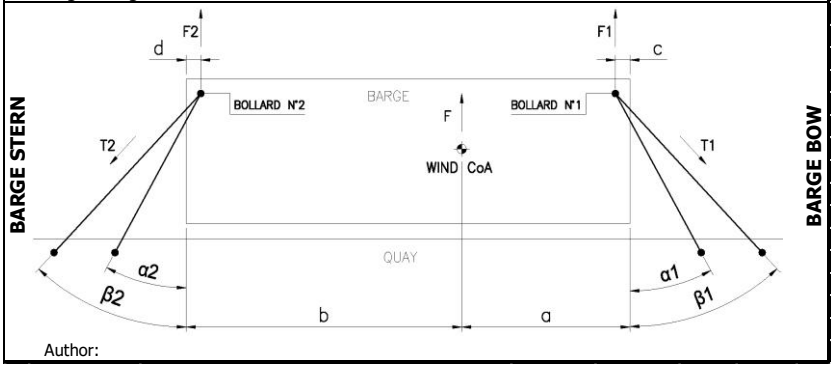
The mooring lines loads have been calculated considering the isostatic system composed by two restraints (barge stern and bow bollard) and a concentrated force applied to Centre of exposed area.

To prevent longitudinal movements of barge six mooring lines have been positioned.

Conservatively, 2/3 of longitudinal load is considered to be applied to a single winch only.

The following spreadsheet shows the calculation relevant to mooring lines tension as per defined mooring configuration:

BARGE PARALLEL TO QUAY MOORING LINES TENSION ANALYSIS				
INPUT DATA				
Barge Orientation			**Bow at Right Side**	
Wind CoA Position from Stern	b	=	53.70	m
Wind CoA Position from Bow	a	=	37.70	m
Bollard 1 Position from Bow	c	=	10.00	m
Bollard 2 Position from Stern	d	=	1.50	m
External Mooring Line at Bow side	β1	=	58	deg
Internal Mooring Line at Bow side	α1	=	46	deg
External Mooring Line at Stern side	β2	=	62	deg
Internal Mooring Line at Stern side	α2	=	51	deg
Wind Force (Applied on CoA)	F	=	25	Ton
RESULTS				
Bollard 1 Transversal Force	F1	=	**16**	Ton
Bollard 2 Transversal Force	F2	=	**9**	Ton
Mooring Triangle Tension - Bow Side	T1	=	**13**	Ton
Mooring Triangle Tension - Stern Side	T2	=	**8**	Ton



Author:

Table 8.5 – Mooring Lines Loads – Barge parallel to quay

9 LOADOUT PROCEDURE

9.1 GENERAL

The basic principles of the operation consist of moving the Topside by means of SPMT until the edge of the bridge plate over the quay is reached, then, after a first set of proper alignment check and compliance of values of tide and water into the ballast tanks, the Topside will be moved on board of the cargo barge.

Topside Row 5 will be the first to be transferred to the barge and the structure weight will be transferred to barge by SPMT tires.

Three suitable bridge plates (one for each SMPT line) will be provided to assure the connection between yard capping beam and barge stern, for details and structural checks of these bridge plates see section 8.3.

The transportation barge VERVECE will be ballasted / deballasted in order to compensate the load transferred by the SPMT and during the progress of the loadout a monitoring system consisting of optical levels measurement set will be adopted to monitor the barge trim and roll.

During Topside loading on, barge will be moored with stern at quay side; yard capping beam and barge deck will be kept at the same level during all loadout phases however little vertical barge movements are allowed considering the arrangement of bridge system composed by steel plates simply supported on barge stern and quay. During topside loading-on, the alignment between barge stern and quay will be continuously checked.

During operations, a system of fenders will be arranged in order to keep unchanged the distance between barge stern and quay, their details are in section 8.3.

9.2 MAIN LOADOUT STEPS

The following table summarizes the main steps necessary to carry out Topside Loadout:

STEP	ACTION	REFERENCE
01	SPMT and Spreader beam position under Topside	Appendix "H"
02	Perform Ballast Plan as per Phase 0 of Ballasting Sequence	Appendix "N"
03	Positioning of Bridge Plates	Appendix "E"
04	Lift Topside by means of SMPT	-
05	Movements necessary to remove Yard Supports and approach to Quay	Appendix "H"
06	Start Loadout Operation	-
07	Start Ballasting Operations	Appendix "N"
08	Reaching Topside final position	Appendix "A"

09	Set down and shimming of Upper Grillage on Lower Grillage	Section 9.5
10	Start Grillage & Seafastening Welding Operation and remove SPMT	-
-	Start ballasting to reach Towing Ballast Condition	Appendix "N"
-	Barge Rotation After Minimum Seafastening Welding Completion	Chapter 8
-	Barge Mooring Parallel to Quay	Appendix "E"
-	Completion of Topside Grillage and SF welds	

Table 9.1 – Main Loadout steps – after step 10, will be performed the LOs of TP and CF

9.3 TOPSIDE, QUAY AND BARGE PREPARATION

9.3.1 Topside

At the time of the loadout, the topside will be completed in terms of structural works and concerning all accessories. A check of the status of completion will be performed prior the loadout and loose items (if any) considered critical for the activity will be properly secured.

All the activities listed below will be carried out prior the loadout:

1. Removal of scaffolding and items not necessary for the loadout;
2. Check that no loose items will be on the topside during the activity;
3. Check that no clashes will occur between topside and quay site facilities and no obstacles will be present along the route;
4. Check the SPMT arrangement;
5. Check that topside weighed weight is within loadout boundaries;

9.3.2 Quay side

Activities required before the loadout listed as follows:

1. Clean off all material and equipment not strictly required for the loadout;
2. Check that no sharp objects will be present along SPMT route;
3. Check that no obstacles will be present between the fenders and the barge;
4. Perform safety inspection;
5. Cordon off the area involved for the operation;
6. Disposal of all the mooring equipment close to the designated bollards and check of compliance of the equipment itself;

7. Check and preparation of bollards and anchor points on-shore;
8. Arrangement of all reference points necessary for the barge level monitoring during the loadout (an optical level and stadia system will be employed for the scope).

9.3.3 Barge Preparation

List of activities to be carried out before starting the loadout:

1. Check that grillage beams are properly welded and positioned on the barge deck and welding adjustments/intervention to be performed if necessary;
2. Check dimensional compliance concerning grillage height on barge deck;
3. Check all barge appurtenances have been removed/installed (bollard/closure frame);
4. Check of the ballast system arrangement and perform function test of ballast system prior to load out operation;
5. Check arrangement of bridge plates;
6. Check that no clashes will occur between topside and barge appurtenances and / or grillages , if any remove;
7. Check if deck manholes are accessible for the using of ballasting portable pumps (ullage level will be monitored through open man holes);
8. Preparation of seafastening materials and welding equipment nearby seafastening installation point to support work immediately after topside set-down;

9.3.4 Personnel preparation

List of activities to be carried out before starting the loadout:

1. Tool box with all personnel involved into loadout operation (as per loadout organization chart) carried out;
2. Check radio communications (walkie-talkie and spare batteries tested);
3. Check first aids availability;
4. Check harbor authority has been informed of imminent start of loadout operation (Loadout Manager responsible for communication with Harbor Authority).

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9.3.5 Fenders

During loadout operation at least two quay fenders (one for each barge side) will be placed between barge stern and the concrete capping beam of the quay in order to keep unchanged the distance between barge stern and quay.

The employed fenders are 1000 mm long and they are composed by an internal steel pipe supporting hard rubber pipe with an external diameter of 800 mm and a thickness equal to 200 mm, these fenders are linked to the capping beam by means of steel chain passing through the internal steel pipe.

The following picture shows a typical section of the fenders employed for loadout operation:

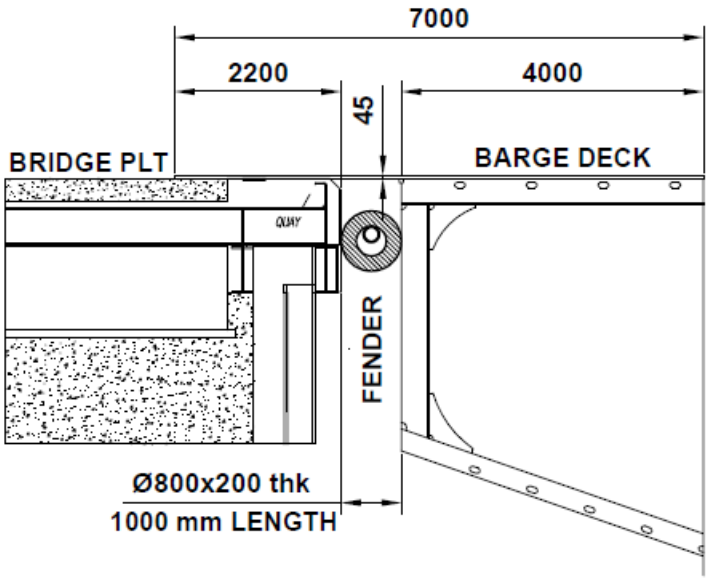


Figure 9.1 – Fender Typical Section

9.3.6 Bridge Plates

In correspondence of each SMPT line a dedicated bridge plate will be positioned to allow the transfer from capping beam to barge stern. According to Rosetti experiences with loadout by means of SPMT the bridge plates will be simple supported (without welding or restrains on to quay / barge side) in order to avoid fixed connection from barge and quay, however the correct alignment from barge and quay will be assured by winches action and will be constantly monitored during loadout operation.

In order to monitor the bridge plates, their position will be marked on barge deck.

The following picture shows a layout of the barge / quay during loadout and the position of eight bridge plates has been pointed out:

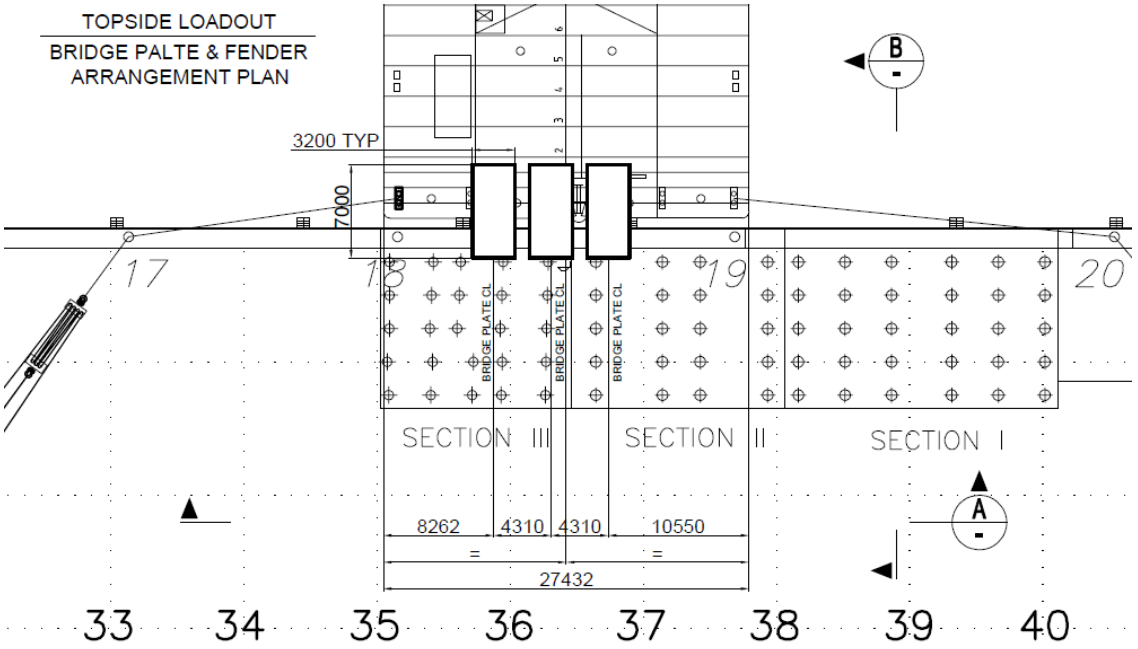


Figure 9.2 – Bridge Plates Arrangement

The following table shows the calculation check relevant to bridge plate considering the worst load condition (max SPMT axle capacity) and considering a bridge plate width equal to 3.000 mm:

BRIDGE PLATE CHECK					
Ref:	**AISC - Allowable Stress Design 89 - Manual of Steel Construction**				
INPUT DATA					
Yield Strength	F_y	=	355	MPa	
Young Modulus	E	=	205.000	MPa	
Bridge Plate Width	b	=	3.000	mm	
Bridge Plate Thickness	t	=	35	mm	
Bridge span	L	=	1.000	mm	
Inertia	J_x	=	1,07E+07	mm^4	
Area Section	A	=	105.000	mm^2	
Modulus	W_x	=	6,13E+05	mm^3	
LOAD DATA					
Load	F	=	360	kN	
AUX OUTPUT DATA					
Allowable Bending Stress	F_b	=	213	MPa	
Allowable Shear Stress	F_v	=	142	MPa	
Max Bending Moment	M_b	=	90.000	kNmm	Considered as Simple supported Beam
Max Deflection	u_z	=	3	mm	Located at Bridge Middle Point
OUTPUT					
Bending Stress	f_b	=	147	MPa	
Shear Stress	f_v	=	5	MPa	Max Shear
Bending Unity Check	U.C.	=	0,69	-	Bending Stress Check
Shear Unity Check	U.C.	=	0,04	-	Shear Stress Check
CHECK					**ALLOWABLE STRESS**

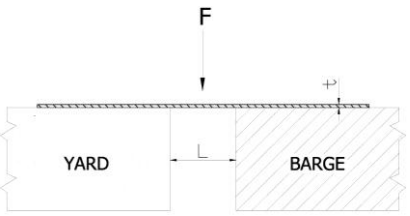


Table 9.2 – Bridge Plate Calculation

9.4 BALLAST SYSTEM

Ballasting sequence is included in Appendix "N".

The ballasting system consists of a 2 x 600 m3/h centrifugal internal pumps + 6 diesel pumps (with a min. nominal capacity of 300 m^3/h) for a total nominal capacity equal to 2400 m^3/h.

Loadout ballast sequence considers max 4 tanks contemporaneously manoeuvred at each loadout phase.

Barge pumps have been dedicated to load transfer, external pumps to tide compensation, load transfer and 2 pumps have been considered as backup. However, the pumps are portable so it is possible to shift a pump from a ballast tank to another one in case of necessity, therefore the capacity of back-up system can be easily increased simply connecting a spare pump or a pump that is not used in that phase.

The details relevant to pumps characteristics and general layout has been included in Appendix "M".

9.5 UPPER GRILLAGE SET DOWN ON LOWER GRILLAGE & SHIMMING PROCEDURE

At the end of load out, when topside is in its final position on barge, the following main actions will take place:

- Final position of topside over grillage agreement between all involved parties (Rosetti, CW , MWS);
- 50% weight download on grillage;
- Check of gap on each support point;
- Topside weight resuming on SPMT system;
- Shimming insertion on support points, if any;
- Complete Topside weight download on grillage.

9.6 MINIMUM SEAFASTENING WELDS

The minimum seafastening welding operation will start as soon as lowering and shimming has been completed. After completion of minimum seafastening the welding activities will proceed in order to complete all seafastening welds with barge in towing condition.

9.7 DIMENSIONAL CONTROL DURING LOADOUT

As described before the barge deck will be monitored during loadout in order to keep under control the stern level (compared to quay elevation) and the barge trim, the following picture shows the typical arrangement employed for barge level monitoring system:

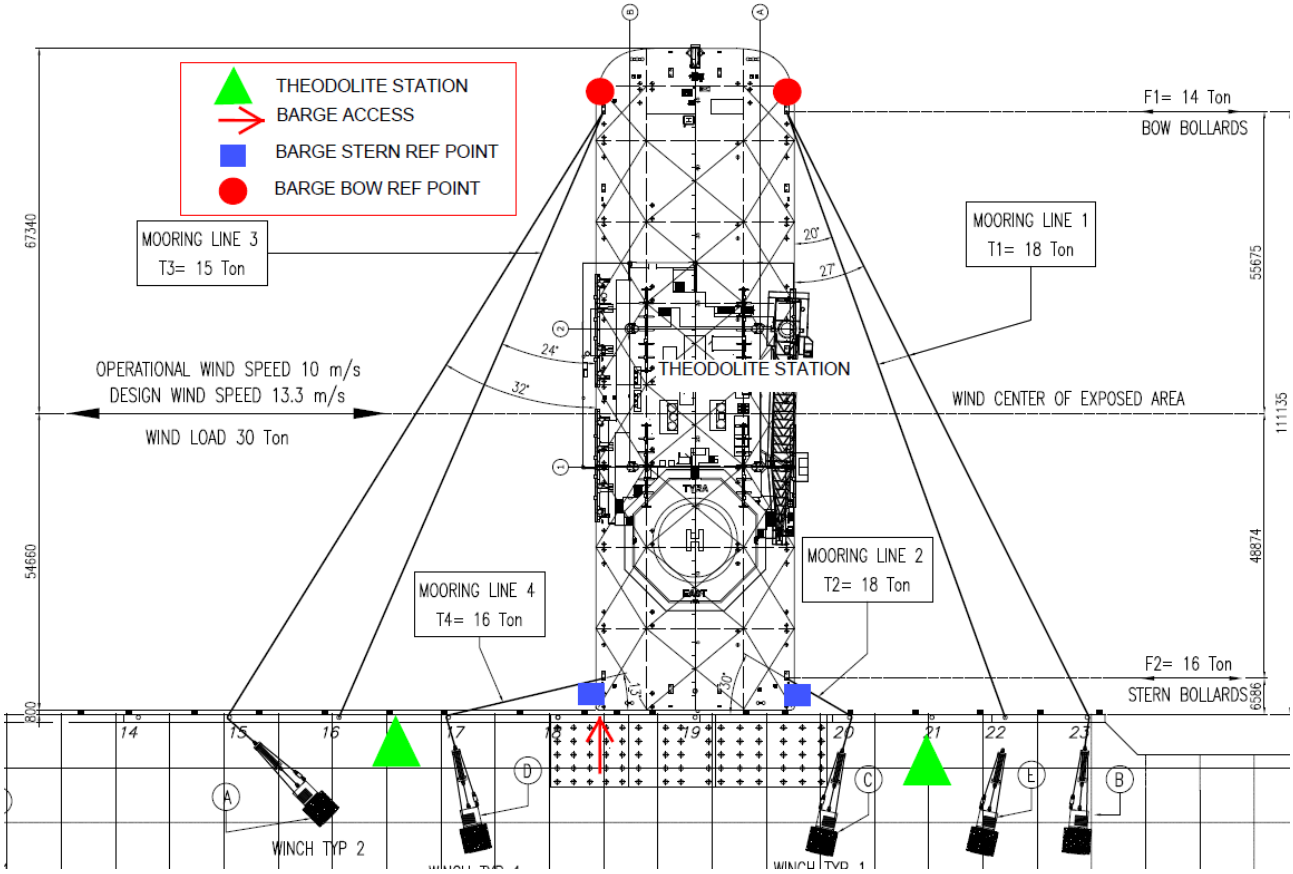


Figure 9.3 – Barge dimensional control system - Typical

10 LOADOUT ORGANIZATION

10.1 ROLES AND RESPONSIBILITY

A description of the functions and responsibilities of the key personnel involved in the operation is given here below:

- *Loadout Manager* is responsible for the whole loadout operations. Client, Certifying Authority and Marine Warranty surveyor representatives liaise only and directly with Loadout Manager. Loadout Manager is also responsible for external parties interface / communication (harbor tugs, port authority and emergency services).
- *Ballast Engineer* is responsible for the operations of the primary ballast system and eventually for the emergency systems, in accordance with the loadout procedure and the instructions of the loadout manager.
- *Mooring System Superintendent* is responsible for mooring the barge onto the quay and for adjusting the barge alignment throughout the load out operation.
- *Surveyors Superintendent* is responsible for the co-ordination of the surveyor teams who check the barge level and alignment during the operation.
- *Intervention Team Superintendent* is responsible for the intervention team equipped with cranes, welding machines, cutting gear etc. which will be ready to intervene throughout the operation.
- *HSE Manager* is responsible for all the aspects related to safety including control of access within the restricted area and the liaison with the first aid team.
- *SPMT Superintendent* is responsible for all the aspects related to correct preparation and execution of transport operation by means of self-propelled modular trailer.
- *CPY Representative* is responsible for interface with Rosetti project team, loadout manager and Marine Surveyor.
- *ABL Marine Surveyor* Issue Certificate of Approval to start the loadout. (A signed copy must be handed to CPY Site Rep prior to topside liftoff). Witness loadout operation. Interface with CPY and Rosetti as required.
- *Project Quality Manager* is responsible for providing all documentation and certification required by MWS and to ensure checklists are completed and signed off.
- *Construction Manager*, in collaboration with Loadout Manager is the responsible all barge / quay activities (bollard removal, double plate positioning, lower grillage installation...) necessary to perform loadout.

- *Tide Surveyor* is responsible for checking the tide variations during loadout operation, he will inform Loadout Manager about tide behavior by radio.

10.1.1 Contact details of key personnel

Here are the following contact details of key personnel:

- *Massimiliano Brunelli – Project Manager;*
  mobile: +39 334 6143049
  e-mail: massimiliano.brunelli@rosetti.it
- *Alessandro Balzarotti – Project Structural Engineer ;*
  mobile: +39 345 1449272
  e-mail: alessandro.balzarotti@teconsrl.it
- *Wolmer Borghi – Construction Manager;*
  mobile: +39 366 6497967
  e-mail: wolmer.borghi@rosetti.it
- *Daniele Ricci Picciloni –Project HSE Manager;*
  phone: +39 335 1225148
  e-mail: daniele.riccipicciloni@rosetti.it
- *Alessandro Berti –Yard Manager & Loadout Manager;*
  mobile: +39 338 5300679
  e-mail: alessandro.berti@rosetti.it
- *Kevin Sirski– ABL Marine Warranty Surveyor;*
  phone: +44 (0) 7442 786279
  e-mail: k.sirski@abl-group.com
- *Jan Duinhoven - Company Representative;*
  mobile +31 642048772
  e-mail: jan.duinhoven@crosswindhkn.nl
- *Jeroen van Loon - Floating Solar Lead & BLPH Construction Manager*
  mobile 31 (0)6 – 43103041
  e-mail: jeroen.vanloon@crosswindhkn.nl

10.2 COMMUNICATIONS

The Loadout Manager has overall responsibility and control of the operation. The Loadout Manager communicates with the Loadout team via walkie-talkie and is the only one entitled to give orders.

The Loadout Team is in constant communication with the Loadout Manager and follows his instructions. In case of any mismatch with expected data and conditions, each Loadout Team component must inform immediately the Load out Manager, who is the only entitled to decide relevant intervention.

In case of immediate danger to the Health and Safety of any operator each Loadout Team component must STOP the operation immediately and then inform the Loadout Manager.

In any case, the Loadout Manager is the only one entitled to restart the operation.

Communication among the load-out key personnel will be made via portable radio. Load-out Manager will be linked to the surveyor superintendent in charge of continuously monitoring the barge draft, trim and heel. The tank sounding will be read in by measuring the ullage through the manholes.

Prior to start the operations the correct functionality of the walkie-talkies (batteries, radio frequency...) will be checked. Each walkie-talkie will be provided with a spare battery ready in case of substitution. A dedicated RF Channel will be employed for loadout operation.

A toolbox talk will be carried out before the load out commences. All personnel involved in the loadout, as per the Operational Organizational Chart, should be present so that everybody understands the operation and is aware of their responsibilities.

Italian will be used throughout the operation. All communications with CPY and Marine Surveyor will be conducted in English.

In the event of the operation being stopped for unforeseen circumstances, as described in this section, the Loadout Manager will inform CPY and the MWS of the nature of the problem and the proposed corrective course of action.

10.3 HSE REQUIREMENTS

For general Safety Measures refer to Project HSE Plan applicable revision and Risk Assessment.

A dedicated HIRA will be held to ensure a correct risk assessment.

10.4 CONTINGENCY PROCEDURE

The following table summarizes the main risks and relative actions.

RISK	INTERVENTION	TIME (min.)
Mooring winch failure	- Winch reinstatement or substitution (see Note 1) - Tugs intervention (see Note 2)	10-15' 15-20'
Primary ballasting system failure	- Portable Pumps Ballasting System	10-15'
SPMT failure	See Appendix "H"	
Clashes removing Requirement	Scaffold items and cutting/burning gear on standby at location on barge	

Table 10.1 –contingency plan

Note 1: one winch 7 t. capacity available as spare winch.

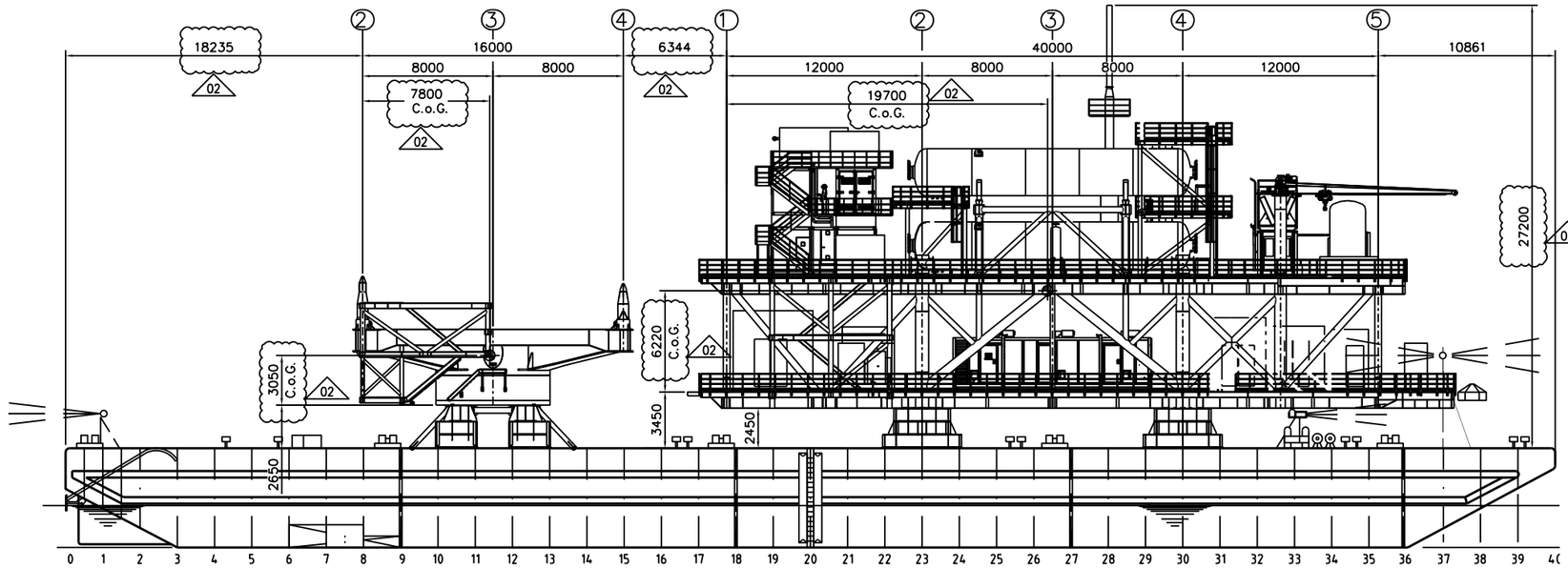
Note 2: During critical phase (loadout operation) Ravenna Harbor guarantee a Tug intervention, on request.

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ATTACHMENT A – TOPSIDE GENERAL ARRANGEMENT ON VERVECE

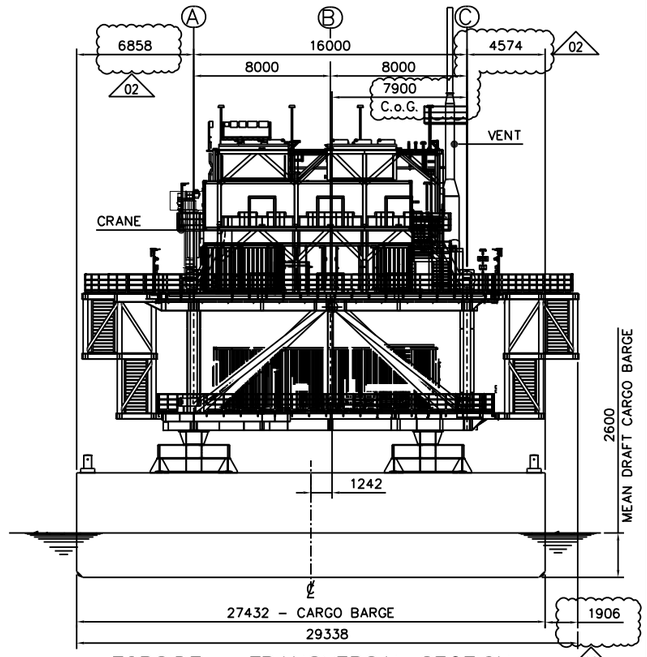
DRAWING NO. 123A90-DDL-TI-DD-99015

REV. 02



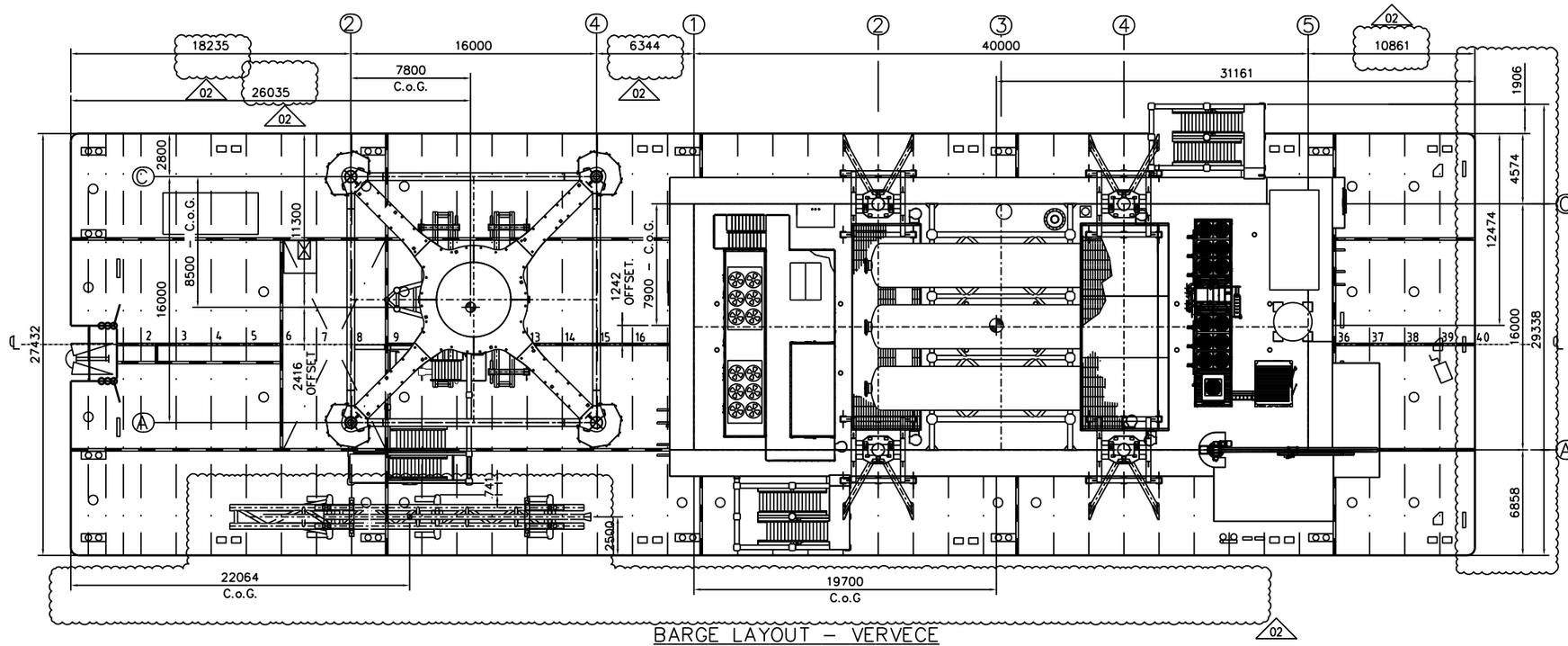
ELEVATION – LONGITUDINAL VIEW

SCALE 1:175



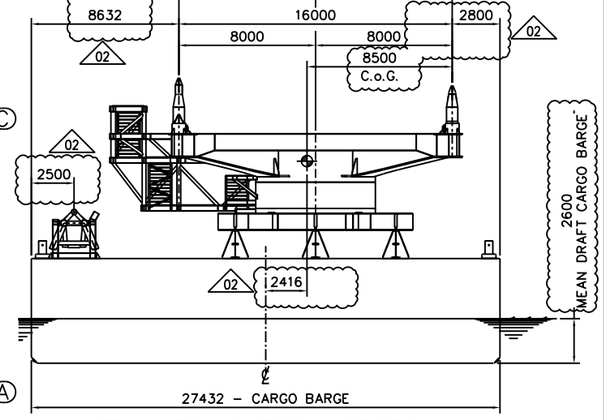
TOPSIDE – TRANSVERSAL SECTION

SCALE 1:175



BARGE LAYOUT – VERVECE

SCALE 1:175



TP – TRANSVERSAL SECTION

SCALE 1:175

VERVECE		
LENGTH	300' 0"	91.440 m
BREADTH	90' 0"	27.432 m
DEPTH	20' 0"	6.096 m

UNIFORM DECK LOAD = 25 T/sqm

CLASS LR+ 100 A1 PONTOON

WELDING WHERE NOT SHOWN : ◺3.5

WEIGHT LIST	
TOPSIDE	= 1802 t
TP	= 290 t
TOPSIDE L.GRILLAGE & SF	= 75 t
TP L.GRILLAGE & SF	= 45 t
CAISSON FRAME	= 26 t
CAISSON GRILLAGE & SF	= 0.5 t

NOTES	HOLDS
1 – ALL DIMENSIONS AND ELEVATIONS ARE IN MILLIMETERS U.N.O. 2 – ALL ELEVATIONS ARE REFERED TO C.D.	

TECON

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
02	26/02/25	SGR	AB	DLS	ACCEPTED FOR CONSTRUCTION (AFC)
01	07/10/24	SGR	AB	DLS	ACCEPTED FOR CONSTRUCTION (AFC)
00	12/01/24	SGR	AB	DLS	ISSUE FOR REVIEW (IFR)

CROSSWIND

ROSETTI MARINO

TITLE : **BASE LOAD POWER HUB (BLPH)**
BARGE LAYOUT

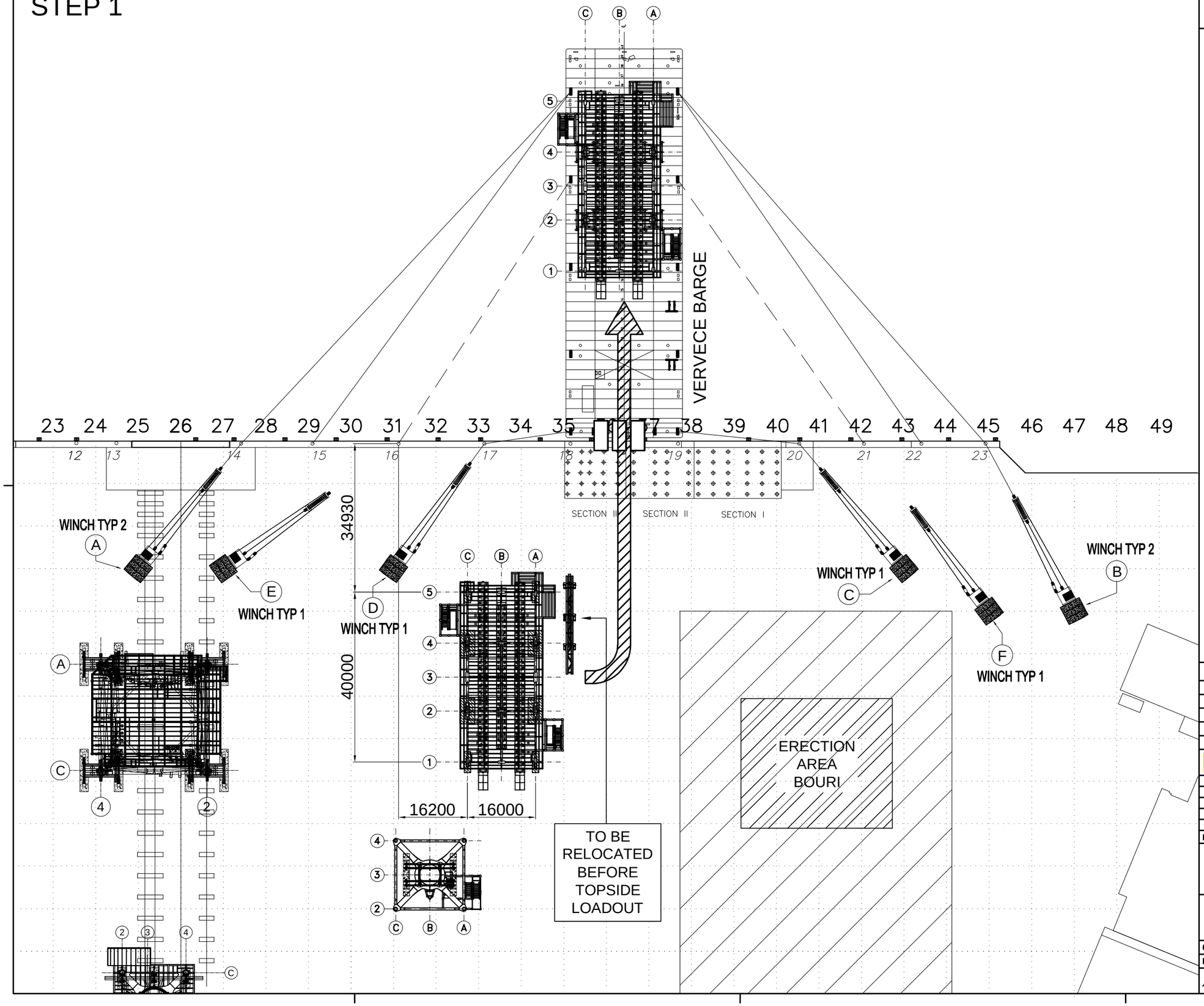
CONTRACT NO./TITLE	CW-1-WP4-2023-05/HOLLANDSE KUST NOORD WIND PARK		SCALE 1:175
DRAWN S.GRIFFINI	CHECKED A.BALZAROTTI	APPROVED D.LO STERZO	DATE 26/02/25
A1	DRAWING NO. 123A90-DDL-TI-DD-99015	SHEET 001	REV. 02

File Name : 123A90-DDL-TI-DD-99015_02.dwg

ATTACHMENT B – TOPSIDE LOCATION ON YARD PIOMBONI

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STEP 1



NOTES

1 – ALL DIMENSIONS AND ELEVATIONS ARE IN MILLIMETERS U.N.O.

REFERENCE DRAWINGS

DWG No.	DESCRIPTION

TECON

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
00	03/03/25	CB	FC	CA	

CROSSWIND

ROSETTI MARINO

TITLE :
BASE LOAD POWER HUB (BLPH)
CROSSWIND LOADOUT
YARD LAYOUT – STEP 1

CONTRACT NO./TITLE CW-1-WP4-2023-05/HOLLANDSE KUST NOORD WIND PARK . | SCALE

DRAWN C.BENZONI | CHECKED F.CERONI | APPROVED C.ANTONELLINI | DATE 03/03/25

A1 | DRAWING NO. 123A90-FDL-MT-DD-00402-00 | SHEET 001 | REV. 00

ATTACHMENT C – CARGO BARGE VERVECE - SPECIFICATIONS

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MARNAVI S.P.A.
TRASPORTI MARITTIMI



90 x 27m. 300 Feet - Flat deck cargo barge

"VERVECE"

• MAIN DESCRIPTION

Built	June 1996
Builder	SEVMASH – SMP Shipyard SEVERODVISNSK (Russia)
Owner	MARNAVI S.p.A. - Naples
Classification	**BV** - I ✠ Hull, Pontoon, No Propulsion, Unrestricted Navigation
Additional Class	**RINA** - C ✠ Pontoon, S, Unrestricted Navigation
IMO number	9088330
Port of Reg. / Flag	Naples / Italian
BV Number	20382G

• MAIN PARTICULARS

Loa	:	91,440 mt / 300 ft
Breath Moulded	:	27,432 mt / 90 ft
Depth Moulded	:	6,096 mt / 20 ft
Summer load line	:	4,842 mt
Deadweight	:	9700 tons (at Summer Draft)
Displacement	:	11573 tons
Light Weight	:	1850 tons
GRT	:	4066 tons
NET	:	1219 tons

• DECK CAPACITIES

Deck area	:	2508 m^2
Uniform Deck Load	:	25 tons / m^2
Point loads	:	200 – 160 – 100 tons
Bollards	:	For mooring 205 KN – For towing 540 KN
Hull and Structures	:	Raked bow and stern with skeg. Welding according to NS 6038
Material Protection	:	All steel shotblasted to Swedish standard SA 2,5 and primed according Jotum material protection. External and internal Cathodic protection. 5 years anode protect.

• BALLAST PUMP CAPACITIES

Tank Arrangement	:	20 ballast tank served from one pump room
Pump capacity	:	2 x 600m^3

• MACHINERY

Engine / Pumps	:	2 x Mitsubishi diesel driving 2 SPP centrifugal pumps
Submersible pump	:	1 portable electrical driven submersible pump for stripping etc.
Generator	:	One Busck 10 KW / 3 x 400 V / 50 Hz
Batteries	:	2 x 24 V / 115 AH

• DECK EQUIPMENT

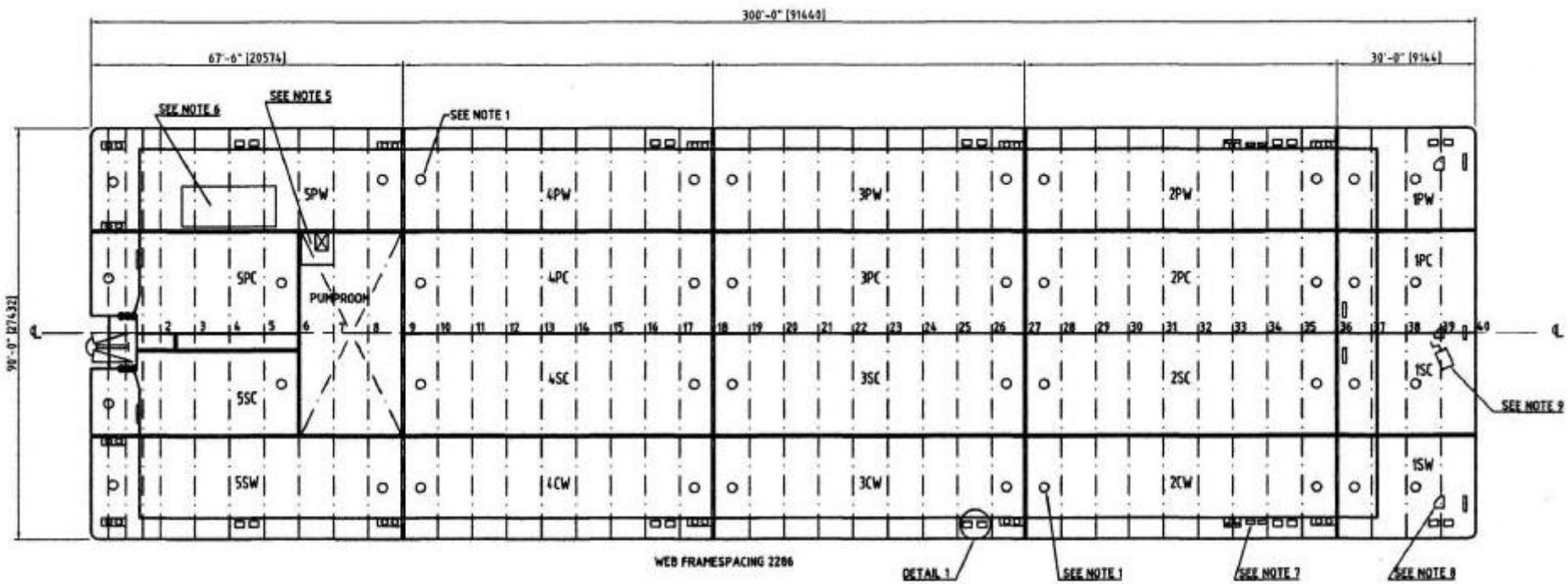
Navigation Light	:	Propane Gas lantern
Anchor	:	Type Stockless, weight 6300 Kg
Anchor Winch	:	Brattvaag / Hagglund hydraulic winch 18 tons pull 1000mt wire 32mm – BL 704 KN
Retriever winch	:	5 tons, manually operated
Towing arrangement	:	Smith's Brackets towing arrangement for main and emergency towing 100 tons SWL

and equipped with water treatment system (from 2023)

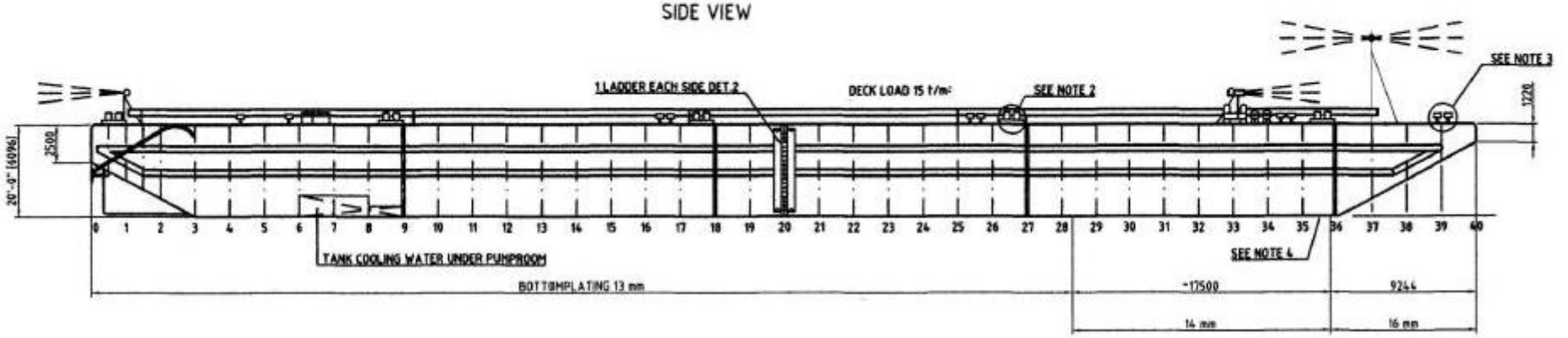
MARNAVI S.P.A. • Address: Via S. Brigida, 39 • 80133 NAPLES • ITALY • Phone: +39 081 251 33 00 • Fax: +39 081 251 33 57 • Email: offshore@marnavioffshore.it • Website: www.marnavi.it

C/B VERVECE – Flat deck cargo barge – 300 x 90 Feet / 90 x 27 m

DECK VIEW



SIDE VIEW



MARNAVI S.P.A.
TRASPORTI MARITTIMI

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ATTACHMENT D – YARD SLAB ON PILES & CAPPING BEAMS CHECK

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ROSETTI MARINO
SEDE -DIREZIONE - UFFICI - OFFICINA
Via Trieste, 230 - Ravenna

OBJECT: **LAUNCH LINE 2 – NEW LOAD CONDITIONS**
VIA DEL MARCHESATO 37 – MARINA DI RAVENNA

REPORT OF CALCULATION

CLIENT: **ROSETTI MARINO S.P.A.**

PREPARED BY : **ING. STEFANO SALVOTTI**
Studio Due Esse s.r.l.
Viale della Lirica, 43 – 48124 Ravenna
Tel. 0544/400044 – Fax. 0544/400112
Ns. comm. 060/13

CONTROLLED:



DESIGNER

REV.	DATE	DESCRIPTION	COMPILED	CONTROLLED	APPROVED
1	09/04/2013	Modified to comments	FRANCESCONI	S2S	-
0	26/03/2013	Issue	FRANCESCONI	S2S	-

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1. INTRODUCTION

This document sets out the static calculations of the launch line 2, located in the plant Rosetti Marino SpA – Yard Piomboni (Via del Marchesato, 37 – Marina di Ravenna).

The launch line 2 is composed of three portions; a first section 20.50x12.00 m with reinforcing structure (L=520 cm) of thickness 60 cm (the total cross section has a thickness 170 cm). The second calculation section has dimensions 16.00x12.00 m and has a reinforcement insole to the beam of crowning of thickness 50 cm; the total size of the slab near the sheet piling is equal to 170 cm. Finally, the third segment has dimensions 14.40x12.00 m and has the same characteristics of the second.

The structures described are on foundations piles and in particular:

- First section: 30 drilled piles ø800, L=31.00 m;
- Second section: 20 drilled piles ø800, L=32.00 m;
- Third section: 25 drilled piles (SOLES) ø700, L=29.00 m.

Verification requirements are two new calculation conditions more restrictive than those of the past calculation. In particular, slabs and drilled piles are to be tested with a load of 15t/sqm. The beam crowning and sheet piling with a uniformly distributed load of 42 t/m.

The calculations will be carried out in line with what performed in the past by the method of the admissible tensions.

In the following figure shows the layout of the area to be investigated.

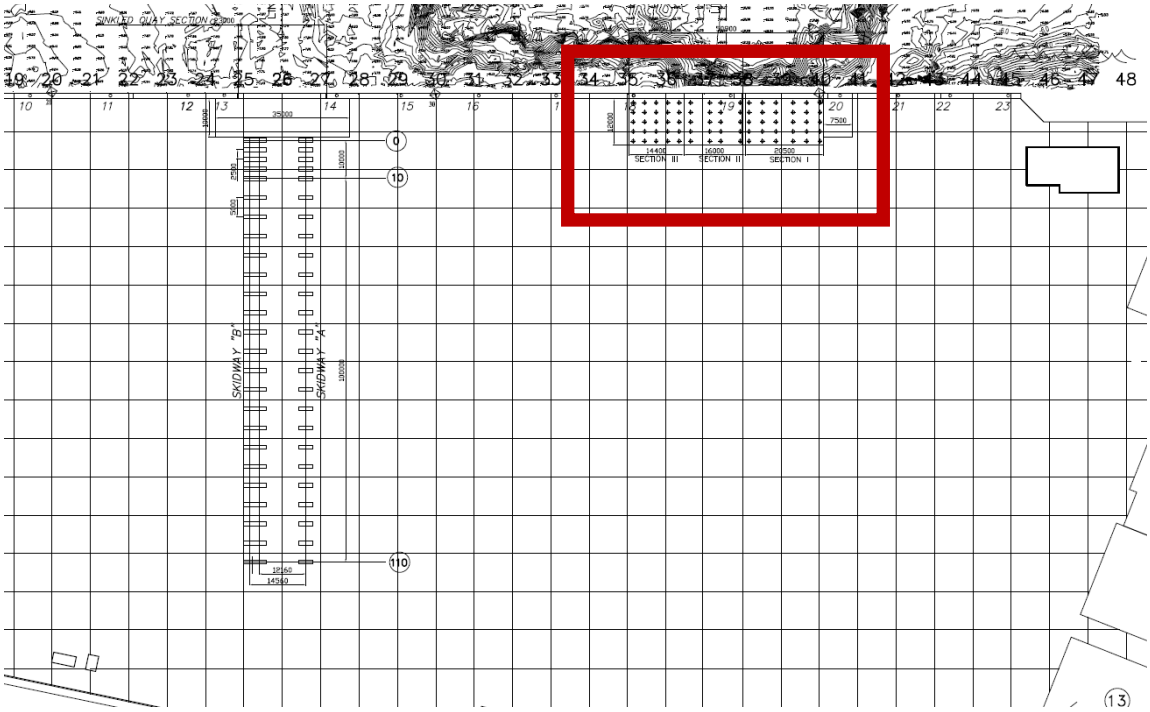


Figure 1 – layout with launch line 2

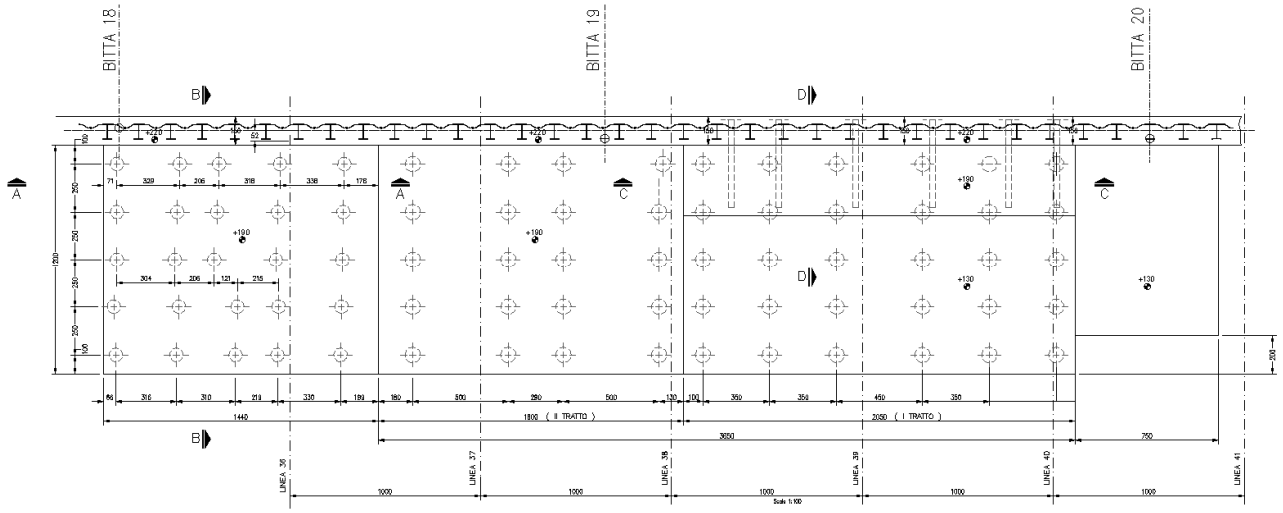


Figure 2 – planimetric detail

2. REFERENCE DOCUMENTS

2.1. Italian regulations

1. Law November 5, 1971, No. 1086 and related instructions issued by Circ. No. 11951 of February 14, 1974: "Regulations for the discipline of the works in reinforced concrete and prestressed and steel structure."

2. D.M. Public Works July 27, 1985: "Technical standards for the execution of the works in reinforced concrete and prestressed, and metal structures."

3. Circ. Min of Public Works October 31, 1986: "Instructions on the technical standards for the performance of reinforced concrete and prestressed and steel structures."

4. D.M. February 14, 1992 - January 9, 1996 and subsequent integration - "Technical standards for the performance of reinforced concrete and prestressed and steel structures."

5. D.M. Public Works February 12, 1982: "Upgrading of technical regulations applicable to the general criteria for the verification of the safety of constructions, loads and overloads"

6. D.M. January 16, 1996 - Technical standards relating to "General criteria for the verification of the safety of constructions, loads and overloads"

7. D.M. Public Works March 11, 1988 "Technical Norms regarding the investigation of soils and rocks, the stability of natural slopes and escarpments, the general criteria and requirements for the design, construction and testing of the works of support tere and works foundation. "

8. D.M. Public Works January 9, 1996 "Technical Standards for the regulation and testing of concrete structures and prestressed and steel structures."

9. Circ. Min of Public Works of 15 October 1996, n. 252 "Guidelines for the application of technical standards for the regulation and testing of concrete structures and prestressed and metal structures" of the Ministerial Decree of 9 January 1996 ".

3. CALCULATION SOFTWARE

Structural modeling : " PROSAP RY2010" (Vers. 8.0.0) - 2S.I. Software e Servizi per l'ingegneria

Inspection of sections c.a.: " VcaSLU " (vers. 7.6) – Prof. Piero Gelfi

4. MATERIALS

For checks in question are considered the following materials.

4.1. Concrete

Concrete R_{ck} 250 kg/cmq for old structures

σ_{cadm} = 85 kg/cmq

τ_{c0} = 5.3 kg/cmq

τ_{c1} = 16.8 kg/cmq

Concrete R_{ck} 450 kg/cmq for new structures

σ_{cadm} = 135 kg/cmq

τ_{c0} = 8.0 kg/cmq

τ_{c1} = 22.60 kg/cmq

4.2. Steel for concrete

Steel type FeB44K for old structures

σ_{adm} = 2600 daN/cmq

f_{yk} = 4300 daN/cmq

f_{tk} = 5400 daN/cmq

Steel type B450C for new structures

σ_{adm} = 2600 daN/cmq

f_{yk} = 4500 daN/cmq

f_{tk} = 5400 daN/cmq

5. SHEET PILES AND BEAM CROWNING

All section of the line 2 are reinforced with concrete cantilevered slab (thickness from 50 to 60 cm), which is necessary to increase the carrying capacity to vertical loads. The dock without the reinforcement insole has carrying capacity of 20 t / m. Each section is tested by the distributed load of 42 t / m.

5.1. Section 1 – 20.50x12.00 m

This section presents a concrete slab reinforcement sheet piling with a thickness of 60 cm, cantilever of 75 cm and reinforcing 1+1ø16/20. The test is carried out considering a live load of 42 t / m.

5.1.1. Load analysis

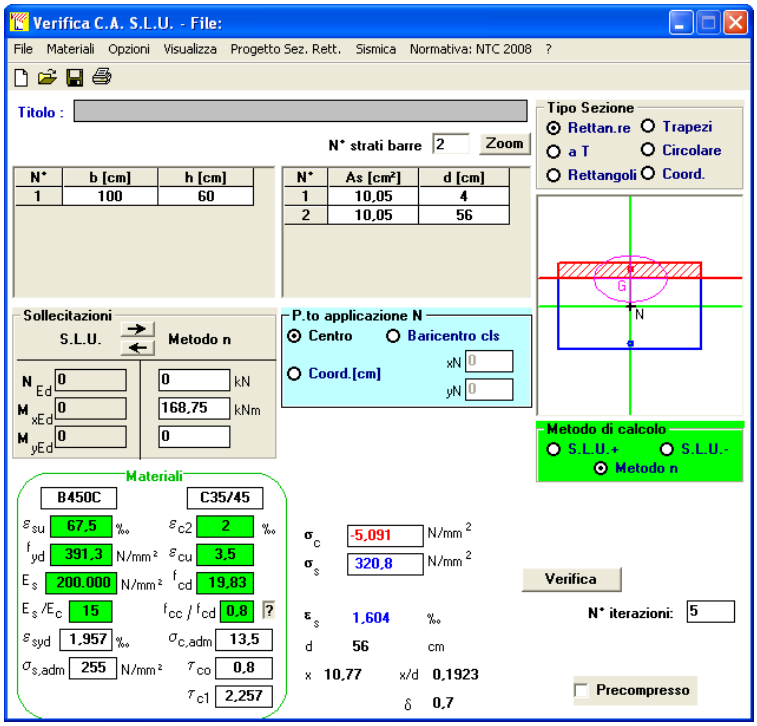
Permanent loads: Weight: 2500x0.60x1.00 = 1500 kg/m = 15.00 kN/m

Live loads: 42 ton

5.1.2. Stress and verification

$M = 15.00 \times 1.40^2/8 + 220 \times 0.75 = 168.75$ kNm/m - bending moment

$V = 15.00 \times 1.40 + 220 = 241$ kN/m - shear



σ_s = 3208 kg/cmq > 2600 daN/cmq

σ_c = 50.91 kg/cmq < 135 daN/cmq

the structure is not verified. The maximum applicable load is equal to **37.7 t/m** (20 t/m + 17.7 t/m).

Verification shear:

V = 241 kN/m

τ_{max} = 24100/(100*0.9*56) = 4.78 daN/cmq < 8.00 daN/cmq = τ_{c0}

Not necessary shear reinforcement.

5.2. Section 2 and 3 – 16.00x12.00 m and 14.40x12.00 m

This section presents a concrete slab reinforcement sheet piling with a thickness of 50 cm, cantilever of 75 cm and reinforcing 1+1ø22/25. The test is carried out considering a live load of 42 t / m.

5.1.1. Load analysis

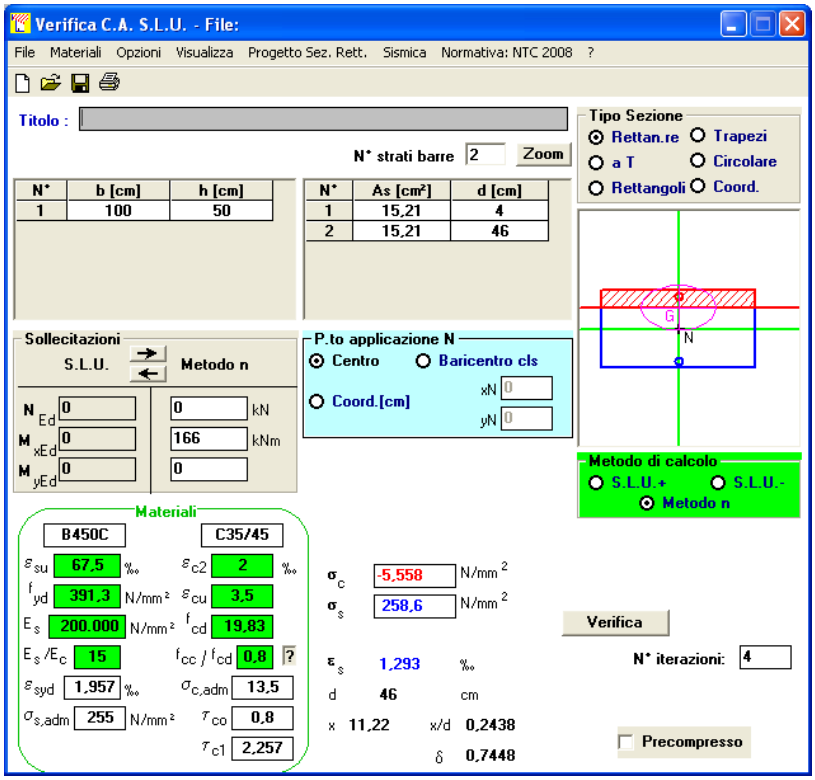
Permanent loads: Weight: 2500x0.50x1.00 = 1250 kg/m = 12.50 kN/m

Live loads: 42 ton

5.1.2. Stress and verification

M = 12.50x0.75^2/8 + 220x0.75 = 166 kNm/m - bending moment

V = 12.50x0.75+ 220 = 229 kN/m - shear



σ_s = 2586 kg/cmq < 2600 daN/cmq

σ_c = 55.58 kg/cmq < 135 daN/cmq

the structure is verified. The maximum applicable load is equal to **42 t/m** (20 t/m + 22 t/m).

Verification shear:

V = 229 kN/m

τ_{max} = 22900/(100*0.9*46) = 5.53 daN/cmq < 8.00 daN/cmq = τ_{c0}

Not necessary shear reinforcement.

5.3. Horizontal pressure on shore sheet piling

The sheet piling is verified with distributed load of 15 t/mq to 12.00 m from the dock. The quay is made up of piles PSP 802 and PZ 610 (combined wall). The sheet piles are infix up to -17.50 m and are anchored by ø75/58 (-0.40 m).

5.3.1 Stratigraphy of reference

First layer: from +2.20 m to -8.00 m - Yellow or gray sand with rare interbedded silty

$$\phi = 30°, c= 0, R_p = 25 \text{ kg/cmq}$$

Second layer: from -8.00 m to -24.80 m – Silt

$$R_p = 7 \text{ kg/cmq}, c_u = 3.4 \text{ t/mq}$$

Third layer: from -24.80 m to -27.20 m - Medium dense sand

$$R_p = 40 \text{ kg/cmq} , \text{ø}=32°$$

Fourth layer: from -27.20 m to -30.50 m – Compact clay

$$R_p = 20 \text{ kg/cmq}, c_u = 11.3 \text{ t/mq}$$

Fifth layer: from -30.50 m to -35.00 m - Dense sand

$$R_p = 80 \text{ kg/cmq} , \text{ø}=35°$$

5.3.2 Pressure on piles

The quay has been calculated for an overload of 4 t / mq. The slab near the dock has a width of 12.00 m and it is on drilled piles. This piles transfer the loads to deeper soil layers and then the sheet piling is not solicited directly by the load 15 t /mq. The width of the slab is greater than the width of the active wedge.

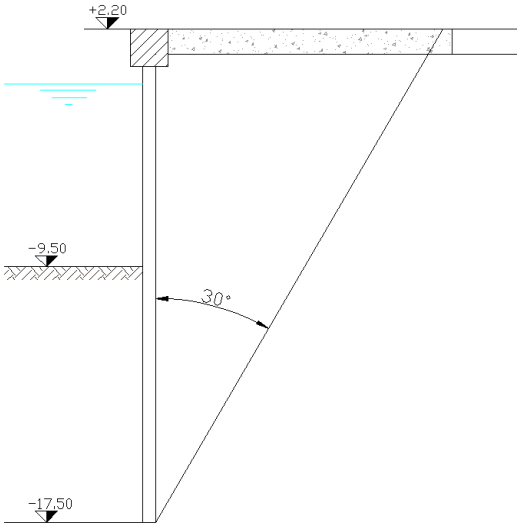


Figure 3 – active wedge

In the following we calculate the forces on the active sheet piles in case of overload equal to 4 t / mq and overloads of up to 15 t / mq to 12.00 m from the dock.

Case 1 – Overload 4 t/mq

The coefficients of active earth pressure for the two layers of soil considered are the following:

$K_{a1} = 0.333$ - ø = 30°

$K_{a2} = 0.455$ - ø = 22°

The uniform pressure on the piles is:

$q_{a1} = 0.333x4 = 1.33$ t/mq

$q_{a2} = 0.455x4 = 1.82$ t/mq

Case 2 – Overload 15 t/mq to 12.00 m from the dock:

We have obtained, from diagrams dimensionless (Gerber 1929 and Spangler 1938), the maximum value of the load pressure on the sheet piles.

m = x/h = 12.00/19.50 ≈ 0.70

z = n h

σ_{hq} = 0.58*q/h = 0.58*15/19.50 = 0.45 t/mq

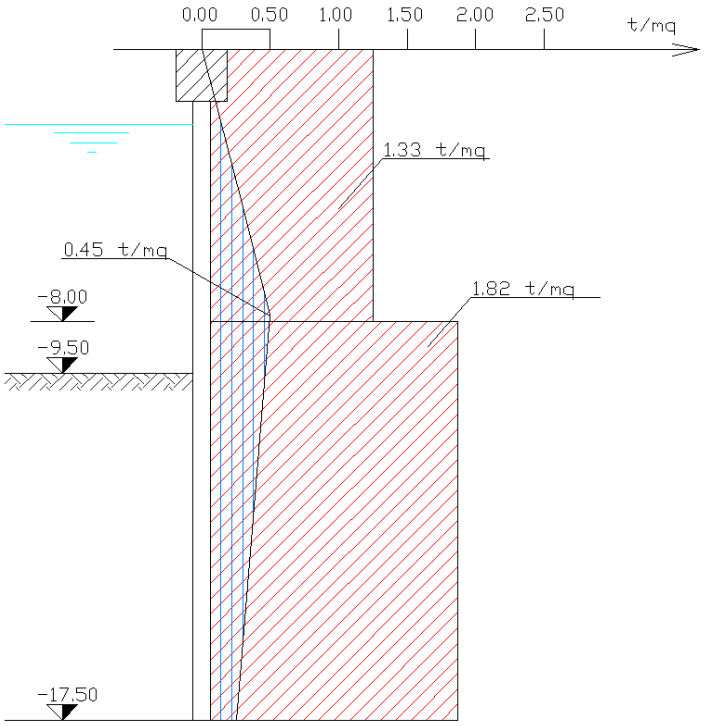


Figure 4 - active soil pressure

6. SLAB ON PILES

We do a finite element model to determine the maximum stress at the head of the foundation piles. The load condition is a uniform pressure equal to 15 t / sq m (requested by the Client) on the slab.

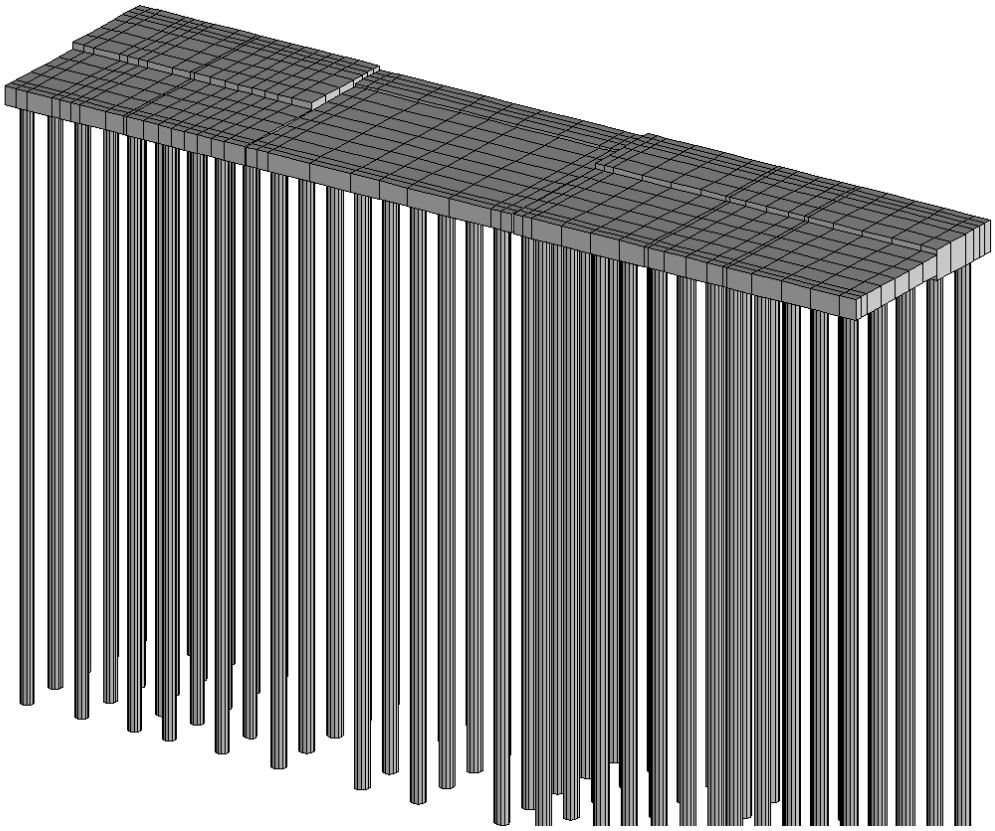


Figure 5 – calculation model

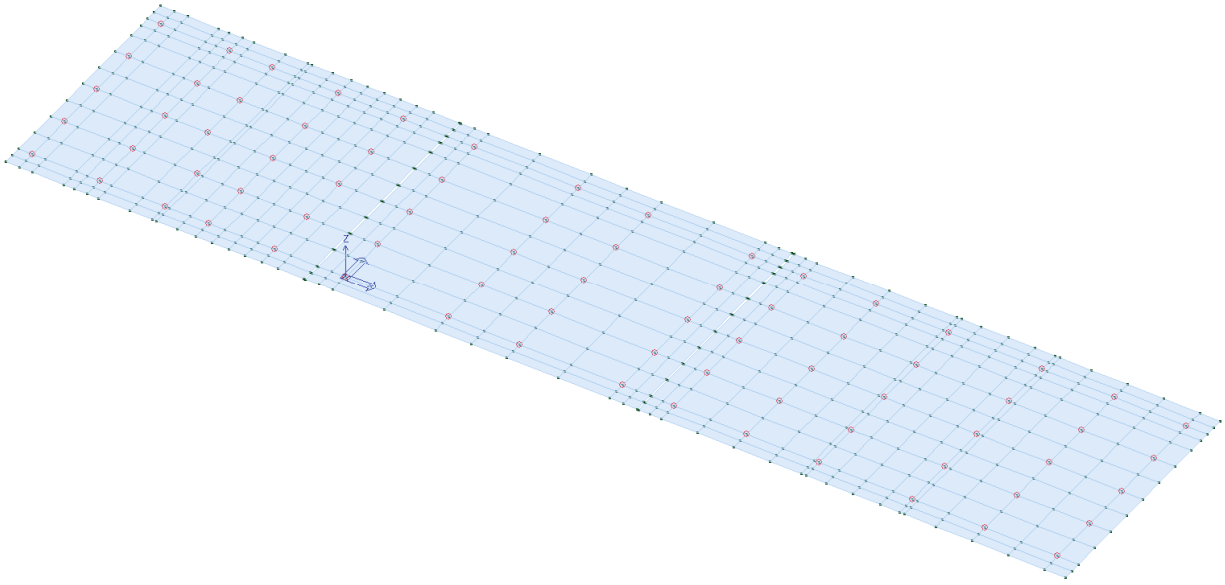


Figure 6 - single-line diagram with an indication of foundation piles

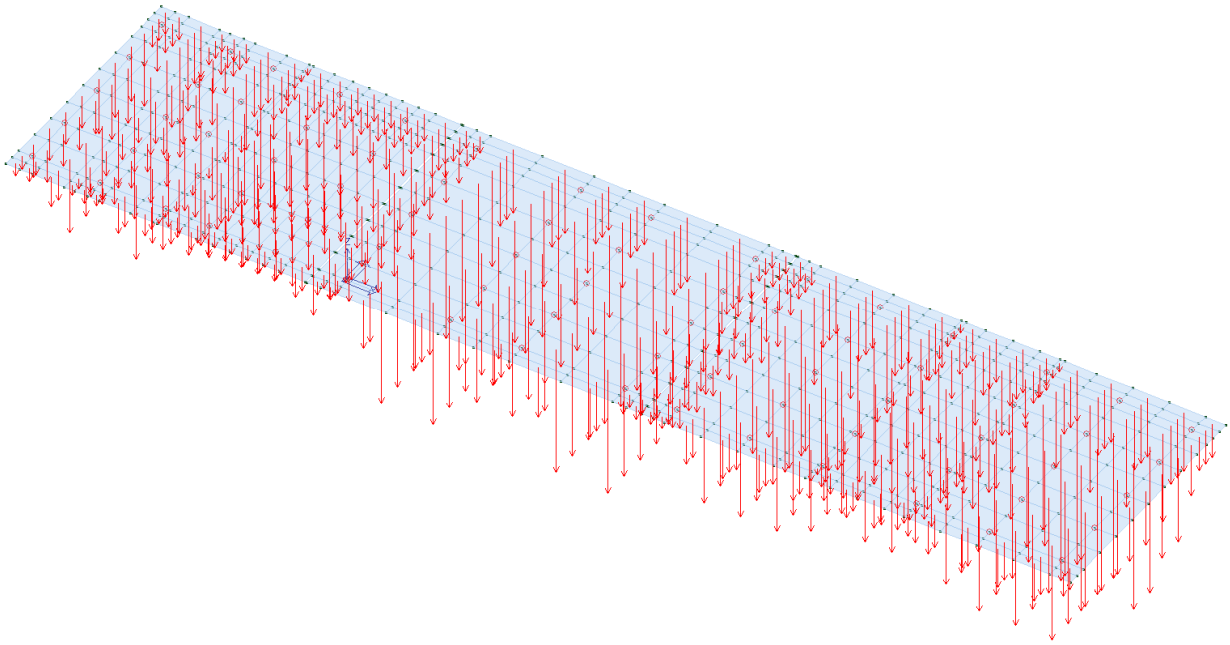


Figure 7 – weight

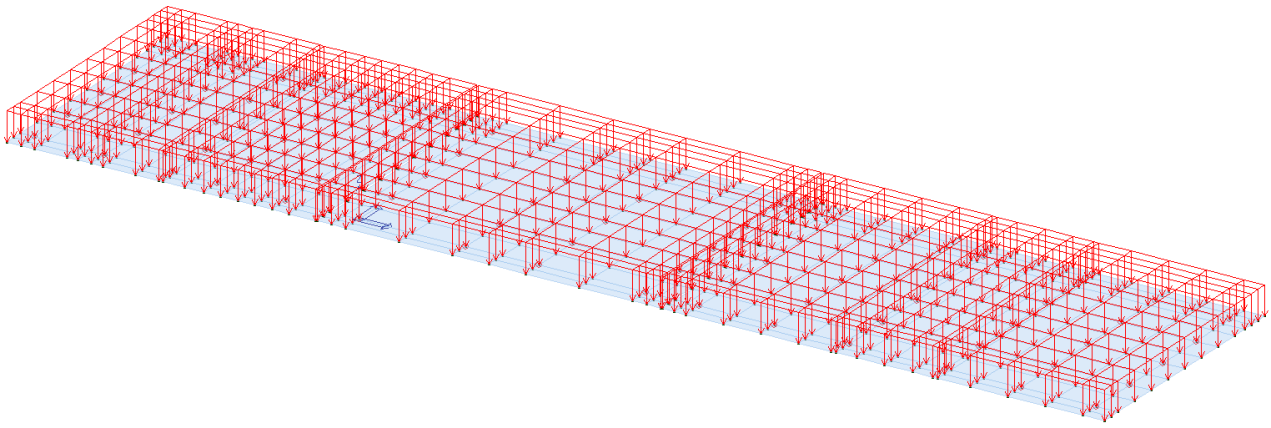


Figure 8 - uniform pressure equal to 15 t / sq m

6.1. Foundation piles

Below are diagrams of incidence of load on the individual foundation piles.

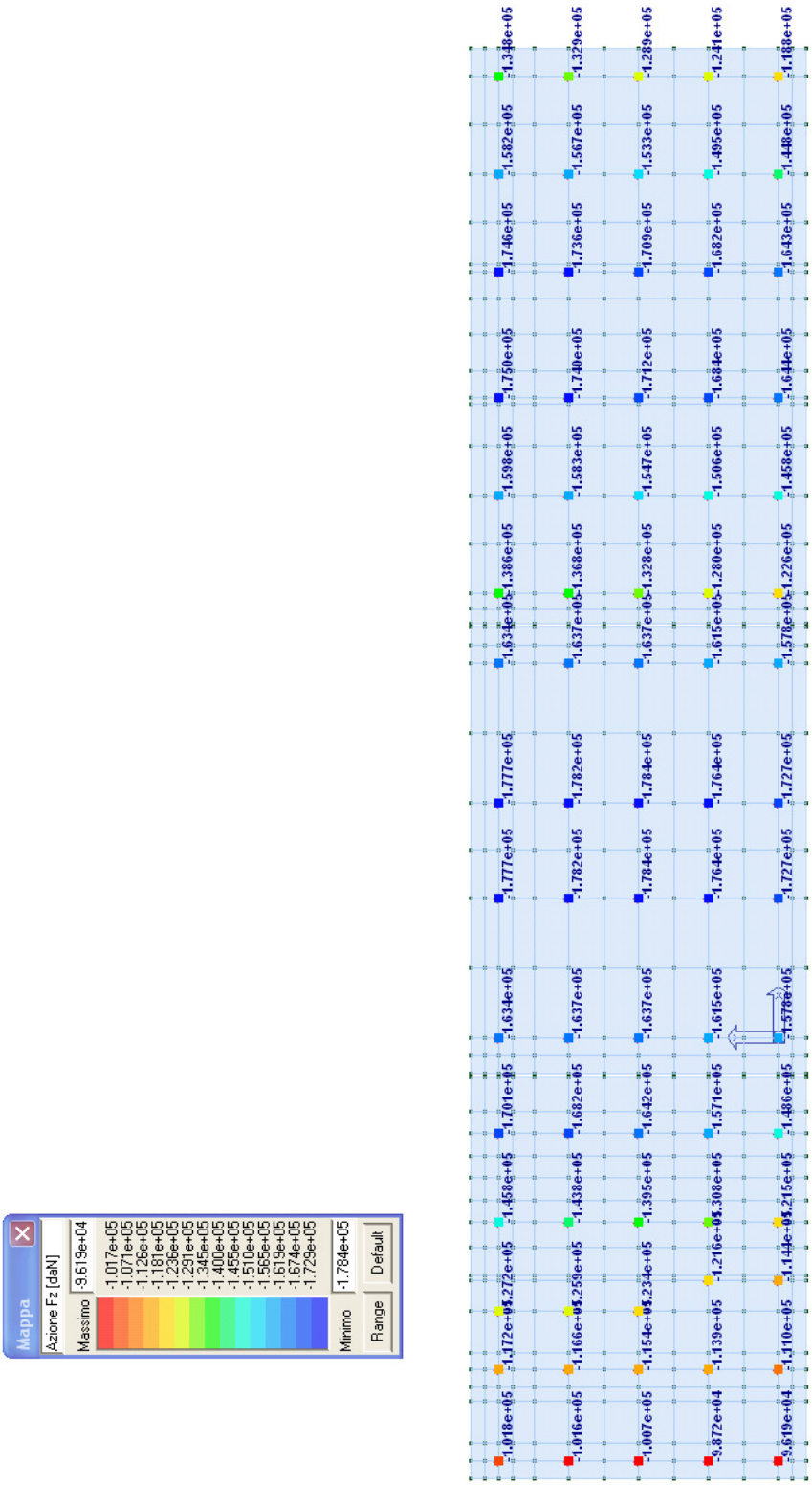


Figure 9 - uniform pressure equal to 15 t / sq m

Analyzes carried out that the maximum axial load on the foundation piles is equal to **178 t**.

Geotechnical studies performed in the past have shown the following flow vertical foundation piles:

- CAPACITY GEOTECHNICAL PILES SOLES ø700: 239 t
- CAPACITY GEOTECHNICAL PILES ø800: 200 t

The value determined by the analysis is lower than those determined by analysis geotechnical and therefore the verification is satisfied. Annexes shows the records of calculating the bearing capacity of foundation piles.

6.2. Foundation slab

Shows the diagrams of bending stress.

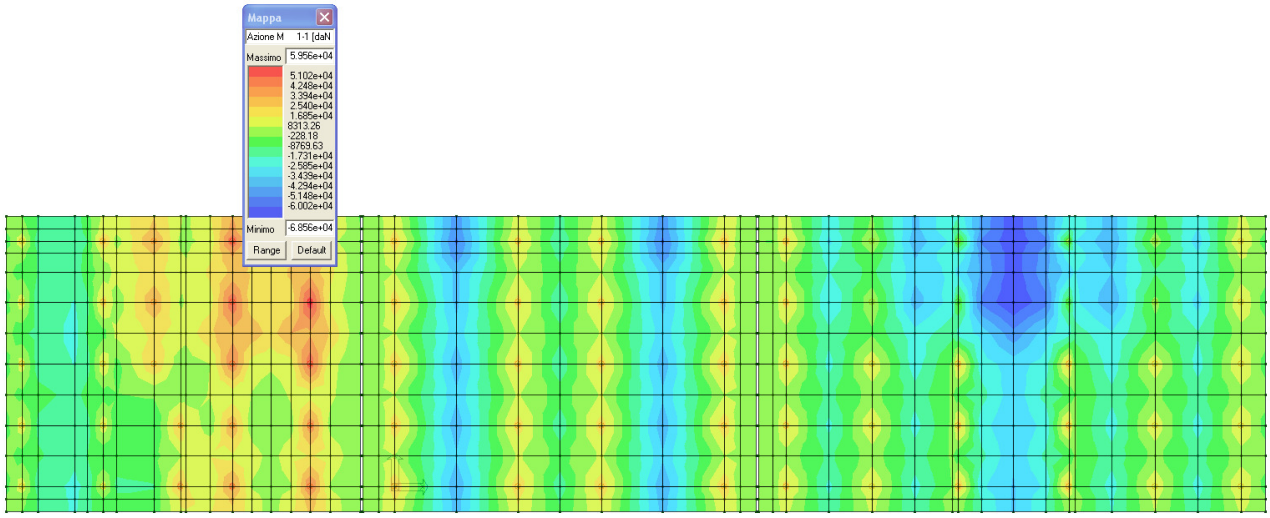


Figure 10 - longitudinal bending moment

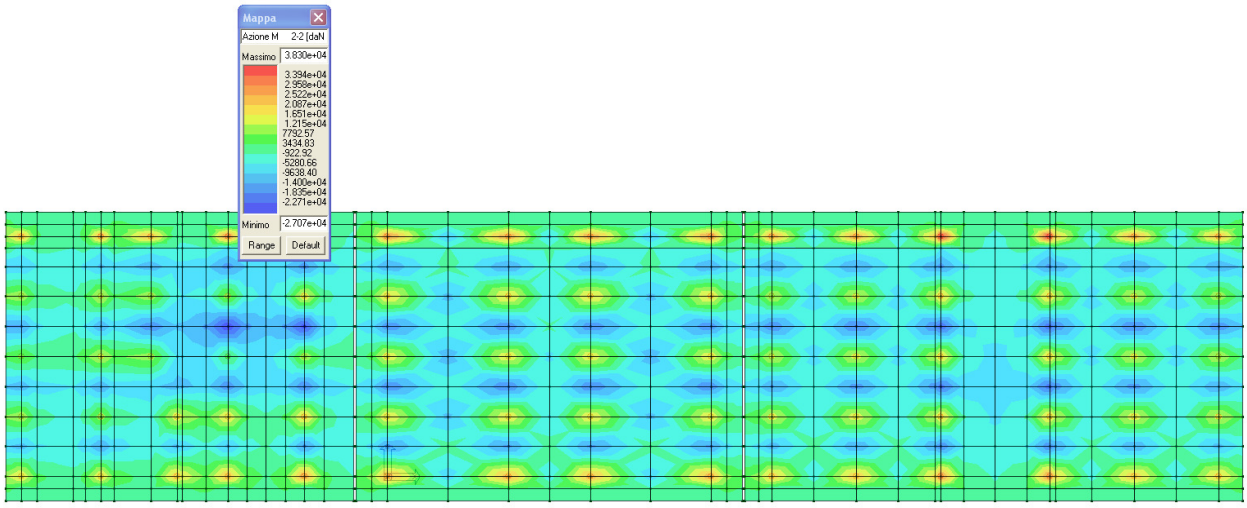


Figure 11- tranverse bending moment

6.2.1 Slab – section 2

The section A has the following characteristics:

b = 100 cm

h = 170 cm

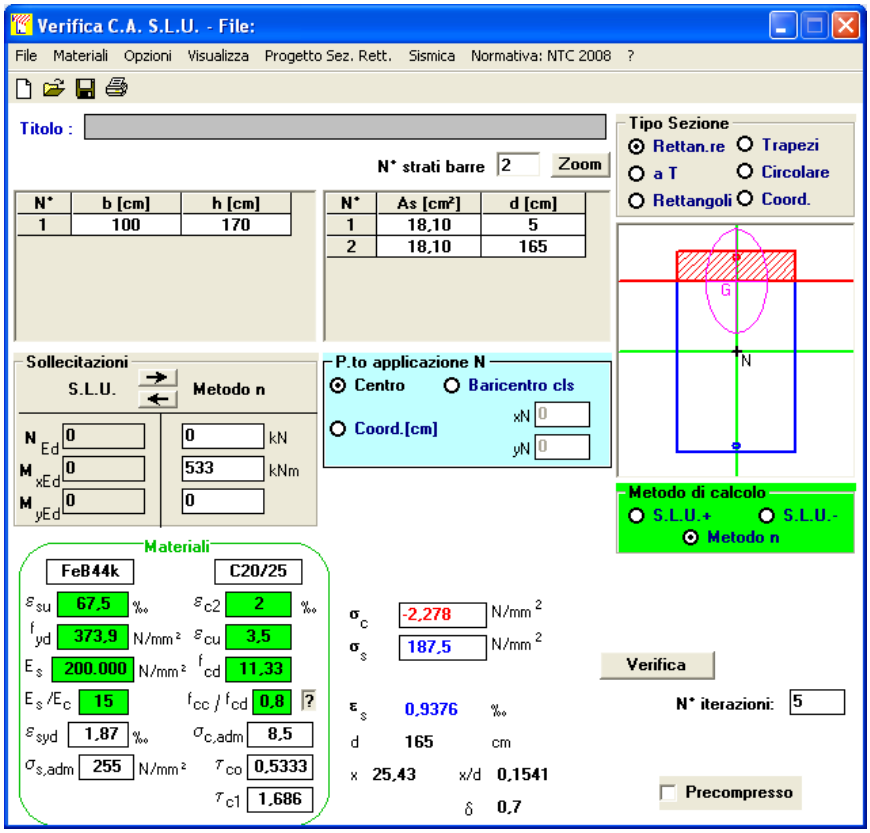
longitudinal reinforcement : 1+1ø24/25.

transverse reinforcement: 1+1ø22/25

M_{long1} = -533 kNm/m = -53.3 tm/m

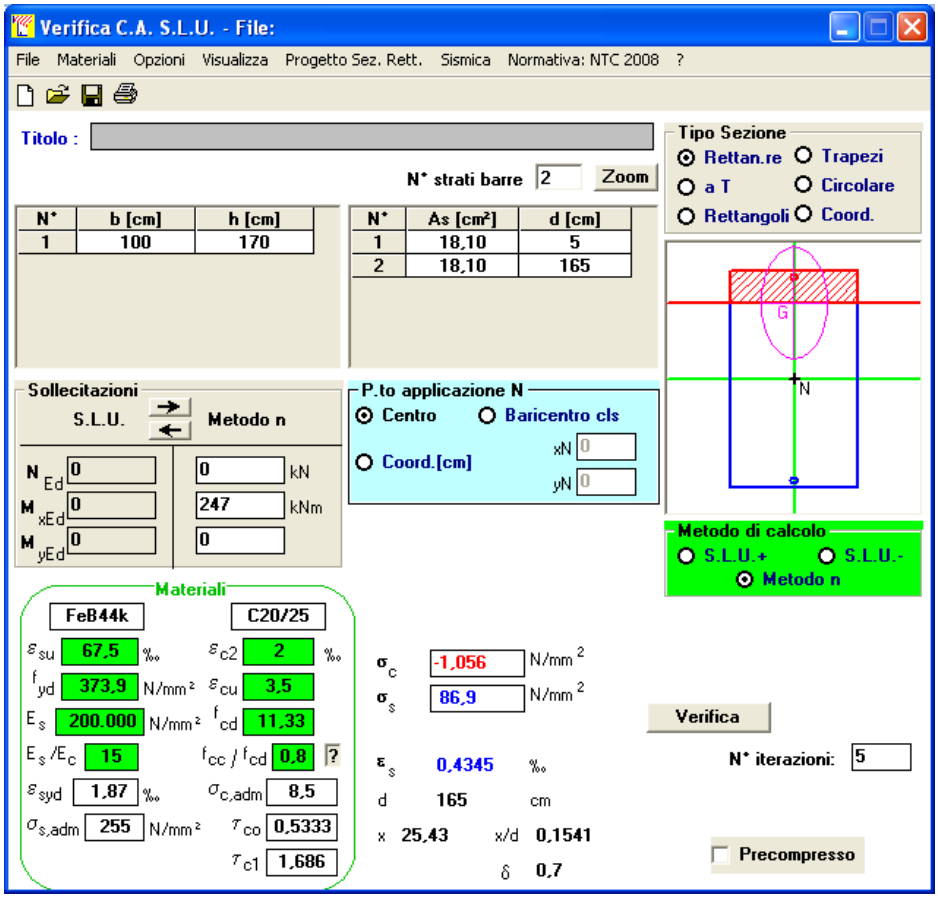
M_{long2} = 247 kNm/m = 24.7 tm/m

M_{trans} = 289 kNm/m = 35.9 tm/m



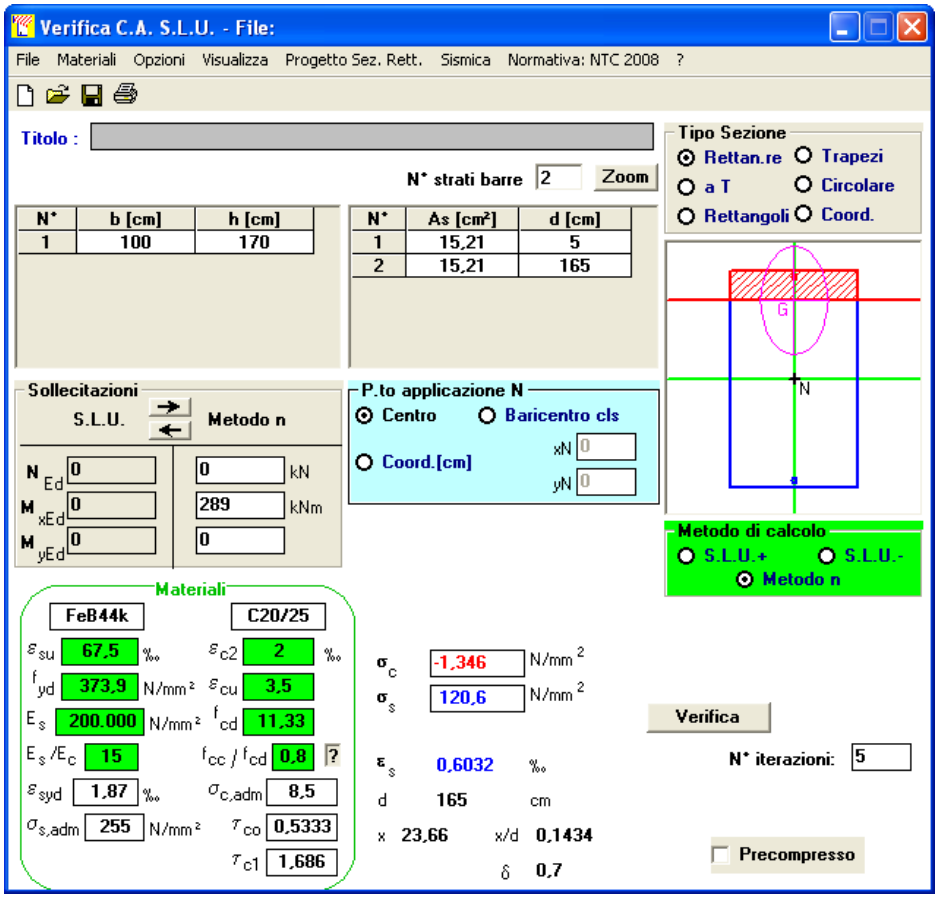
σ_s = 1875 daN/cmq < 2600 daN/cmq OK

σ_c = 22.78 daN/cmq < 85 daN/cmq OK



σ_s = 869 daN/cmq < 2600 daN/cmq OK

σ_c = 10.56 daN/cmq < 85 daN/cmq OK



σ_s = 1206 daN/cmq < 2600 daN/cmq OK

σ_c = 13.46 daN/cmq < 85 daN/cmq OK

The section B has the following characteristics:

b = 100 cm

h = 100 cm

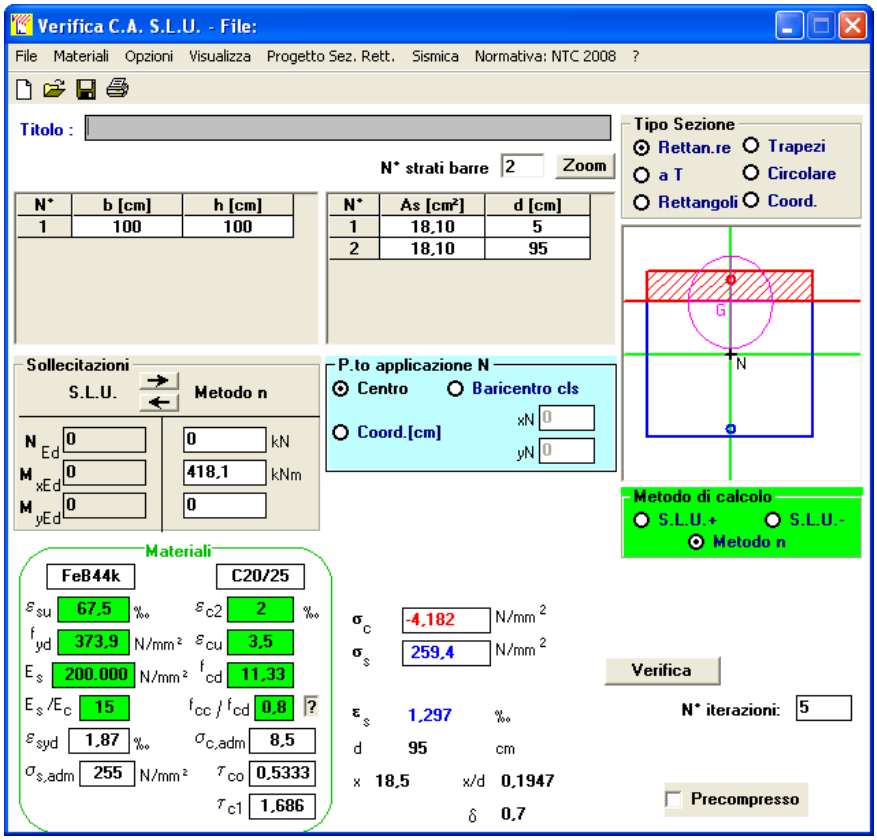
longitudinal reinforcement : 1+1ø24/25.

transverse reinforcement: 1+1ø22/25

M_{long1} = -418 kNm/m = -41.8 tm/m

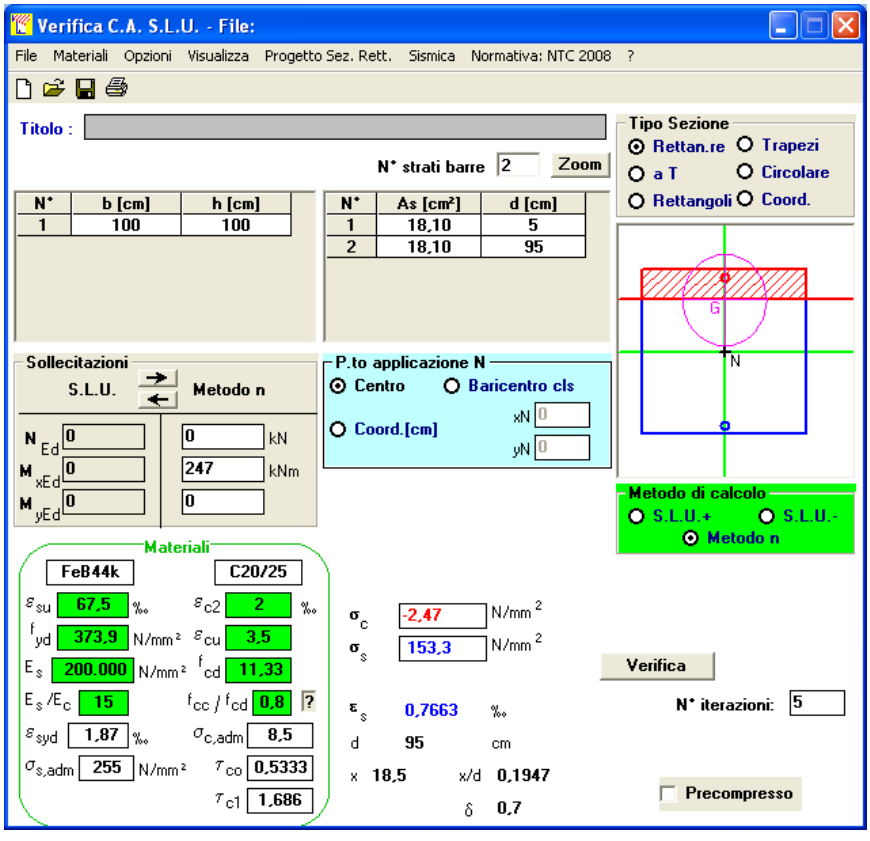
M_{long2} = -247 kNm/m = -24.7 tm/m

M_{trans} = 248 kNm/m = 24.8 tm/m



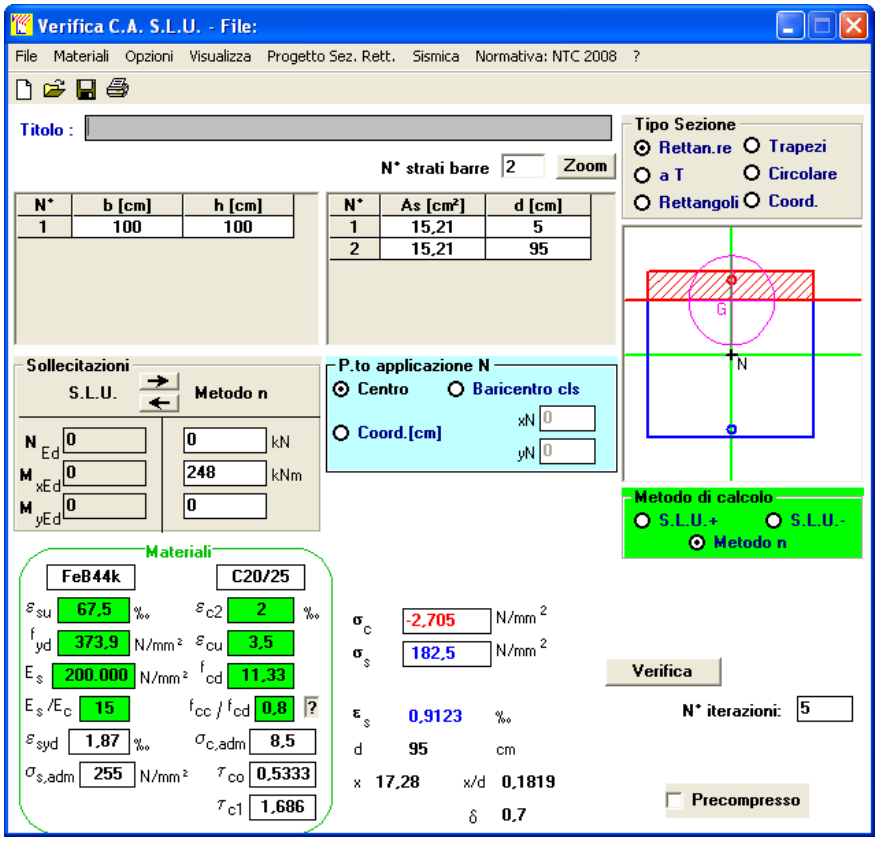
σ_s = 2594 daN/cmq < 2600 daN/cmq OK

σ_c = 41.82 daN/cmq < 85 daN/cmq OK



σ_s = 1533 daN/cmq < 2600 daN/cmq OK

σ_c = 24.70 daN/cmq < 85 daN/cmq OK



σ_s = 1825 daN/cmq < 2600 daN/cmq OK

σ_c = 27.05 daN/cmq < 85 daN/cmq OK

6.2.2 Slab – section 3

The section A has the following characteristics:

b = 100 cm

h = 170 cm

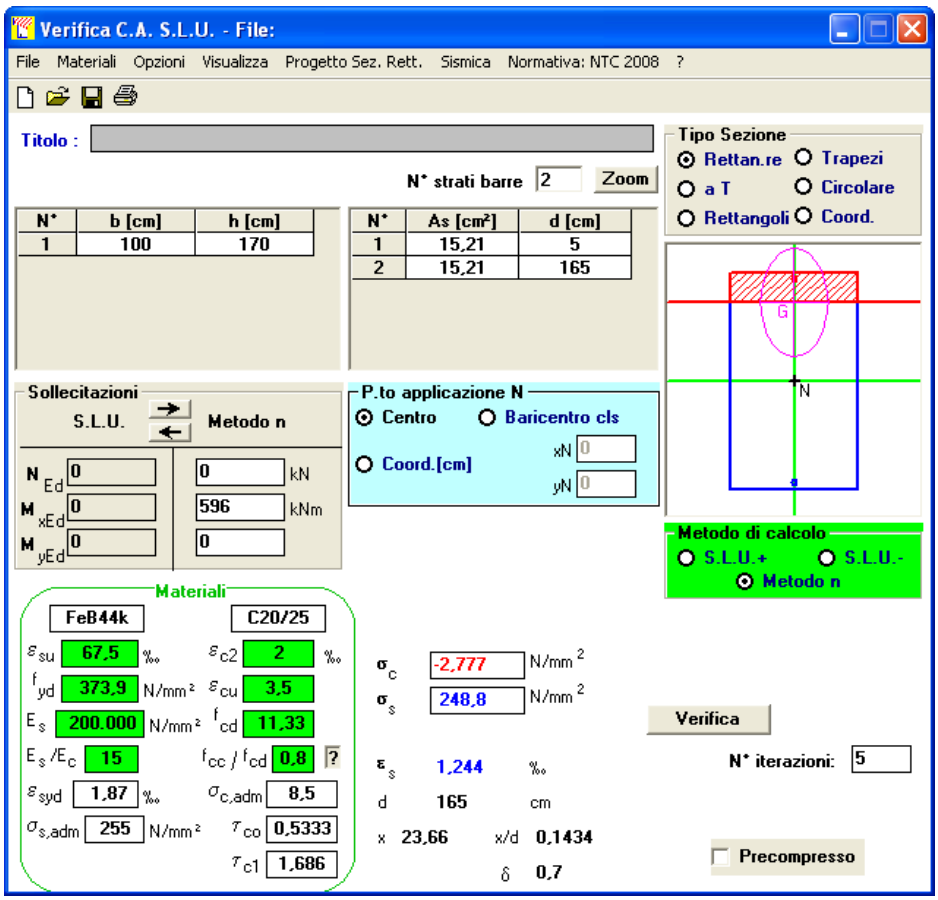
longitudinal reinforcement : 1+1ø22/25 for both directions.

transverse reinforcement: 1+1ø22/25 for both directions

M_{long1} = +596 kNm/m = 59.6 tm/m

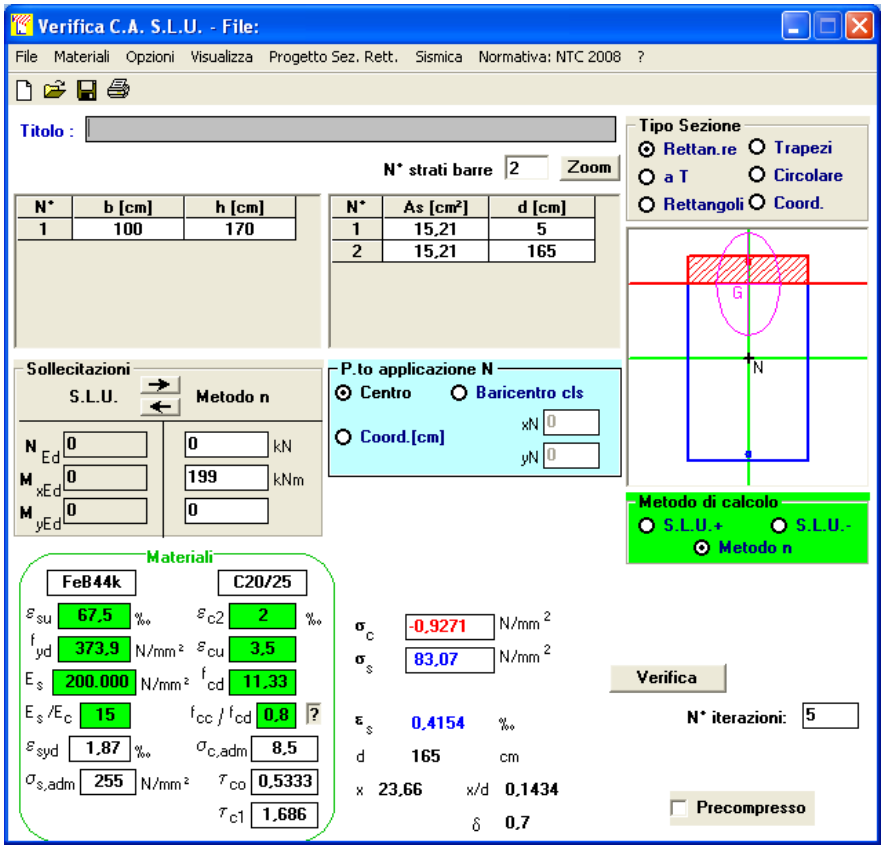
M_{long2} = -199 kNm/m = -20.0 tm/m

M_{trans} = 359 kNm/m = 35.9 tm/m



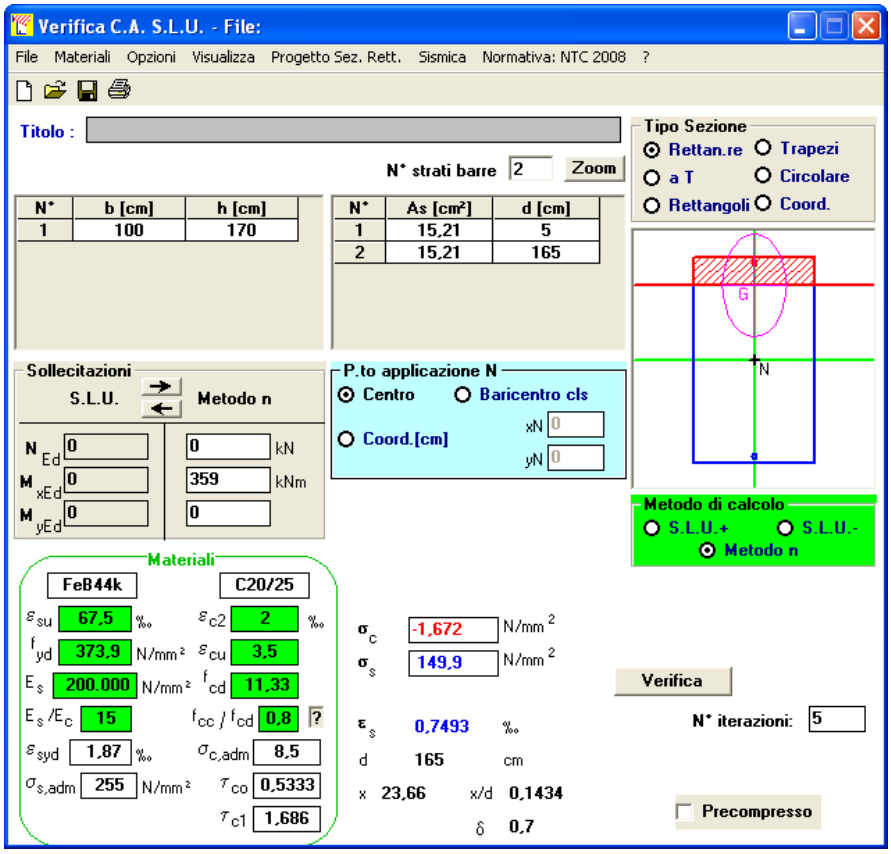
σ_s = 2488 daN/cmq < 2600 daN/cmq OK

σ_c = 27.77 daN/cmq < 85 daN/cmq OK



σ_s = 831 daN/cmq < 2600 daN/cmq OK

σ_c = 9.27 daN/cmq < 85 daN/cmq OK



σ_s = 1499 daN/cmq < 2600 daN/cmq OK

σ_c = 16.72 daN/cmq < 85 daN/cmq OK

The section B has the following characteristics:

b = 100 cm

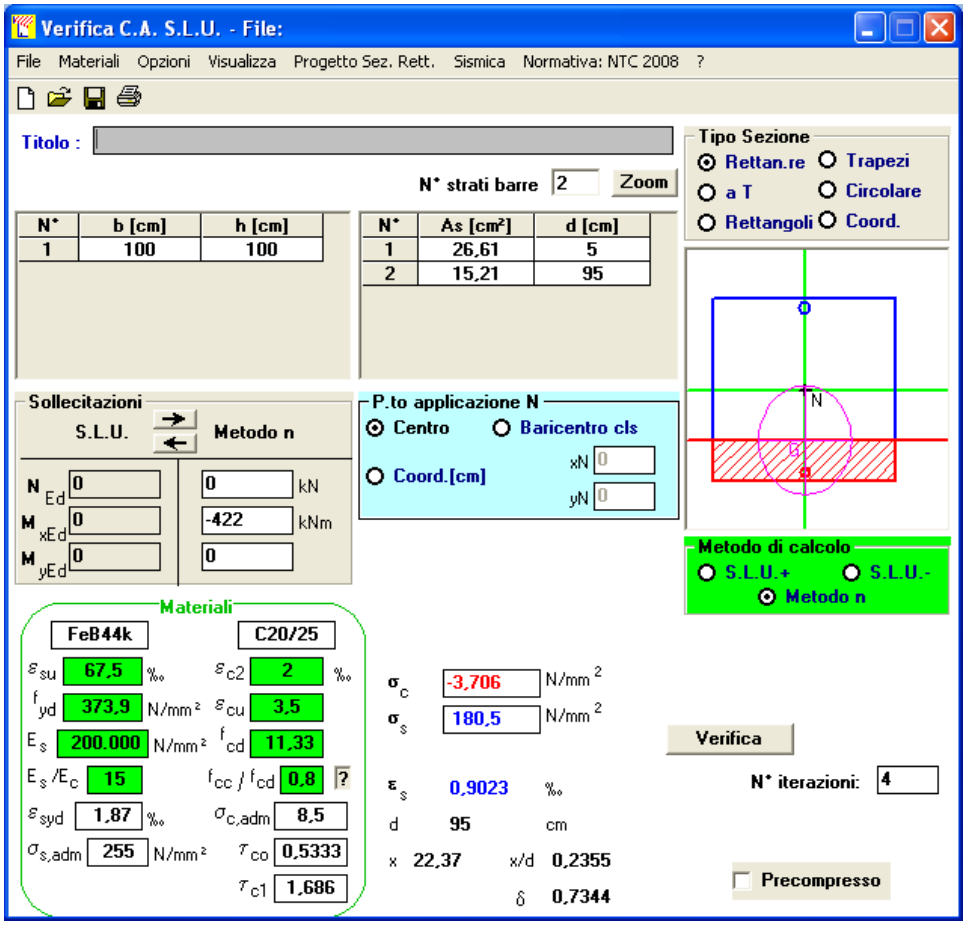
h = 100 cm

Longitudinal reinforcement : 1+1ø22/25 for both directions and 3ø22 for pile.

Transverse reinforcement: 1+1ø22/25 for both directions

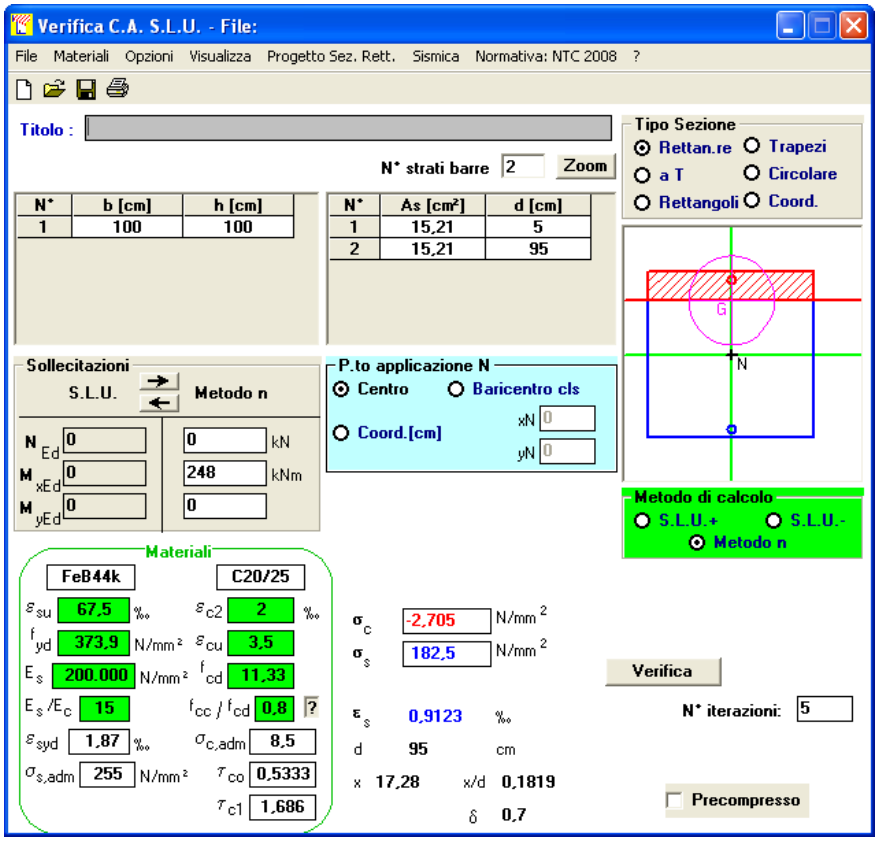
M_{long} = 422 kNm/m = 42.2 tm/m

M_{transv} = 265 kNm/m = 26.5 tm/m



σ_s = 1805 daN/cmq < 2600 daN/cmq OK

σ_c = 37.06 daN/cmq < 85 daN/cmq OK



σ_s = 1825 daN/cmq < 2600 daN/cmq OK

σ_c = 27.05 daN/cmq < 85 daN/cmq OK

6.2.3 Slab – section 1

The section A has the following characteristics:

b = 100 cm

h = 170 cm

For old slab (h_1=110 cm):

transverse reinforcement : 1+1ø22/25 for both directions.

Longitudinal reinforcement: 1+1ø22/25 for both directions

For new slab (h_2=60 cm):

transverse reinforcement : 1+1ø16/20 for both directions.

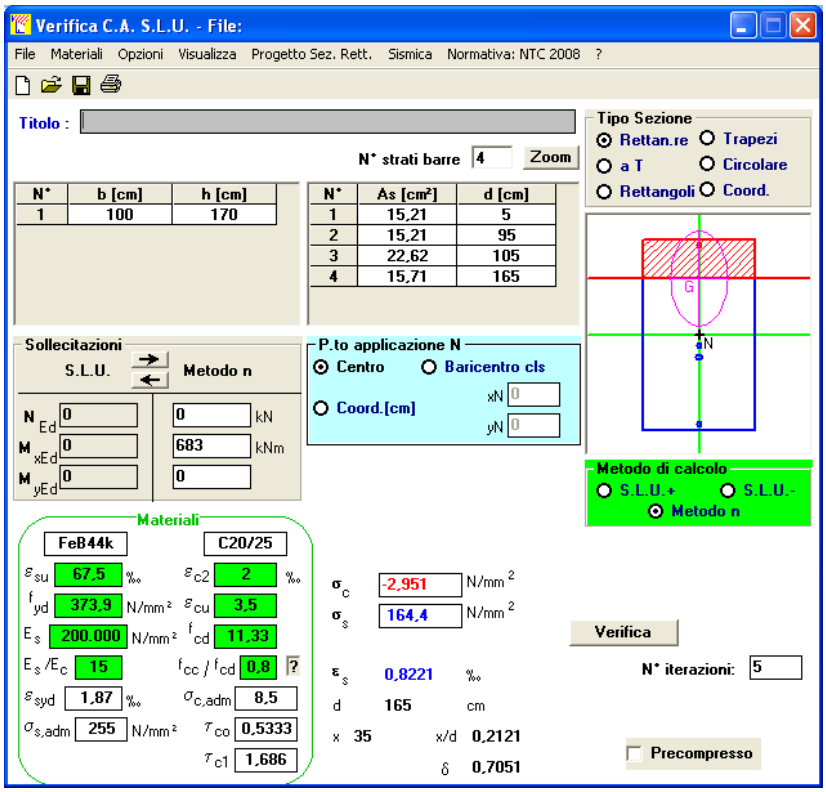
Longitudinal reinforcement: 1ø20/20 for top surface

1ø24/20 for bottom surface

M_{long1} = -683 kNm/m = 68.3 tm/m

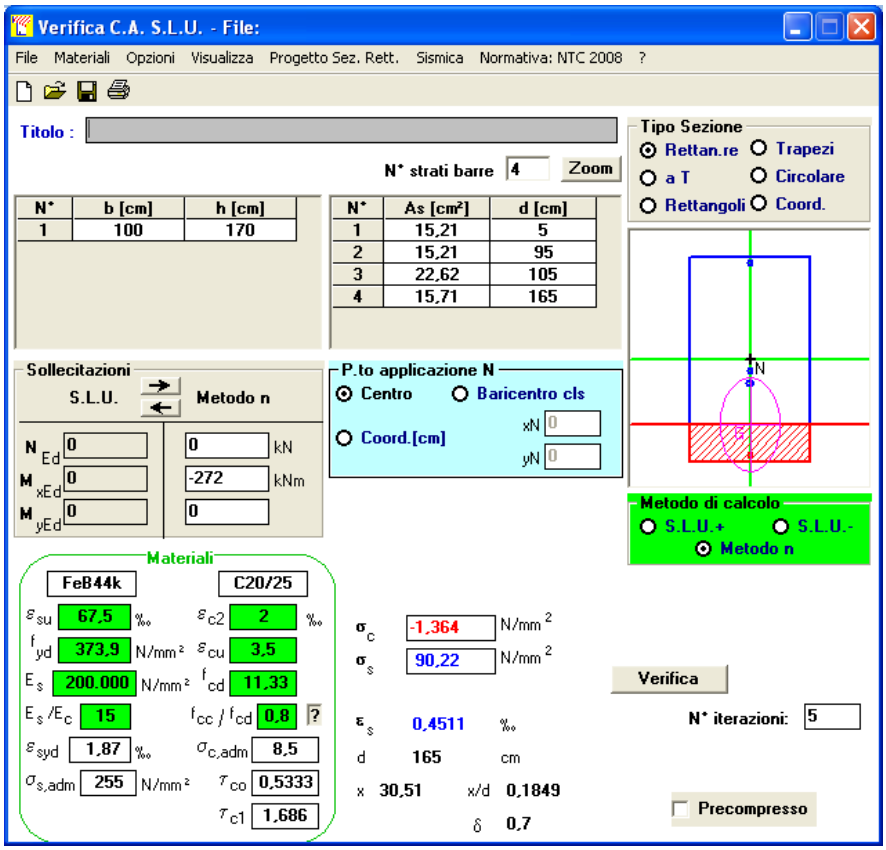
M_{long2} = 272 kNm/m = 27.2 tm/m

M_{trans} = 383 kNm/m = 38.3 tm/m



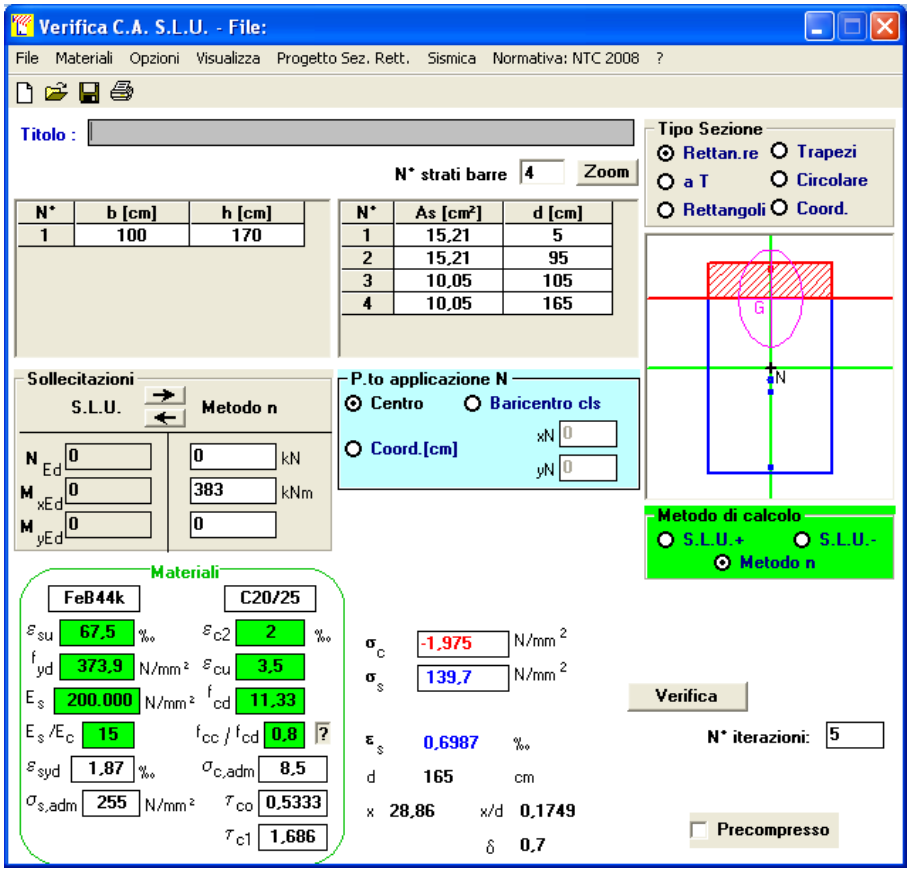
σ_s = 1644 daN/cmq < 2600 daN/cmq OK

σ_c = 29.51 daN/cmq < 85 daN/cmq OK



σ_s = 902 daN/cmq < 2600 daN/cmq OK

σ_c = 13.64 daN/cmq < 85 daN/cmq OK



σ_s = 1397 daN/cmq < 2600 daN/cmq OK

σ_c = 19.75 daN/cmq < 85 daN/cmq OK

The section B has the following characteristics:

b = 100 cm

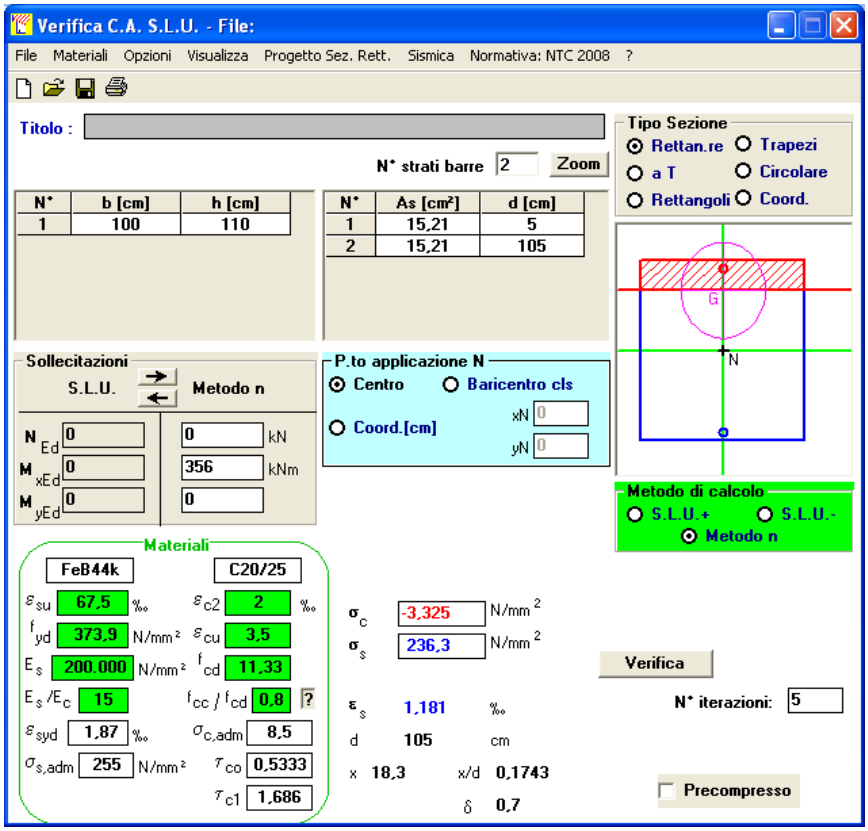
h = 110 cm

transverse reinforcement : 1+1ø22/25 for both directions.

Longitudinal reinforcement: 1+1ø22/25 for both directions

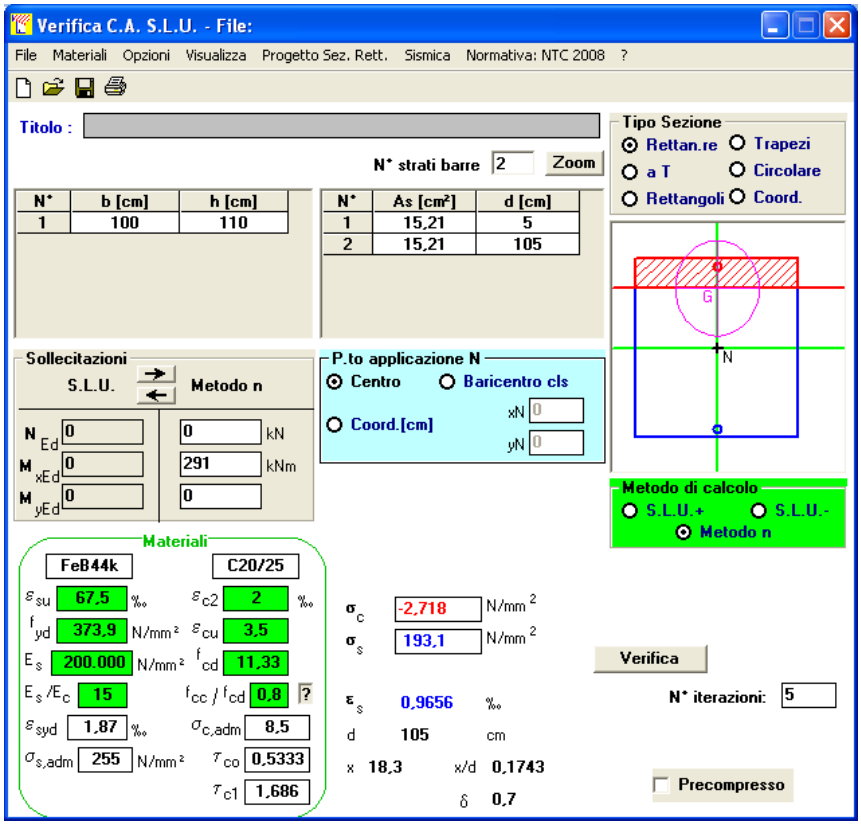
M_{long} = 356 kNm/m = 35.6 tm/m

M_{trans} = 291 kNm/m = 29.1 tm/m



σ_s = 2363 daN/cmq < 2600 daN/cmq OK

σ_c = 33.25 daN/cmq < 85 daN/cmq OK



σ_s = 1931 daN/cmq < 2600 daN/cmq OK

σ_c = 27.18 daN/cmq < 85 daN/cmq OK

7. CONCLUSION

in this report are the structural controls of the dock located at Yard Piomboni (property Rosetti Marino SpA). We have investigated two new load conditions:

- slabs and drilled piles are to be tested with a load of 15t/sqm;
- The beam crowning and sheet piling with a uniformly distributed load of 42 t/m.

The analysis shows that:

<u>Sheet Piles And Beam Crowning:</u>

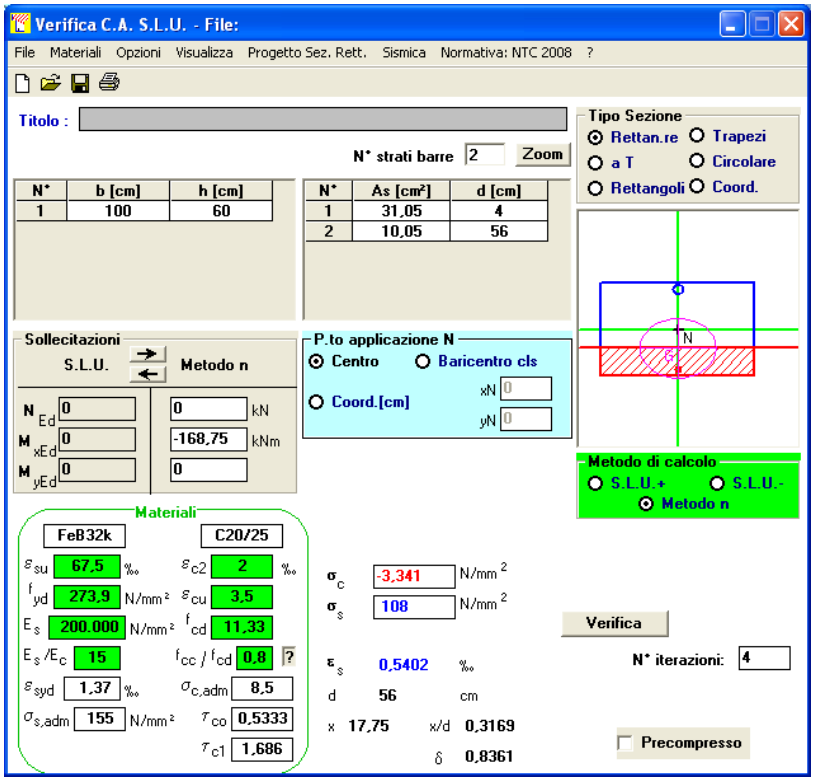
Section 1, Section 2 and section 3 are suitable for supporting the new design loads.

In particular the increasing capacity to vertical loads is due to:

- Section 2 and 3, concrete cantilevered slab;
- Section1, a concrete slab with the presence of HEB 500 steel beams (i=400 cm).

Below shows the calculation of the new slab (para. 5.1) to which is added the area of steel resulting from the presence of the beams HEB500 (i = 400 cm).

A = 30*2.8/4 = 21 cmq/m



σ_s = 1080 kg/cmq > 1550 daN/cmq

σ_c = 33.41 kg/cmq < 135 daN/cmq

in this case the structure is verified for the loading of 42 t/m.

Slab on piles:

All drilled piles and concrete slabs are verified in the new load conditions.

8. ANNEX

8.1. Geotechnical foundation piles

1. GEOMETRIA PLATEA E DEL PALO SOLES®

PLATEA LINEA DI VARO 2 - ZONA BITTA 18 (vedi Allegato 4.1. – 4.2. – 4.3.)

Dimensioni:

parallelamente al molo = 14,40 ml

ortogonalmente al molo 12,00 ml

Spessore platea: ml 1,70 per una fascia di larghezza circa 4,40 ml a ridosso del molo

ml 1,00 per una fascia rimanente di larghezza circa 7.60 ml

PALI SOLES® (vedi Allegato 4.4. – 4.5.)

N pali SOLES® eseguiti = 25

ϕ_{palo} = diametro del palo SOLES® = 700 mm

$\phi_{base\ palo}$ = diametro della flangia di base del palo SOLES® = 600 mm

L_{palo} = lunghezza del palo SOLES® da estradosso. platea di fondazione a base palo corrispondente alla lunghezza riportata nel "Modulo di registrazione dati infissione"

$H_{fondazione}$ = spessore della platea di fondazione

L'_{palo} = lunghezza del palo SOLES® da intradosso platea di fondazione a flangia di base del palo; $L'_{palo} = L_{palo} - H_{fondazione}$

D = distanza tra la flangia allargatrice e la flangia di base ≈ H platea + 0,55 ml

L_{utile} = lunghezza tratto iniettato palo SOLES® ove si sviluppa la resistenza laterale $L_{utile} = L'palo – D$

2. ESEMPIO DI CALCOLO A CONSUNTIVO DELLA PORTATA GEOTECNICA AMMISSIBILE DEL PALO SOLES® ϕ 700 - n.ro 1- (Q^*_{amm})

La portata geotecnica ammissibile dei pali SOLES® è stata calcolata impiegando le formule tipiche dei pali trivellati. I coefficienti che consentono di valutare la portata limite laterale e la portata limite di base sono però stati adattati per tenere conto della particolare tecnologia d'infissione dei pali SOLES®.

Infatti:

1) i pali SOLES® sono infissi staticamente a mezzo di speciali martinetti oleodinamici fino al raggiungimento della portata e/o lunghezza richiesta che permette la verifica istantanea della spinta applicata durante l'infissione pertanto, alla fine dell'esecuzione di ogni singolo palo, è rilevata e verbalizzata la portata limite di punta.
2) l'unicità della tecnologia di esecuzione del palo SOLES® che prevede l'infissione del palo dopo avere eseguito la struttura di fondazione, garantisce un maggior consolidamento del terreno al di sotto della struttura di fondazione sia per effetto della non estrazione di terreno, sia per effetto del confinamento superiore del terreno esercitato dalla fondazione stessa.:

Dalla *"Nota sintetica di calcolo – Portata geotecnica ammissibile dei pali SOLES®"* la portata geotecnica ammissibile dei pali SOLES® risulta dalla seguente espressione:

$$Q^*_{amm} = (Q_{lim,\,lat} - W_{palo})/ F.S._{lat} + Q^*_{lim,\,base} / F.S._{base}$$

Dove:

- Q^*_{amm} = Portata geotecnica ammissibile a consuntivo del palo [ton]
- $Q_{lim,\,lat}$ = Portata limite laterale del palo SOLES calcolata a partire dai dati contenuti nella *"Relazione di calcolo strutturale. Rev. 1 del "01/07/10"*
- W_{palo} = Peso del palo SOLES® [ton]
- $F.S._{lat}$ = Fattore di sicurezza per la portata laterale = 2,5
- $Q^*_{lim,\,base}$ = Portata limite di base del palo registrata al termine dell'infissione [ton]
- $F.S._{base}$ = Fattore di sicurezza per la portata di base = 2

2.1. Portata limite laterale palo SOLES® ϕ 700 - n.ro 1- ($Q_{lim\ lat}$)

In base alle considerazioni sopra esposte il calcolo della portata laterale per il palo SOLES® ϕ 700 mm - n.ro 1 può essere eseguito come segue:

$$Qlim,lat = \Sigma_i (\alpha\ cu_{i\text{-esima}} + k\ \mu\ \sigma v'_{i\text{-esima}})\ \phi_{palo} \times \pi \times h_{i\text{-esima strato}}$$

Con:

α = 1 (valore legato alla particolare tecnologia di infissione del palo SOLES®)

$cu_{i\text{-esimo}}$ = coesione non drenata nell'i-esimo strato di terreno

k = 1 (valore legato alla particolare tecnologia di infissione del palo SOLES®)

μ = tg $\phi_{i\text{-esimo}}$

$\phi_{i\text{-esimo}}$ = angolo di attrito interno nell'i-esimo strato di terreno

$\sigma v'_{i\text{-esima}}$ = carico litostatico efficace a metà dell'i-esimo strato di terreno

ϕ_{palo} = diametro del palo SOLES® = 700 mm

$h_{i\text{-esima strato}}$ = spessore dell'i-esimo strato di terreno

Per il palo SOLES® ϕ 700 n.ro 1 ubicato nella platea in c.a., che ha estradosso a quota di circa +1,80 ml rispetto alla quota 0,00 risulta (Vedi Allegato 4.6):

1) La platea di fondazione ha uno spessore di ml 1,70 sulle prime 2 file di pali (da palo n.ro 1 a palo n.ro 10) e di ml 1,00 per i pali delle rimanenti 3 file (da palo n.ro 11 a palo n.ro 25). Pertanto per il palo n.ro 1 oggetto del presente calcolo lo spessore platea è pari a 1,70 ml;
2) L'intradosso della platea quindi si trova ad una profondità di ⏚ + 0,10 m sulle prime 2 file di pali (da palo n.ro 1 a palo n.ro 10) e di ⏚ + 0,80 m per i pali delle rimanenti 3 file (da palo n.ro 11 a palo n.ro 25). Pertanto per il palo n.ro 1 oggetto del presente calcolo l'intradosso platea si trova ad una quota di ⏚ + 0,10 m rispetto allo 0.00;
3) La lunghezza totale del palo (da estradosso platea a flangia di testata) è di 39,00 m pertanto la flangia di testata del palo è posta ad una profondità di ⏚ - 37,20 m rispetto alla quota 0,00
4) La lunghezza del palo compreso tra la flangia allargatrice e la flangia di base (tratto non iniettato) è pari a 2,25 ml
5) La lunghezza utile del palo (da intradosso magro di pulizia sp.=0,10 ml a flangia allargatrice) risulta di conseguenza pari a: 34,95 m;
6) A favore di sicurezza, visti gli scavi eseguiti in fase di realizzazione della platea per messa a nudo dei tiranti delle bitte e delle palancole, la resistenza laterale del terreno è stata considerata nulla sino alla profondità di circa -2,00 rispetto allo 0,00, ed è stata considerata nulla pure nel tratto non iniettato compreso compreso tra la flangia di base e la flangia allargatrice

$Q_{lim,\ lat}$ = PORTATA LIMITE LATERALE

N.B. Il calcolo della portata laterale è eseguito considerando le caratteristiche terreno impiegate per il calcolo dei trivellati ma i coefficienti sono assunti direttamente da RACCOMANDAZIONI AGI 1984 considerando la particolare tecnologia del palo SOLES

Il calcolo della portata laterale unitaria del palo è fatta distinguendo tra:

Terreno coerente (Limi - Argille) $\tau_{lim} = \alpha\ Cu$

Terreno incoerente (sabbie - Ghiaie) $\tau_{lim} = k \times \mu \times \sigma'v \times tg\phi$

Profondità strato (rispetto alla quota 0,00)		NATURA DELLO STRATO	Spessore strato	Diametro palo nello strato i-esimo	Area laterale strato i-esimo	Altezza del baricentro dello strato i-esimo	Quota baricentro dello strato i-esimo rispetto allo 0,00 della prova	Densità terreno	Densità efficace terreno	Carico litostatico efficace a metà strato	Carico litostatico efficace alla base dello strato	Angolo d'attrito interno drenato	μ	Coefficiente di spinta assunto nella relazione	Resistenza al taglio limite per terreni incoerenti	Coesione non drenata media	Coefficiente alfa per argille secondo Golberg	Resistenza al taglio limite per terreni coerenti	Portanza limite laterale per l'i-esimo strato
da	a		h_{strato}	ϕ_{PALO}	$A_{laterale}$	h_i		(γ)	(γ')	(σ'_v)		(ϕ)	$(\tan\phi)$	k	(τ_{lim})	Cu	α	(τ_{lim})	P^i
ml	ml		ml	ml	mq	ml	ml	ton/mc	ton/mc	ton/mq	ton/mq	(°)			ton/mq	ton/mq		ton/mq	ton
2,20	0,80	fondazione	1,40																
0,80	-2,00	riporto	2,80	0,700	8,18	1,40	-0,60	1,8	1,8	2,52	5,04	0	0,000	0,00	0,00	0,00	0,00	0,00	0,00
-2,00	-4,50	sabbia	2,50	0,700	5,50	1,25	-3,25	1,8	0,8	6,04	7,04	30	0,577	1,00	3,49	0,00	0,00	0,00	19,17
-4,50	-8,00	sabbia	3,50	0,700	7,70	1,75	-6,25	1,8	0,8	8,44	9,84	30	0,577	1,00	4,87	0,00	0,00	0,00	37,51
-8,00	-24,80	argilla	16,80	0,700	36,95	8,40	-16,40	1,8	0,8	16,56	23,28	0	0,000	1,00	0,00	3,40	1,00	3,40	125,61
-24,80	-27,20	sabbia	2,40	0,700	5,28	1,20	-26,00	1,8	0,8	24,24	25,20	32	0,625	1,00	15,15	0,00	0,00	0,00	79,94
-27,20	-30,50	argilla	3,30	0,700	7,26	1,65	-28,85	1,8	0,8	26,52	27,84	0	0,000	1,00	0,00	11,30	1,00	11,30	82,00
-30,50	-34,95	sabbia	4,45	0,700	9,79	2,23	-32,73	1,8	0,8	29,62	31,40	35	0,700	1,00	20,74	0,00	0,00	0,00	202,96
-34,95	-37,20	tratto tra flangia allatgatrice e di base	2,25	0,700	4,95	1,13	-36,08	1,8	0,8	32,30	33,20	0	0,000	0,00	0,00	0,00	0,00	0,00	0,00
																		$Q_{lim,\ lat}$ =	ton 547,20

2.2. Peso del palo SOLES® ϕ 700 - n.ro 1- (W_{palo})

$$W_{palo} = \phi^2_{palo} \times \pi / 4 \times L'_{palo} \times \gamma$$

Con:

ϕ_{palo} = diametro del palo SOLES® = 700 mm

L'_{palo} = lunghezza palo da intradosso platea di fondazione a flangia di testata = 37,30 ml

$\gamma_{c.a.}$ = peso specifico palo ≈ 2,5 tonn / m^3

Risulta:

$W_{palo} = \phi^2_{palo} \times \pi / 4 \times L'_{palo} \times \gamma \approx$ 35,8 tonn

2.3. Portata limite di base del palo SOLES® ϕ 700 - n.ro 1 ($Q^*_{lim,\ base}$)

In base alla nota esplicativa per la determinazione della forza applicata dalla macchina piantapali in fase di infissione (Vedi Allegato 4.7.) e dal "Modulo di registrazione dati infissione" per il palo SOLES® n.ro 1 (Vedi Allegato 4.8.) si ricava che:

$$Q^*_{lim,\ base} = P_{olio} \times [A_{mart\ MPP018} \times 2] = 80 \times [(23^2 \times \pi / 4) \times 2] \cong 66{,}48 \text{ tonn}$$

2.4. Calcolo a consuntivo della portata geotecnica ammissibile del palo SOLES® ϕ 700 - n.ro 1- (Q^*_{amm})

$$Q^*_{amm} = (Q_{lim,\ lat} - W_{palo}) / F.S._{lat} + Q^*_{lim,\ base} / F.S._{base} =$$

$$= (547{,}20 - 35{,}80)/2{,}5 + 66{,}48 / 2 = \mathbf{237{,}8\ tonn} > 200 \text{ tonn}$$

3. CALCOLO A CONSUNTIVO DELLA PORTATA GEOTECNICA AMMISSIBILE DEI PALI SOLES® ϕ 700 – PLATEA ZONA BITTA 18 (Q^*_{amm})

In maniera analoga è possibile calcolare a consuntivo la portata geotecnica ammissibile di tutti i 25 pali SOLES® della platea zona bitta 18.

I valori così ottenuti sono sinteticamente riportati nella tabella che segue da cui si evince che il valore della portata geotecnica ammissibile è per tutti i pali SOLES superiore a quello richiesto in progetto (200 tonn)

Palo n.ro	H platea [ml]	L_{palo} da "Modulo di registrazione dati infissione" [ml]	$Q_{lim,lat}$ [tonn]	W_{palo} [tonn]	$Q^*_{lim,base}$ [tonn]	$F.S._{lat}$	$F.S._{base}$	$Q^*amm = (Q\ lim,\ lat - Wpalo)/ F.S.lat + Q^*\ lim,\ base / F.S.base =$ [tonn]
1	1,70	39,00	547,20	35,77	66,48	2,5	2,0	237,8
2	1,70	40,40	616,10	37,12	58,17	2,5	2,0	260,7
3	1,70	38,60	528,00	35,40	91,40	2,5	2,0	242,7
4	1,70	42,00	697,80	38,70	74,80	2,5	2,0	301,0
5	1,70	39,00	547,20	35,80	74,80	2,5	2,0	242,0
6	1,70	39,40	566,60	36,20	74,80	2,5	2,0	249,6
7	1,70	39,00	547,20	35,80	74,80	2,5	2,0	242,0
8	1,70	38,80	537,60	35,60	83,10	2,5	2,0	242,4
9	1,70	38,55	525,60	35,30	87,25	2,5	2,0	239,7
10	1,70	39,00	547,20	35,77	99,70	2,5	2,0	254,4
11	1,00	39,60	611,10	37,00	74,80	2,5	2,0	267,0
12	1,00	39,00	581,35	36,45	99,71	2,5	2,0	267,8
13	1,00	39,00	581,35	36,45	83,10	2,5	2,0	259,5
14	1,00	39,60	611,10	37,02	78,94	2,5	2,0	269,1
15	1,00	39,00	581,35	36,45	74,79	2,5	2,0	255,4
16	1,00	39,00	581,35	36,45	83,10	2,5	2,0	259,5
17	1,00	39,60	611,10	37,02	49,86	2,5	2,0	254,6
18	1,00	39,60	611,10	37,02	49,86	2,5	2,0	254,6
19	1,00	39,40	601,13	36,83	74,79	2,5	2,0	263,1
20	1,00	38,60	561,76	36,06	99,71	2,5	2,0	260,1
21	1,00	39,90	626,14	37,31	74,79	2,5	2,0	272,9
22	1,00	39,00	581,35	36,45	66,48	2,5	2,0	251,2
23	1,00	39,60	611,10	37,02	83,10	2,5	2,0	271,2
24	1,00	39,70	616,10	37,12	58,17	2,5	2,0	260,7
25	1,00	39,50	606,11	36,93	83,10	2,5	2,0	269,2

VERIFICA DELLA PORTATA DEI PALI DI FONDAZIONE Φ 80 ESISTENTI
ASPETTI GENERALI DELL'OPERA

Pali Φ 80 cm trivellati, profondità di infissione 33 m, quota testa palo +0.80 m quota piede palo -32 m.

CARATTERISTICHE DEI MATERIALI PALI ESISTENTI PRIMO STRALCIO
I materiali impiegati nella realizzazione dei pali hanno le caratteristiche di seguito elencate.

Calcestruzzo pali

Classe di resistenza:	Rck 250
Classe di esposizione:	-
Classe di consistenza:	S4
Diametro massimo inerte:	-
E palo	2.8 10e16 t/m^2

Acciaio per c.a.
Fe B 44 K

MODELLO DI COMPORTAMENTO DEL PALO
La palificata realizzata nell'ultimo stralcio (oggetto della presente relazione) ha caratteristiche dimensionali (diametro e lunghezza di infissione) analoghe alla palificata realizzata nel primo stralcio (anno di costruzione 1986), il modello di comportamento del singolo palo è analogo.
Per la valutazione del cedimento atteso si è fatto riferimento ad un modello non lineare denominato metodo delle curve di trasferimento (Chin) adottando per la caratterizzazione geotecnica del terreno un legame costitutivo, sia per l'attrito laterale che per la resistenza di punta, variabile con legge iperbolica del tipo:

$$q(z) = w(z) / (1/ K_e + w(z) /q_{lim})$$

z = profondità dal piano di fondazione
$q(z)$ = reazione mobilitata all'interfaccia tra palo e terreno per unità di superficie
$w(z)$ = cedimento del palo
K_e = rigidezza iniziale della curva costitutiva
q_{lim} = resistenza limite del terreno

I valori della rigidezza iniziale, k_e , sono stati desunti in base ad elaborazioni di dati di letteratura assumendo:

$$K_e = q_{lim}/\chi D$$

relazione nella quale:
χ= 0.0025 per q(z) < (resistenza laterale)
χ = 0.0030 per la resistenza alla punta di pali trivellati

Per la modellazione del comportamento del palo si sono distinti 5 strati principali, si riporta la stratigrafia semplificata:

1. da +2.20 m a -8.00 m – Sabbia con intercalazioni limose
   Rp = 5 kg/cmq
   Φ = 30°
   Cu = 0

2. da -8.00 m a -24.80 m – Limo argilloso normalconsolidato
   Rp = 7 kg/cmq
   Cu = 3.4 t/mq

3. da -24.80 m a -27.20 m – Sabbia mediamente andensata
   Rp = 40 kg/cmq
   Φ = 32°

4. da -27.20 m a -30.50 m – Argilla compatta
   Rp = 20 kg/cmq
   Cu = 11,3 t/mq

5. da -30.50 m a -35.00 m – Sabbia fortemente andensata
   Rp = 80 kg/cmq
   Φ = 35°

I valori della resistenza limite laterale sono stati calcolati secondo la relazione:

$$Plim = 3{,}14\ D \sum \tau i\ hi$$

τi = resistenza tangenziale limite dello strato i-esimo

τi = α Cu per i terreni coesivi

τi = $\sigma_{(vi)}$ Ki tg δi per i terreni incoerenti

$\sigma_{(vi)}$ pressione efficace dello strato i-esimo

ki = 1- sen Φ (per i pali trivellati) coeff. di spinta orizzontale

i valori di Tlim strato per strato sono pari a:

1. Tlim = 2.1
2. Tlim = 2.7
3. Tlim = 8.3
4. Tlim = 4.5
5. Tlim = 9.6

Il valore di resistenza alla punta viene calcolato con il metodo Berezantev

Metodo di Berezantev.

Nc = Nq-1/tgϕ	**86,28**	
Nq= 10^m	**50,82**	
m =-0.764 + 0.076 ϕ'(°)	1,71	
ϕ' - angolo attrito interno dopo l'infissione	32,50	°
ϕ - angolo attrito interno prima della l'infissione	30,00	°
c	0,00	kg/cm^2
Cu	0,00	kg/cm^3
D - diametro palo	0,80	m
L - lunghezza palo	33,00	m
profondità testa palo	2,00	m
profondità di falda	1,20	m
coefficiente amplificazione base	**1,00**	
Ap punta	0,50	m^2
As fusto	82,90	m^2
Rck cls	450	Kg/cm^2
E palo	381.838	Kg/cm^2
pressione verticale alla profondità della punta del palo		
qL= γ' * L	29.200	kg/m^2
	2,92	Kg/cm^2
γ' - peso specifico efficace	800	kg/m^3
γ - peso specifico terreno	1.800	kg/m^3
pressione limite alla punta		
qp =Nc*c + Nq*ql	**148,38**	**kg/cm^2**

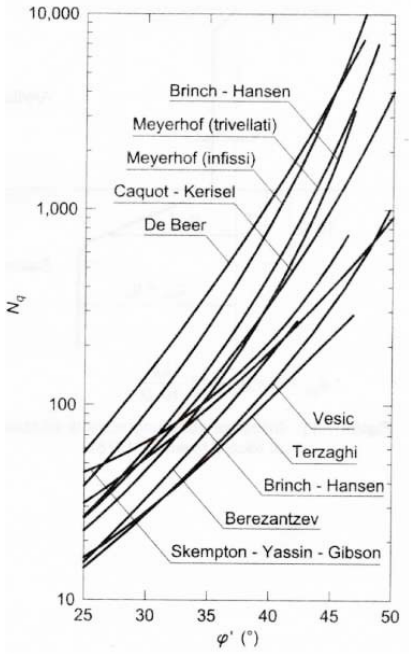
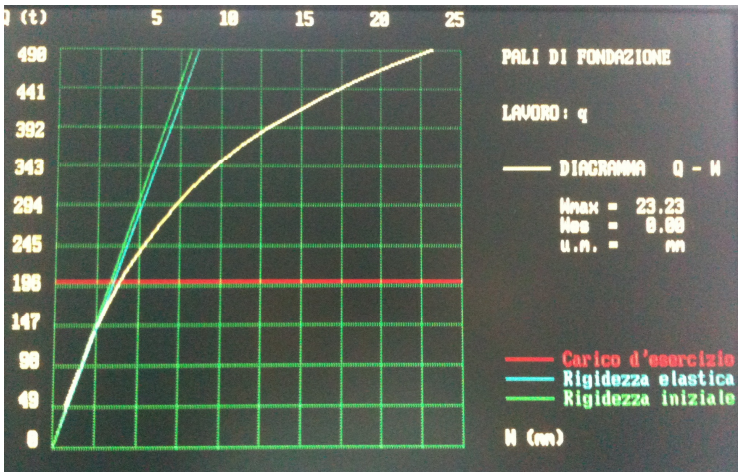


Diagramma carico-deformazione del palo



Q/Qes.	Q	QL	QP	We	Wr	Wtot
(-)	(t)	(t.)	(t.)	(mm)	(mm)	(mm)
0.25	50	46	4	0.55	0.20	0.75
0.35	70	65	5	0.78	0.30	1.08
0.45	90	83	7	1.01	0.42	1.43
0.55	110	100	10	1.25	0.56	1.81
0.65	130	118	12	1.50	0.71	2.21
0.75	150	134	16	1.75	0.90	2.64
0.85	170	151	19	2.00	1.11	3.11
0.95	190	167	23	2.26	1.36	3.62
1.05	210	182	28	2.52	1.65	4.17
1.15	230	197	33	2.78	1.99	4.78
1.25	250	211	39	3.05	2.40	5.45
1.35	270	224	46	3.32	2.86	6.19
1.45	290	236	54	3.60	3.41	7.01
1.55	310	248	62	3.89	4.05	7.93
1.65	330	258	72	4.17	4.79	8.96
1.75	350	268	82	4.46	5.64	10.11
1.85	370	276	94	4.76	6.63	11.39
1.95	390	284	106	5.06	7.77	12.83
2.05	410	291	119	5.36	9.07	14.44
2.15	430	298	132	5.67	10.58	16.25
2.25	450	303	147	5.99	12.30	18.29
2.35	470	309	161	6.30	14.29	20.60
2.45	490	313	177	6.62	16.61	23.23

P = 500 t

Z (m)	N (t)
0.00	500.00
1.00	490.25
2.00	485.56
3.00	480.87
4.00	476.19
5.00	471.51
6.00	466.83
7.00	462.17
8.00	456.11
9.00	450.05
10.00	444.00
11.00	437.97
12.00	431.93
13.00	425.91
14.00	419.89
15.00	413.88
16.00	407.89
17.00	401.90
18.00	395.92
19.00	389.95
20.00	383.98
21.00	378.03
22.00	372.07
23.00	366.12
24.00	346.85
25.00	327.60
26.00	308.36
27.00	298.06
28.00	287.77
29.00	277.50
30.00	255.31
31.00	233.14

32.00	210.98
33.00	176.83

PARAMETRI DELL'ANALISI LIMITE

Coeff. d'interpolazione	M = 1.39E-02
Coeff. d'interpolazione	N = 1.46E-03
Coeff. correlazione lineare	= 0.9999
Deviazione standard (t)	= 2.56

8.1. Numerical calculations

SIMULATION OF MATERIALS
LEGEND OF MATERIAL DATA TABLE

The program allows to utilize various materials. The material types foreseen by the program are listed below:

1	material of r.c. type
2	material of steel type
3	material of masonry type
4	material of wooden type
5	material of general type

The materials utilized in the present simulation are identifiable by means of identification symbol and numerical code (the latter is actually indicated in the description of the structural elements).
The table shows the following data for each material:

Young	modulus of normal elasticity
Poisson	transversal shrinkage factor
G	modulus of tangential elasticity
Gamma	specific weight
Alfa	thermal expansion factor

The above stated data are utilized to simulate the static performance and to determine inertial and thermal loads.
Following data are indicated for the materials of type:

1	***r.c.***		
		Rck	cubic specific strength
		Fctm	average simple tensile strength
2	***steel***		
		Ft	breaking tensile strength
		Fy	yield tension
		Fd	estimated strength
		Fdt	estimated strength for thickness t>40 mm
		Sadm	allowed tension
		Sadmt	allowed tension for thickness t>40 mm
3	***masonry***		
		Resist. Fk	characteristic compression strength
		Resist. Fvko	characteristic shear strength
4	***wood***		
		Resist. comp.	compression allowed strength
		Resist. traz.	tensile allowed tension strength
		Resist. fless.	bending allowed strength
		Resist. tau	shear allowed strength
		Lamellare	lamellar or massive

MATERIAL DATA TABLE

Id	Type / Notes		Young	Poisson	G	Gamma	Alfa
		daN/cm2	daN/cm2		daN/cm2	daN/cm3	
1	Calcestruzzo Classe C25/30		3.145e+05	0.12	1.404e+05	2.50e-03	1.00e-05
	Rck	300.0					
	fctm	25.6					

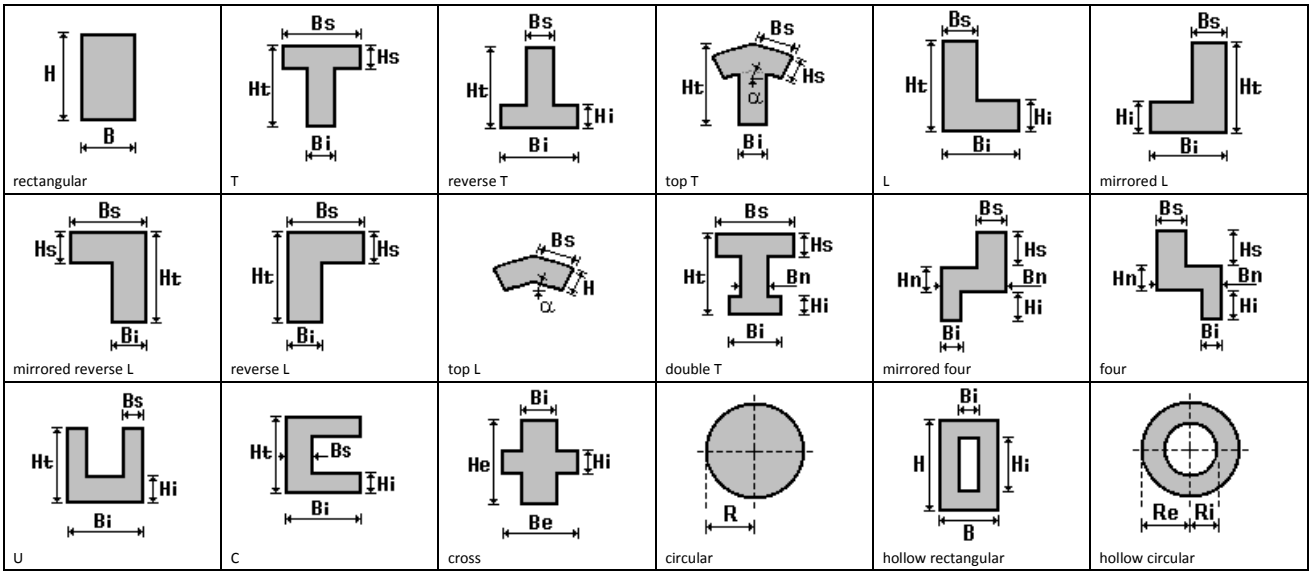
SIMULATION OF SECTIONS
LEGEND OF SECTION DATA TABLE
The program allows to use various sections. The following section types are provided:

1 section of general type
2 simple steel sections
3 special and coupled steel sections

The sections utilized for simulation are identifiable by means of reference symbol and numerical code (the latter is actually indicated in the description of the structural elements).
For each section the following data are indicated in the table:

Area	section area
A V2	section area/shear factor for shear in direction 2
A V3	section area/shear factor for shear in direction 3
Jt	stiffness torsional factor
J2-2	moment of inertia of the section referred to axis 2
J3-3	moment of inertia of the section referred to axis 3
W2-2	section modulus referred to axis 2
W3-3	section modulus referred to axis 3
Wp2-2	plastic section modulus referred to axis 2
Wp3-3	plastic section modulus referred to axis 3

The above data are utilized to determine the inertia loads and to define the structural element stiffness; whenever the value of Area V2 (and/or Area V3) is zero, the deformation for shear V2 (and/or V3) is negligible.
The inertial section characteristics are estimated within element reference 2-3.



About the simple and coupled sections, reference axis 3 coincides with the axis x, according to the most widely known section reference charts.

About the general type sections (type 1):
the dimensional values labeled with B refer to the axis 2
the dimensional values labeled with H refer to the axis 3

Id	Type	Area	A V2	A V3	Jt	J 2-2	J 3-3	W 2-2	W 3-3	Wp 2-2	Wp 3-3
		cm2	cm2	cm2	cm4	cm4	cm4	cm3	cm3	cm3	cm3

SIMULATION OF STRUCTURE: NODES
LEGEND OF NODES DATA TABLE

The program utilizes the structural node.
Each node is identifiable by Cartesian coordinates in the global reference system (X Y Z).
Appropriate code of stiff constraint, code of special foundation and a set of 6 springs (three for displacement and three for rotation) are assigned to each node. The table below shows the above indicated possibilities. In particular the table indicates the following data for each node:

Nodo	node number
X	X coordinate value (idem Y and Z).
Note	six values relative to 6 degrees of freedom foreseen for the node TxTyTzRxRyRz, value 1 indicates that displacement or rotation in question is fixed, value 0 indicates that the displacement and rotation in question is free.
Note	(FS = 1, 2,…) special foundation type code (1, 2,… is referred to these types: isolated foundations, piles, isolated foundations on piles,…) associated to the node.
Rig. TX	stiffness value attributed to elastic constrain eventually applied to the node, i.e. TX (idem TY, TZ, RX, RY, RZ).

NODES DATA TABLE

Node	X	Y	Z	Node	X	Y	Z	Node	X	Y	Z
	cm	cm	cm		cm	cm	cm		cm	cm	cm
6	0.0	1100.0	0.0	7	0.0	-100.0	0.0	8	1090.0	950.0	0.0
9	-130.0	-50.0	0.0	10	-130.0	-100.0	0.0	11	-130.0	950.0	0.0
12	-130.0	1000.0	0.0	13	-130.0	1100.0	0.0	14	1340.0	950.0	0.0
20	500.0	1100.0	0.0	21	500.0	-100.0	0.0	27	840.0	1100.0	0.0
28	840.0	-100.0	0.0	34	1340.0	1100.0	0.0	35	1340.0	-100.0	0.0
36	0.0	950.0	0.0	37	-130.0	875.0	0.0	38	-130.0	750.0	0.0
39	500.0	950.0	0.0	40	-130.0	625.0	0.0	41	-130.0	500.0	0.0
42	670.0	950.0	0.0	43	1340.0	1050.0	0.0	44	-130.0	375.0	0.0
45	-130.0	250.0	0.0	46	840.0	950.0	0.0	47	-130.0	125.0	0.0
48	1340.0	875.0	0.0	49	-130.0	0.0	0.0	50	-65.0	1100.0	0.0
51	-65.0	875.0	0.0	52	0.0	1050.0	0.0	53	250.0	1050.0	0.0
54	250.0	1000.0	0.0	55	250.0	1100.0	0.0	56	500.0	1050.0	0.0
57	0.0	875.0	0.0	58	250.0	875.0	0.0	59	250.0	750.0	0.0
60	500.0	875.0	0.0	61	670.0	1050.0	0.0	62	670.0	1000.0	0.0
63	670.0	1100.0	0.0	64	840.0	1050.0	0.0	65	670.0	875.0	0.0
66	670.0	750.0	0.0	67	840.0	875.0	0.0	68	1090.0	1050.0	0.0
69	1090.0	1000.0	0.0	70	1090.0	1100.0	0.0	71	1090.0	875.0	0.0
72	1090.0	750.0	0.0	73	1340.0	625.0	0.0	74	-65.0	950.0	0.0
75	-65.0	-100.0	0.0	76	-65.0	-50.0	0.0	77	0.0	625.0	0.0
78	250.0	625.0	0.0	79	250.0	500.0	0.0	80	500.0	625.0	0.0
81	670.0	625.0	0.0	82	670.0	500.0	0.0	83	840.0	625.0	0.0
84	1090.0	625.0	0.0	85	1090.0	500.0	0.0	86	1340.0	375.0	0.0
87	-65.0	0.0	0.0	88	-65.0	1000.0	0.0	89	-65.0	1050.0	0.0
90	0.0	375.0	0.0	91	250.0	375.0	0.0	92	250.0	250.0	0.0

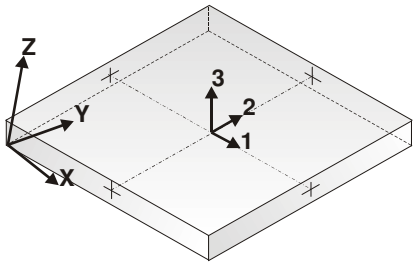
93	500.0	375.0	0.0	94	670.0	375.0	0.0	95	670.0	250.0	0.0
96	840.0	375.0	0.0	97	1090.0	375.0	0.0	98	1090.0	250.0	0.0
99	1340.0	125.0	0.0	100	-65.0	750.0	0.0	101	-65.0	500.0	0.0
102	-65.0	625.0	0.0	103	0.0	125.0	0.0	104	250.0	125.0	0.0
105	250.0	0.0	0.0	106	500.0	125.0	0.0	107	670.0	125.0	0.0
108	670.0	0.0	0.0	109	840.0	125.0	0.0	110	1090.0	125.0	0.0
111	1090.0	0.0	0.0	112	1340.0	-50.0	0.0	113	-65.0	250.0	0.0
114	-65.0	375.0	0.0	115	-65.0	125.0	0.0	116	0.0	-50.0	0.0
117	250.0	-50.0	0.0	118	250.0	-100.0	0.0	119	500.0	-50.0	0.0
120	670.0	-50.0	0.0	121	670.0	-100.0	0.0	122	840.0	-50.0	0.0
123	1090.0	-50.0	0.0	124	1090.0	-100.0	0.0	125	250.0	950.0	0.0
126	-130.0	1050.0	0.0	127	1405.0	875.0	0.0	128	1405.0	950.0	0.0
129	1405.0	-100.0	0.0	130	1405.0	-50.0	0.0	131	1405.0	0.0	0.0
132	1405.0	1000.0	0.0	133	1405.0	1050.0	0.0	134	1405.0	750.0	0.0
135	1405.0	500.0	0.0	136	1405.0	625.0	0.0	137	1405.0	250.0	0.0
138	1405.0	375.0	0.0	139	1405.0	125.0	0.0	140	1405.0	1100.0	0.0
141	1470.0	1100.0	0.0	142	1470.0	1050.0	0.0	143	1470.0	750.0	0.0
144	1470.0	875.0	0.0	145	1470.0	950.0	0.0	146	1470.0	1000.0	0.0
147	1470.0	500.0	0.0	148	1470.0	625.0	0.0	149	1470.0	-100.0	0.0
150	1470.0	-50.0	0.0	151	1470.0	0.0	0.0	152	1470.0	250.0	0.0
153	1470.0	375.0	0.0	154	1470.0	125.0	0.0	160	1590.0	1100.0	0.0
161	1590.0	-100.0	0.0	162	1480.0	1050.0	0.0	163	1480.0	-50.0	0.0
164	1480.0	-100.0	0.0	165	1480.0	950.0	0.0	166	1480.0	1000.0	0.0
167	1480.0	1100.0	0.0	168	1480.0	375.0	0.0	169	1480.0	250.0	0.0
170	1535.0	250.0	0.0	171	1480.0	125.0	0.0	172	1535.0	0.0	0.0
173	1480.0	0.0	0.0	174	1535.0	1100.0	0.0	175	1535.0	875.0	0.0
176	1590.0	1050.0	0.0	177	1535.0	1000.0	0.0	178	1535.0	1050.0	0.0
179	1590.0	375.0	0.0	180	1535.0	950.0	0.0	181	1590.0	875.0	0.0
182	1535.0	-100.0	0.0	183	1535.0	-50.0	0.0	184	1590.0	625.0	0.0
185	1535.0	750.0	0.0	186	1535.0	500.0	0.0	187	1535.0	625.0	0.0
188	1590.0	125.0	0.0	189	1535.0	375.0	0.0	190	1590.0	950.0	0.0
191	1480.0	875.0	0.0	192	1480.0	750.0	0.0	193	1535.0	125.0	0.0
194	1480.0	625.0	0.0	195	1480.0	500.0	0.0	196	1590.0	-50.0	0.0
202	1940.0	1100.0	0.0	203	1940.0	-100.0	0.0	204	3540.0	375.0	0.0
205	3265.0	750.0	0.0	206	3540.0	875.0	0.0	207	3265.0	250.0	0.0
208	1940.0	1050.0	0.0	209	3265.0	375.0	0.0	210	3540.0	625.0	0.0
211	1940.0	375.0	0.0	212	3265.0	875.0	0.0	213	1940.0	875.0	0.0
214	3265.0	125.0	0.0	215	3265.0	950.0	0.0	216	1940.0	625.0	0.0
217	3540.0	125.0	0.0	218	3265.0	1000.0	0.0	219	3540.0	950.0	0.0
220	1940.0	125.0	0.0	221	3265.0	-100.0	0.0	222	1940.0	950.0	0.0
223	3540.0	-50.0	0.0	224	1940.0	-50.0	0.0	230	2290.0	1100.0	0.0
231	2290.0	-100.0	0.0	232	1765.0	500.0	0.0	233	2115.0	500.0	0.0
234	2515.0	500.0	0.0	235	2915.0	500.0	0.0	236	2290.0	1050.0	0.0
237	3265.0	500.0	0.0	238	1765.0	1050.0	0.0	239	2290.0	375.0	0.0
240	1765.0	1100.0	0.0	241	2290.0	875.0	0.0	242	1765.0	-50.0	0.0
243	1765.0	0.0	0.0	244	2290.0	625.0	0.0	245	1765.0	625.0	0.0
246	1765.0	750.0	0.0	247	1765.0	250.0	0.0	248	2290.0	125.0	0.0
249	1765.0	375.0	0.0	250	2290.0	950.0	0.0	251	1765.0	875.0	0.0
252	2290.0	-50.0	0.0	258	2740.0	1100.0	0.0	259	2740.0	-100.0	0.0
260	1765.0	125.0	0.0	261	1765.0	950.0	0.0	262	1765.0	1000.0	0.0
263	1765.0	-100.0	0.0	264	2740.0	1050.0	0.0	265	2115.0	1050.0	0.0
266	2115.0	1100.0	0.0	267	2740.0	375.0	0.0	268	2115.0	-50.0	0.0
269	2740.0	875.0	0.0	270	2115.0	0.0	0.0	271	2115.0	625.0	0.0
272	2740.0	625.0	0.0	273	2115.0	750.0	0.0	274	2115.0	250.0	0.0
275	2115.0	375.0	0.0	276	2740.0	125.0	0.0	277	2115.0	875.0	0.0
278	2740.0	950.0	0.0	279	2115.0	125.0	0.0	280	2740.0	-50.0	0.0
286	3090.0	1100.0	0.0	287	3090.0	-100.0	0.0	288	2115.0	950.0	0.0
289	2115.0	1000.0	0.0	290	2115.0	-100.0	0.0	291	2515.0	1050.0	0.0
292	3090.0	1050.0	0.0	293	2515.0	1100.0	0.0	294	2515.0	-50.0	0.0
295	3090.0	375.0	0.0	296	2515.0	0.0	0.0	297	3090.0	875.0	0.0
298	2515.0	625.0	0.0	299	2515.0	750.0	0.0	300	3090.0	625.0	0.0
301	2515.0	250.0	0.0	302	2515.0	375.0	0.0	303	2515.0	875.0	0.0
304	3090.0	125.0	0.0	305	2515.0	125.0	0.0	306	3090.0	950.0	0.0
307	2515.0	950.0	0.0	308	3090.0	-50.0	0.0	314	3440.0	1100.0	0.0
315	3440.0	-100.0	0.0	316	2515.0	1000.0	0.0	317	2515.0	-100.0	0.0
318	2915.0	1050.0	0.0	319	2915.0	1100.0	0.0	320	3440.0	1050.0	0.0
321	2915.0	-50.0	0.0	322	2915.0	0.0	0.0	323	3440.0	375.0	0.0
324	2915.0	625.0	0.0	325	3440.0	875.0	0.0	326	2915.0	750.0	0.0
327	2915.0	250.0	0.0	328	3440.0	625.0	0.0	329	2915.0	375.0	0.0
330	2915.0	875.0	0.0	331	2915.0	125.0	0.0	332	3440.0	125.0	0.0
333	2915.0	950.0	0.0	334	3440.0	950.0	0.0	335	2915.0	1000.0	0.0
336	3440.0	-50.0	0.0	337	3540.0	0.0	0.0	338	3540.0	250.0	0.0
339	3540.0	500.0	0.0	340	3540.0	750.0	0.0	341	3540.0	1000.0	0.0
342	3540.0	1100.0	0.0	343	3540.0	-100.0	0.0	344	2915.0	-100.0	0.0
345	3265.0	1050.0	0.0	346	3265.0	1100.0	0.0	347	3265.0	-50.0	0.0
348	3540.0	1050.0	0.0	349	3265.0	0.0	0.0	350	3265.0	625.0	0.0
351	-140.0	-50.0	0.0	352	-140.0	-100.0	0.0	353	-140.0	950.0	0.0
354	-140.0	1000.0	0.0	355	-140.0	1100.0	0.0	356	-140.0	875.0	0.0
357	-140.0	750.0	0.0	358	-140.0	625.0	0.0	359	-140.0	500.0	0.0
360	-140.0	375.0	0.0	361	-140.0	250.0	0.0	362	-140.0	125.0	0.0
363	-140.0	0.0	0.0	364	-140.0	1050.0	0.0	365	-343.0	1100.0	0.0
371	-1450.0	625.0	0.0	372	-343.0	-100.0	0.0	373	-343.0	950.0	0.0
374	-343.0	1050.0	0.0	375	-343.0	875.0	0.0	376	-343.0	625.0	0.0
377	-343.0	375.0	0.0	378	-343.0	125.0	0.0	379	-343.0	-50.0	0.0
380	-1450.0	375.0	0.0	381	-661.0	1100.0	0.0	382	-661.0	875.0	0.0
383	-661.0	950.0	0.0	384	-661.0	-100.0	0.0	385	-661.0	-50.0	0.0

388	-661.0	1050.0	0.0	391	-661.0	625.0	0.0	393	-661.0	375.0	0.0
394	-661.0	125.0	0.0	395	-1185.0	1100.0	0.0	401	-1450.0	125.0	0.0
402	-1185.0	-100.0	0.0	403	-1185.0	950.0	0.0	404	-1185.0	1050.0	0.0
405	-1185.0	875.0	0.0	406	-1185.0	625.0	0.0	407	-1185.0	375.0	0.0
408	-263.0	1100.0	0.0	409	-263.0	875.0	0.0	410	-263.0	950.0	0.0
411	-263.0	-100.0	0.0	412	-263.0	-50.0	0.0	413	-263.0	0.0	0.0
414	-263.0	1000.0	0.0	415	-263.0	1050.0	0.0	416	-263.0	750.0	0.0
417	-263.0	500.0	0.0	418	-263.0	625.0	0.0	419	-263.0	250.0	0.0
420	-263.0	375.0	0.0	421	-263.0	125.0	0.0	422	-850.0	1100.0	0.0
423	-850.0	0.0	0.0	424	-850.0	250.0	0.0	425	-850.0	500.0	0.0
426	-850.0	750.0	0.0	427	-850.0	1000.0	0.0	428	-1185.0	125.0	0.0
429	-850.0	-100.0	0.0	430	-850.0	950.0	0.0	431	-850.0	1050.0	0.0
432	-850.0	875.0	0.0	433	-850.0	625.0	0.0	434	-850.0	375.0	0.0
435	-850.0	125.0	0.0	436	-850.0	-50.0	0.0	437	-1185.0	-50.0	0.0
438	-1450.0	-50.0	0.0	439	-1300.0	1100.0	0.0	440	-1300.0	875.0	0.0
441	-1300.0	950.0	0.0	442	-1300.0	-100.0	0.0	443	-1300.0	-50.0	0.0
444	-1300.0	0.0	0.0	445	-1300.0	1000.0	0.0	446	-1300.0	1050.0	0.0
447	-1300.0	750.0	0.0	448	-1300.0	500.0	0.0	449	-1300.0	625.0	0.0
450	-1300.0	250.0	0.0	451	-1300.0	375.0	0.0	452	-1300.0	125.0	0.0
453	-1515.0	1100.0	0.0	454	-1515.0	875.0	0.0	455	-1515.0	950.0	0.0
456	-1515.0	-100.0	0.0	457	-1515.0	-50.0	0.0	460	-1515.0	1050.0	0.0
463	-1515.0	625.0	0.0	465	-1515.0	375.0	0.0	466	-979.0	1100.0	0.0
467	-979.0	875.0	0.0	468	-979.0	950.0	0.0	469	-979.0	-100.0	0.0
470	-979.0	-50.0	0.0	471	-979.0	0.0	0.0	473	-979.0	1050.0	0.0
476	-979.0	625.0	0.0	477	-979.0	250.0	0.0	478	-979.0	375.0	0.0
479	-979.0	125.0	0.0	480	-1450.0	1100.0	0.0	481	-1450.0	0.0	0.0
482	-1450.0	250.0	0.0	483	-1450.0	500.0	0.0	484	-1450.0	750.0	0.0
485	-1450.0	1000.0	0.0	486	-1515.0	125.0	0.0	487	-1450.0	-100.0	0.0
488	-1450.0	950.0	0.0	489	-1450.0	1050.0	0.0	490	-1450.0	875.0	0.0
491	-1580.0	875.0	0.0	492	-1580.0	950.0	0.0	493	-1580.0	-100.0	0.0
494	-1580.0	-50.0	0.0	495	-1580.0	0.0	0.0	496	-1580.0	1000.0	0.0
497	-1580.0	1050.0	0.0	498	-1580.0	1100.0	0.0	499	-1580.0	750.0	0.0
500	-1580.0	500.0	0.0	501	-1580.0	625.0	0.0	502	-1580.0	250.0	0.0
503	-1580.0	375.0	0.0	504	-1580.0	125.0	0.0	505	-1250.0	875.0	0.0
506	-750.0	875.0	0.0	507	-1250.0	1100.0	0.0	508	-1250.0	950.0	0.0
509	-1250.0	-100.0	0.0	510	-1250.0	-50.0	0.0	511	-1250.0	0.0	0.0
512	-1250.0	1000.0	0.0	513	-1250.0	1050.0	0.0	514	-1250.0	750.0	0.0
515	-1250.0	500.0	0.0	516	-1250.0	625.0	0.0	517	-1250.0	250.0	0.0
518	-1250.0	375.0	0.0	519	-1250.0	125.0	0.0	520	-750.0	1100.0	0.0
521	-750.0	950.0	0.0	522	-750.0	-100.0	0.0	523	-750.0	-50.0	0.0
524	-750.0	0.0	0.0	525	-750.0	1000.0	0.0	526	-750.0	1050.0	0.0
527	-750.0	750.0	0.0	528	-750.0	500.0	0.0	529	-750.0	625.0	0.0
530	-750.0	250.0	0.0	531	-750.0	375.0	0.0	532	-750.0	125.0	0.0
533	2265.0	750.0	0.0	534	2765.0	750.0	0.0	535	2265.0	1050.0	0.0
536	2265.0	1100.0	0.0	537	2265.0	-50.0	0.0	538	2265.0	0.0	0.0
539	2265.0	625.0	0.0	540	2265.0	250.0	0.0	541	2265.0	375.0	0.0
542	2265.0	500.0	0.0	543	2265.0	875.0	0.0	544	2265.0	125.0	0.0
545	2265.0	950.0	0.0	546	2265.0	1000.0	0.0	547	2265.0	-100.0	0.0
548	2765.0	1050.0	0.0	549	2765.0	1100.0	0.0	550	2765.0	-50.0	0.0
551	2765.0	0.0	0.0	552	2765.0	625.0	0.0	553	2765.0	250.0	0.0
554	2765.0	375.0	0.0	555	2765.0	500.0	0.0	556	2765.0	875.0	0.0
557	2765.0	125.0	0.0	558	2765.0	950.0	0.0	559	2765.0	1000.0	0.0
560	2765.0	-100.0	0.0	561	-1130.0	875.0	0.0	562	-870.0	875.0	0.0
563	-1130.0	1100.0	0.0	564	-1130.0	950.0	0.0	565	-1130.0	-100.0	0.0
566	-1130.0	-50.0	0.0	567	-1130.0	0.0	0.0	568	-1130.0	1000.0	0.0
569	-1130.0	1050.0	0.0	570	-1130.0	750.0	0.0	571	-1130.0	500.0	0.0
572	-1130.0	625.0	0.0	573	-1130.0	250.0	0.0	574	-1130.0	375.0	0.0
575	-1130.0	125.0	0.0	576	-870.0	1100.0	0.0	577	-870.0	950.0	0.0
578	-870.0	-100.0	0.0	579	-870.0	-50.0	0.0	581	-870.0	1000.0	0.0
582	-870.0	1050.0	0.0	583	-870.0	750.0	0.0	584	-870.0	500.0	0.0
585	-870.0	625.0	0.0	587	-870.0	375.0	0.0	588	-870.0	125.0	0.0
589	2645.0	750.0	0.0	590	2385.0	750.0	0.0	591	2385.0	1050.0	0.0
592	2385.0	1100.0	0.0	593	2385.0	-50.0	0.0	594	2385.0	0.0	0.0
595	2385.0	625.0	0.0	596	2385.0	250.0	0.0	597	2385.0	375.0	0.0
598	2385.0	500.0	0.0	599	2385.0	875.0	0.0	600	2385.0	125.0	0.0
601	2385.0	950.0	0.0	602	2385.0	1000.0	0.0	603	2385.0	-100.0	0.0
604	2645.0	1050.0	0.0	605	2645.0	1100.0	0.0	606	2645.0	-50.0	0.0
607	2645.0	0.0	0.0	608	2645.0	625.0	0.0	609	2645.0	250.0	0.0
610	2645.0	375.0	0.0	611	2645.0	500.0	0.0	612	2645.0	875.0	0.0
613	2645.0	125.0	0.0	614	2645.0	950.0	0.0	615	2645.0	1000.0	0.0
616	2645.0	-100.0	0.0	617	-581.5	1100.0	0.0	618	-581.5	875.0	0.0
619	-581.5	950.0	0.0	620	-581.5	-100.0	0.0	621	-581.5	-50.0	0.0
622	-581.5	0.0	0.0	623	-581.5	1000.0	0.0	624	-581.5	1050.0	0.0
625	-581.5	750.0	0.0	626	-581.5	500.0	0.0	627	-581.5	625.0	0.0
628	-581.5	250.0	0.0	629	-581.5	375.0	0.0	630	-581.5	125.0	0.0
631	-502.0	1100.0	0.0	632	-502.0	875.0	0.0	633	-502.0	950.0	0.0
634	-502.0	-100.0	0.0	635	-502.0	-50.0	0.0	636	-502.0	0.0	0.0
637	-502.0	1000.0	0.0	638	-502.0	1050.0	0.0	639	-502.0	750.0	0.0
640	-502.0	500.0	0.0	641	-502.0	625.0	0.0	642	-502.0	250.0	0.0
643	-502.0	375.0	0.0	644	-502.0	125.0	0.0	645	-422.5	1100.0	0.0
646	-422.5	875.0	0.0	647	-422.5	950.0	0.0	648	-422.5	-100.0	0.0
649	-422.5	-50.0	0.0	650	-422.5	0.0	0.0	651	-422.5	1000.0	0.0
652	-422.5	1050.0	0.0	653	-422.5	750.0	0.0	654	-422.5	500.0	0.0
655	-422.5	625.0	0.0	656	-422.5	250.0	0.0	657	-422.5	375.0	0.0
658	-422.5	125.0	0.0								

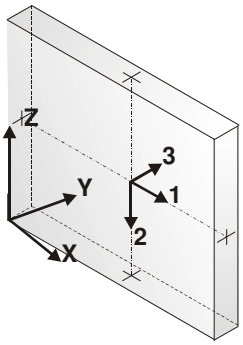
Node	X	Y	Z	Notes	Stiff. TX	Stiff. TY	Stiff. TZ	Stiff. RX	Stiff. RY	Stiff. RZ
	cm	cm	cm		daN/cm	daN/cm	daN/cm	daN cm/rad	daN cm/rad	daN cm/rad
1	0.0	0.0	0.0	FS=2						
2	0.0	250.0	0.0	FS=2						
3	0.0	500.0	0.0	FS=2						
4	0.0	750.0	0.0	FS=2						
5	0.0	1000.0	0.0	FS=2						
15	500.0	0.0	0.0	FS=2						
16	500.0	250.0	0.0	FS=2						
17	500.0	500.0	0.0	FS=2						
18	500.0	750.0	0.0	FS=2						
19	500.0	1000.0	0.0	FS=2						
22	840.0	0.0	0.0	FS=2						
23	840.0	250.0	0.0	FS=2						
24	840.0	500.0	0.0	FS=2						
25	840.0	750.0	0.0	FS=2						
26	840.0	1000.0	0.0	FS=2						
29	1340.0	0.0	0.0	FS=2						
30	1340.0	250.0	0.0	FS=2						
31	1340.0	500.0	0.0	FS=2						
32	1340.0	750.0	0.0	FS=2						
33	1340.0	1000.0	0.0	FS=2						
155	1590.0	0.0	0.0	FS=2						
156	1590.0	250.0	0.0	FS=2						
157	1590.0	500.0	0.0	FS=2						
158	1590.0	750.0	0.0	FS=2						
159	1590.0	1000.0	0.0	FS=2						
197	1940.0	0.0	0.0	FS=2						
198	1940.0	250.0	0.0	FS=2						
199	1940.0	500.0	0.0	FS=2						
200	1940.0	750.0	0.0	FS=2						
201	1940.0	1000.0	0.0	FS=2						
225	2290.0	0.0	0.0	FS=2						
226	2290.0	250.0	0.0	FS=2						
227	2290.0	500.0	0.0	FS=2						
228	2290.0	750.0	0.0	FS=2						
229	2290.0	1000.0	0.0	FS=2						
253	2740.0	0.0	0.0	FS=2						
254	2740.0	250.0	0.0	FS=2						
255	2740.0	500.0	0.0	FS=2						
256	2740.0	750.0	0.0	FS=2						
257	2740.0	1000.0	0.0	FS=2						
281	3090.0	0.0	0.0	FS=2						
282	3090.0	250.0	0.0	FS=2						
283	3090.0	500.0	0.0	FS=2						
284	3090.0	750.0	0.0	FS=2						
285	3090.0	1000.0	0.0	FS=2						
309	3440.0	0.0	0.0	FS=2						
310	3440.0	250.0	0.0	FS=2						
311	3440.0	500.0	0.0	FS=2						
312	3440.0	750.0	0.0	FS=2						
313	3440.0	1000.0	0.0	FS=2						
366	-343.0	0.0	0.0	FS=1						
367	-343.0	250.0	0.0	FS=1						
368	-343.0	500.0	0.0	FS=1						
369	-343.0	750.0	0.0	FS=1						
370	-343.0	1000.0	0.0	FS=1						
386	-661.0	0.0	0.0	FS=1						
387	-661.0	1000.0	0.0	FS=1						
389	-661.0	750.0	0.0	FS=1						
390	-661.0	500.0	0.0	FS=1						
392	-661.0	250.0	0.0	FS=1						
396	-1185.0	0.0	0.0	FS=1						
397	-1185.0	250.0	0.0	FS=1						
398	-1185.0	500.0	0.0	FS=1						
399	-1185.0	750.0	0.0	FS=1						
400	-1185.0	1000.0	0.0	FS=1						
458	-1515.0	0.0	0.0	FS=1						
459	-1515.0	1000.0	0.0	FS=1						
461	-1515.0	750.0	0.0	FS=1						
462	-1515.0	500.0	0.0	FS=1						
464	-1515.0	250.0	0.0	FS=1						
472	-979.0	1000.0	0.0	FS=1						
474	-979.0	750.0	0.0	FS=1						
475	-979.0	500.0	0.0	FS=1						
580	-870.0	0.0	0.0	FS=1						
586	-870.0	250.0	0.0	FS=1						

STRUCTURE SIMULATION: SHELL ELEMENTS
LEGEND OF SHELL DATA TABLE

The program utilizes three -or four- node elements generally known as shells.
Each shell element is identifiable with I, J, K, L nodes (L=I for three-node elements).
Each element is characterized by a set of properties indicated in the table and required to complete its simulation.



non vertical 3D element orientation



vertical 3D element orientation

The following requisites are indicated in the table for each element:

Elem.	element number
Note	code of: *Shell* (shell element at non vertical elevation) *Shell fond.* (Winkler shell element) *Wall* (shell element at vertical elevation) *Membrane* (membrane element)
Nodo I (J, K, L)	node number I (J, K, L)
Mat.	material code assigned to the element
Spessore	element thickness (constant)
Wink V	under layer constant (Winkler coefficient) for the simulation of vertical elastic soil
Wink O	under layer constant (Winkler coefficient) for the simulation of horizontal elastic soil

Elem.	Notes	Node I	Node J	Node K	Node L	Mat.	Thickness	Wink V	Wink O
							cm	daN/cm3	daN/cm3
1	Shell	89	52	6	50	1	130.0		
2	Shell	60	65	42	39	1	130.0		
3	Shell	5	54	53	52	1	130.0		
4	Shell	4	59	58	57	1	100.0		
5	Shell	19	62	61	56	1	130.0		
6	Shell	18	66	65	60	1	100.0		
7	Shell	26	69	68	64	1	130.0		
8	Shell	25	72	71	67	1	100.0		
9	Shell	100	4	57	51	1	100.0		
10	Shell	3	79	78	77	1	100.0		
11	Shell	17	82	81	80	1	100.0		
12	Shell	24	85	84	83	1	100.0		
13	Shell	74	36	5	88	1	130.0		
14	Shell	2	92	91	90	1	100.0		
15	Shell	16	95	94	93	1	100.0		
16	Shell	23	98	97	96	1	100.0		
17	Shell	65	67	46	42	1	130.0		
18	Shell	1	105	104	103	1	100.0		
19	Shell	15	108	107	106	1	100.0		
20	Shell	22	111	110	109	1	100.0		
21	Shell	101	3	77	102	1	100.0		
22	Shell	7	118	117	116	1	100.0		
23	Shell	21	121	120	119	1	100.0		
24	Shell	28	124	123	122	1	100.0		
25	Shell	51	57	36	74	1	130.0		
26	Shell	75	7	116	76	1	100.0		
27	Shell	76	116	1	87	1	100.0		
28	Shell	102	77	4	100	1	100.0		
29	Shell	67	71	8	46	1	130.0		
30	Shell	57	58	125	36	1	130.0		
31	Shell	113	2	90	114	1	100.0		
32	Shell	114	90	3	101	1	100.0		
33	Shell	71	48	14	8	1	130.0		
34	Shell	87	1	103	115	1	100.0		
35	Shell	115	103	2	113	1	100.0		
36	Shell	37	51	74	11	1	130.0		
37	Shell	52	53	55	6	1	130.0		
38	Shell	54	19	56	53	1	130.0		
39	Shell	53	56	20	55	1	130.0		
40	Shell	36	125	54	5	1	130.0		
41	Shell	59	18	60	58	1	100.0		
42	Shell	125	39	19	54	1	130.0		

43	Shell	56	61	63	20	1	130.0
44	Shell	62	26	64	61	1	130.0
45	Shell	61	64	27	63	1	130.0
46	Shell	39	42	62	19	1	130.0
47	Shell	66	25	67	65	1	100.0
48	Shell	42	46	26	62	1	130.0
49	Shell	64	68	70	27	1	130.0
50	Shell	69	33	43	68	1	130.0
51	Shell	68	43	34	70	1	130.0
52	Shell	46	8	69	26	1	130.0
53	Shell	72	32	48	71	1	100.0
54	Shell	8	14	33	69	1	130.0
55	Shell	10	75	76	9	1	100.0
56	Shell	9	76	87	49	1	100.0
57	Shell	12	88	89	126	1	130.0
58	Shell	77	78	59	4	1	100.0
59	Shell	79	17	80	78	1	100.0
60	Shell	78	80	18	59	1	100.0
61	Shell	80	81	66	18	1	100.0
62	Shell	82	24	83	81	1	100.0
63	Shell	81	83	25	66	1	100.0
64	Shell	83	84	72	25	1	100.0
65	Shell	85	31	73	84	1	100.0
66	Shell	84	73	32	72	1	100.0
67	Shell	126	89	50	13	1	130.0
68	Shell	38	100	51	37	1	100.0
69	Shell	11	74	88	12	1	130.0
70	Shell	90	91	79	3	1	100.0
71	Shell	92	16	93	91	1	100.0
72	Shell	91	93	17	79	1	100.0
73	Shell	93	94	82	17	1	100.0
74	Shell	95	23	96	94	1	100.0
75	Shell	94	96	24	82	1	100.0
76	Shell	96	97	85	24	1	100.0
77	Shell	98	30	86	97	1	100.0
78	Shell	97	86	31	85	1	100.0
79	Shell	41	101	102	40	1	100.0
80	Shell	40	102	100	38	1	100.0
81	Shell	45	113	114	44	1	100.0
82	Shell	103	104	92	2	1	100.0
83	Shell	105	15	106	104	1	100.0
84	Shell	104	106	16	92	1	100.0
85	Shell	106	107	95	16	1	100.0
86	Shell	108	22	109	107	1	100.0
87	Shell	107	109	23	95	1	100.0
88	Shell	109	110	98	23	1	100.0
89	Shell	111	29	99	110	1	100.0
90	Shell	110	99	30	98	1	100.0
91	Shell	44	114	101	41	1	100.0
92	Shell	49	87	115	47	1	100.0
93	Shell	47	115	113	45	1	100.0
94	Shell	116	117	105	1	1	100.0
95	Shell	118	21	119	117	1	100.0
96	Shell	117	119	15	105	1	100.0
97	Shell	119	120	108	15	1	100.0
98	Shell	121	28	122	120	1	100.0
99	Shell	120	122	22	108	1	100.0
100	Shell	122	123	111	22	1	100.0
101	Shell	124	35	112	123	1	100.0
102	Shell	123	112	29	111	1	100.0
103	Shell	58	60	39	125	1	130.0
104	Shell	88	5	52	89	1	130.0
105	Shell	133	142	141	140	1	130.0
106	Shell	134	143	144	127	1	100.0
107	Shell	128	145	146	132	1	130.0
108	Shell	135	147	148	136	1	100.0
109	Shell	127	144	145	128	1	130.0
110	Shell	129	149	150	130	1	100.0
111	Shell	130	150	151	131	1	100.0
112	Shell	136	148	143	134	1	100.0
113	Shell	137	152	153	138	1	100.0
114	Shell	138	153	147	135	1	100.0
115	Shell	131	151	154	139	1	100.0
116	Shell	139	154	152	137	1	100.0
117	Shell	48	127	128	14	1	130.0
118	Shell	35	129	130	112	1	100.0
119	Shell	112	130	131	29	1	100.0
120	Shell	33	132	133	43	1	130.0
121	Shell	43	133	140	34	1	130.0
122	Shell	32	134	127	48	1	100.0
123	Shell	14	128	132	33	1	130.0
124	Shell	31	135	136	73	1	100.0
125	Shell	73	136	134	32	1	100.0
126	Shell	30	137	138	86	1	100.0
127	Shell	86	138	135	31	1	100.0
128	Shell	29	131	139	99	1	100.0

129	Shell	99	139	137	30	1	100.0
130	Shell	132	146	142	133	1	130.0
131	Shell	178	176	160	174	1	170.0
132	Shell	183	196	155	172	1	110.0
133	Shell	187	184	158	185	1	170.0
134	Shell	173	172	193	171	1	110.0
135	Shell	171	193	170	169	1	110.0
136	Shell	170	156	179	189	1	110.0
137	Shell	189	179	157	186	1	110.0
138	Shell	195	186	187	194	1	110.0
139	Shell	185	158	181	175	1	170.0
140	Shell	172	155	188	193	1	110.0
141	Shell	193	188	156	170	1	110.0
142	Shell	191	175	180	165	1	170.0
143	Shell	180	190	159	177	1	170.0
144	Shell	194	187	185	192	1	170.0
145	Shell	169	170	189	168	1	110.0
146	Shell	177	159	176	178	1	170.0
147	Shell	168	189	186	195	1	110.0
148	Shell	162	178	174	167	1	170.0
149	Shell	164	182	183	163	1	110.0
150	Shell	163	183	172	173	1	110.0
151	Shell	186	157	184	187	1	110.0
152	Shell	166	177	178	162	1	170.0
153	Shell	192	185	175	191	1	170.0
154	Shell	165	180	177	166	1	170.0
155	Shell	175	181	190	180	1	170.0
156	Shell	182	161	196	183	1	110.0
157	Shell	238	208	202	240	1	170.0
158	Shell	242	224	197	243	1	110.0
159	Shell	245	216	200	246	1	170.0
160	Shell	247	198	211	249	1	110.0
161	Shell	249	211	199	232	1	110.0
162	Shell	246	200	213	251	1	170.0
163	Shell	243	197	220	260	1	110.0
164	Shell	260	220	198	247	1	110.0
165	Shell	261	222	201	262	1	170.0
166	Shell	262	201	208	238	1	170.0
167	Shell	232	199	216	245	1	110.0
168	Shell	251	213	222	261	1	170.0
169	Shell	263	203	224	242	1	110.0
170	Shell	535	236	230	536	1	170.0
171	Shell	537	252	225	538	1	110.0
172	Shell	539	244	228	533	1	170.0
173	Shell	540	226	239	541	1	110.0
174	Shell	541	239	227	542	1	110.0
175	Shell	533	228	241	543	1	170.0
176	Shell	538	225	248	544	1	110.0
177	Shell	544	248	226	540	1	110.0
178	Shell	545	250	229	546	1	170.0
179	Shell	546	229	236	535	1	170.0
180	Shell	542	227	244	539	1	110.0
181	Shell	543	241	250	545	1	170.0
182	Shell	547	231	252	537	1	110.0
183	Shell	604	264	258	605	1	170.0
184	Shell	606	280	253	607	1	110.0
185	Shell	608	272	256	589	1	170.0
186	Shell	609	254	267	610	1	110.0
187	Shell	610	267	255	611	1	110.0
188	Shell	589	256	269	612	1	170.0
189	Shell	607	253	276	613	1	110.0
190	Shell	613	276	254	609	1	110.0
191	Shell	614	278	257	615	1	170.0
192	Shell	615	257	264	604	1	170.0
193	Shell	611	255	272	608	1	110.0
194	Shell	612	269	278	614	1	170.0
195	Shell	616	259	280	606	1	110.0
196	Shell	318	292	286	319	1	170.0
197	Shell	321	308	281	322	1	110.0
198	Shell	324	300	284	326	1	170.0
199	Shell	327	282	295	329	1	110.0
200	Shell	329	295	283	235	1	110.0
201	Shell	326	284	297	330	1	170.0
202	Shell	322	281	304	331	1	110.0
203	Shell	331	304	282	327	1	110.0
204	Shell	333	306	285	335	1	170.0
205	Shell	335	285	292	318	1	170.0
206	Shell	235	283	300	324	1	110.0
207	Shell	330	297	306	333	1	170.0
208	Shell	344	287	308	321	1	110.0
209	Shell	345	320	314	346	1	170.0
210	Shell	347	336	309	349	1	110.0
211	Shell	350	328	312	205	1	170.0
212	Shell	207	310	323	209	1	110.0
213	Shell	209	323	311	237	1	110.0
214	Shell	205	312	325	212	1	170.0

215	Shell	349	309	332	214	1	110.0
216	Shell	214	332	310	207	1	110.0
217	Shell	215	334	313	218	1	170.0
218	Shell	218	313	320	345	1	170.0
219	Shell	237	311	328	350	1	110.0
220	Shell	212	325	334	215	1	170.0
221	Shell	221	315	336	347	1	110.0
222	Shell	320	348	342	314	1	170.0
223	Shell	336	223	337	309	1	110.0
224	Shell	328	210	340	312	1	170.0
225	Shell	310	338	204	323	1	110.0
226	Shell	323	204	339	311	1	110.0
227	Shell	312	340	206	325	1	170.0
228	Shell	309	337	217	332	1	110.0
229	Shell	332	217	338	310	1	110.0
230	Shell	334	219	341	313	1	170.0
231	Shell	313	341	348	320	1	170.0
232	Shell	311	339	210	328	1	110.0
233	Shell	325	206	219	334	1	170.0
234	Shell	315	343	223	336	1	110.0
235	Shell	176	238	240	160	1	170.0
236	Shell	196	242	243	155	1	110.0
237	Shell	184	245	246	158	1	170.0
238	Shell	156	247	249	179	1	110.0
239	Shell	179	249	232	157	1	110.0
240	Shell	158	246	251	181	1	170.0
241	Shell	155	243	260	188	1	110.0
242	Shell	188	260	247	156	1	110.0
243	Shell	190	261	262	159	1	170.0
244	Shell	159	262	238	176	1	170.0
245	Shell	157	232	245	184	1	110.0
246	Shell	181	251	261	190	1	170.0
247	Shell	161	263	242	196	1	110.0
248	Shell	208	265	266	202	1	170.0
249	Shell	224	268	270	197	1	110.0
250	Shell	216	271	273	200	1	170.0
251	Shell	198	274	275	211	1	110.0
252	Shell	211	275	233	199	1	110.0
253	Shell	200	273	277	213	1	170.0
254	Shell	197	270	279	220	1	110.0
255	Shell	220	279	274	198	1	110.0
256	Shell	222	288	289	201	1	170.0
257	Shell	201	289	265	208	1	170.0
258	Shell	199	233	271	216	1	110.0
259	Shell	213	277	288	222	1	170.0
260	Shell	203	290	268	224	1	110.0
261	Shell	591	291	293	592	1	170.0
262	Shell	593	294	296	594	1	110.0
263	Shell	595	298	299	590	1	170.0
264	Shell	596	301	302	597	1	110.0
265	Shell	597	302	234	598	1	110.0
266	Shell	590	299	303	599	1	170.0
267	Shell	594	296	305	600	1	110.0
268	Shell	600	305	301	596	1	110.0
269	Shell	601	307	316	602	1	170.0
270	Shell	602	316	291	591	1	170.0
271	Shell	598	234	298	595	1	110.0
272	Shell	599	303	307	601	1	170.0
273	Shell	603	317	294	593	1	110.0
274	Shell	548	318	319	549	1	170.0
275	Shell	550	321	322	551	1	110.0
276	Shell	552	324	326	534	1	170.0
277	Shell	553	327	329	554	1	110.0
278	Shell	554	329	235	555	1	110.0
279	Shell	534	326	330	556	1	170.0
280	Shell	551	322	331	557	1	110.0
281	Shell	557	331	327	553	1	110.0
282	Shell	558	333	335	559	1	170.0
283	Shell	559	335	318	548	1	170.0
284	Shell	555	235	324	552	1	110.0
285	Shell	556	330	333	558	1	170.0
286	Shell	560	344	321	550	1	110.0
287	Shell	292	345	346	286	1	170.0
288	Shell	308	347	349	281	1	110.0
289	Shell	300	350	205	284	1	170.0
290	Shell	282	207	209	295	1	110.0
291	Shell	295	209	237	283	1	110.0
292	Shell	284	205	212	297	1	170.0
293	Shell	281	349	214	304	1	110.0
294	Shell	304	214	207	282	1	110.0
295	Shell	306	215	218	285	1	170.0
296	Shell	285	218	345	292	1	170.0
297	Shell	283	237	350	300	1	110.0
298	Shell	297	212	215	306	1	170.0
299	Shell	287	221	347	308	1	110.0
300	Shell	409	356	353	410	1	170.0

301	Shell	411	352	351	412	1	100.0
302	Shell	412	351	363	413	1	100.0
303	Shell	414	354	364	415	1	170.0
304	Shell	415	364	355	408	1	170.0
305	Shell	416	357	356	409	1	170.0
306	Shell	410	353	354	414	1	170.0
307	Shell	417	359	358	418	1	170.0
308	Shell	418	358	357	416	1	170.0
309	Shell	419	361	360	420	1	100.0
310	Shell	420	360	359	417	1	100.0
311	Shell	413	363	362	421	1	100.0
312	Shell	421	362	361	419	1	100.0
313	Shell	375	409	410	373	1	170.0
314	Shell	372	411	412	379	1	100.0
315	Shell	379	412	413	366	1	100.0
316	Shell	370	414	415	374	1	170.0
317	Shell	374	415	408	365	1	170.0
318	Shell	369	416	409	375	1	170.0
319	Shell	373	410	414	370	1	170.0
320	Shell	368	417	418	376	1	170.0
321	Shell	376	418	416	369	1	170.0
322	Shell	367	419	420	377	1	100.0
323	Shell	377	420	417	368	1	100.0
324	Shell	366	413	421	378	1	100.0
325	Shell	378	421	419	367	1	100.0
326	Shell	646	375	373	647	1	170.0
327	Shell	648	372	379	649	1	100.0
328	Shell	649	379	366	650	1	100.0
329	Shell	651	370	374	652	1	170.0
330	Shell	652	374	365	645	1	170.0
331	Shell	653	369	375	646	1	170.0
332	Shell	647	373	370	651	1	170.0
333	Shell	654	368	376	655	1	170.0
334	Shell	655	376	369	653	1	170.0
335	Shell	656	367	377	657	1	100.0
336	Shell	657	377	368	654	1	100.0
337	Shell	650	366	378	658	1	100.0
338	Shell	658	378	367	656	1	100.0
339	Shell	506	382	383	521	1	170.0
340	Shell	522	384	385	523	1	100.0
341	Shell	523	385	386	524	1	100.0
342	Shell	525	387	388	526	1	170.0
343	Shell	526	388	381	520	1	170.0
344	Shell	527	389	382	506	1	170.0
345	Shell	521	383	387	525	1	170.0
346	Shell	528	390	391	529	1	170.0
347	Shell	529	391	389	527	1	170.0
348	Shell	530	392	393	531	1	100.0
349	Shell	531	393	390	528	1	100.0
350	Shell	524	386	394	532	1	100.0
351	Shell	532	394	392	530	1	100.0
352	Shell	562	432	430	577	1	170.0
353	Shell	578	429	436	579	1	100.0
354	Shell	579	436	423	580	1	100.0
355	Shell	581	427	431	582	1	170.0
356	Shell	582	431	422	576	1	170.0
357	Shell	583	426	432	562	1	170.0
358	Shell	577	430	427	581	1	170.0
359	Shell	584	425	433	585	1	170.0
360	Shell	585	433	426	583	1	170.0
361	Shell	586	424	434	587	1	100.0
362	Shell	587	434	425	584	1	100.0
363	Shell	580	423	435	588	1	100.0
364	Shell	588	435	424	586	1	100.0
365	Shell	561	467	468	564	1	170.0
366	Shell	565	469	470	566	1	100.0
367	Shell	566	470	471	567	1	100.0
368	Shell	568	472	473	569	1	170.0
369	Shell	569	473	466	563	1	170.0
370	Shell	570	474	467	561	1	170.0
371	Shell	564	468	472	568	1	170.0
372	Shell	571	475	476	572	1	170.0
373	Shell	572	476	474	570	1	170.0
374	Shell	573	477	478	574	1	100.0
375	Shell	574	478	475	571	1	100.0
376	Shell	567	471	479	575	1	100.0
377	Shell	575	479	477	573	1	100.0
378	Shell	505	405	403	508	1	170.0
379	Shell	509	402	437	510	1	100.0
380	Shell	510	437	396	511	1	100.0
381	Shell	512	400	404	513	1	170.0
382	Shell	513	404	395	507	1	170.0
383	Shell	514	399	405	505	1	170.0
384	Shell	508	403	400	512	1	170.0
385	Shell	515	398	406	516	1	170.0
386	Shell	516	406	399	514	1	170.0

387	Shell	517	397	407	518	1	100.0
388	Shell	518	407	398	515	1	100.0
389	Shell	511	396	428	519	1	100.0
390	Shell	519	428	397	517	1	100.0
391	Shell	490	440	441	488	1	170.0
392	Shell	487	442	443	438	1	100.0
393	Shell	438	443	444	481	1	100.0
394	Shell	485	445	446	489	1	170.0
395	Shell	489	446	439	480	1	170.0
396	Shell	484	447	440	490	1	170.0
397	Shell	488	441	445	485	1	170.0
398	Shell	483	448	449	371	1	170.0
399	Shell	371	449	447	484	1	170.0
400	Shell	482	450	451	380	1	100.0
401	Shell	380	451	448	483	1	100.0
402	Shell	481	444	452	401	1	100.0
403	Shell	401	452	450	482	1	100.0
404	Shell	460	489	480	453	1	170.0
405	Shell	461	484	490	454	1	170.0
406	Shell	455	488	485	459	1	170.0
407	Shell	462	483	371	463	1	170.0
408	Shell	454	490	488	455	1	170.0
409	Shell	456	487	438	457	1	100.0
410	Shell	457	438	481	458	1	100.0
411	Shell	463	371	484	461	1	170.0
412	Shell	464	482	380	465	1	100.0
413	Shell	465	380	483	462	1	100.0
414	Shell	458	481	401	486	1	100.0
415	Shell	486	401	482	464	1	100.0
416	Shell	491	454	455	492	1	170.0
417	Shell	493	456	457	494	1	100.0
418	Shell	494	457	458	495	1	100.0
419	Shell	496	459	460	497	1	170.0
420	Shell	497	460	453	498	1	170.0
421	Shell	499	461	454	491	1	170.0
422	Shell	492	455	459	496	1	170.0
423	Shell	500	462	463	501	1	170.0
424	Shell	501	463	461	499	1	170.0
425	Shell	502	464	465	503	1	100.0
426	Shell	503	465	462	500	1	100.0
427	Shell	495	458	486	504	1	100.0
428	Shell	504	486	464	502	1	100.0
429	Shell	459	485	489	460	1	170.0
430	Shell	440	505	508	441	1	170.0
431	Shell	442	509	510	443	1	100.0
432	Shell	443	510	511	444	1	100.0
433	Shell	445	512	513	446	1	170.0
434	Shell	446	513	507	439	1	170.0
435	Shell	447	514	505	440	1	170.0
436	Shell	441	508	512	445	1	170.0
437	Shell	448	515	516	449	1	170.0
438	Shell	449	516	514	447	1	170.0
439	Shell	450	517	518	451	1	100.0
440	Shell	451	518	515	448	1	100.0
441	Shell	444	511	519	452	1	100.0
442	Shell	452	519	517	450	1	100.0
443	Shell	432	506	521	430	1	170.0
444	Shell	429	522	523	436	1	100.0
445	Shell	436	523	524	423	1	100.0
446	Shell	427	525	526	431	1	170.0
447	Shell	431	526	520	422	1	170.0
448	Shell	426	527	506	432	1	170.0
449	Shell	430	521	525	427	1	170.0
450	Shell	425	528	529	433	1	170.0
451	Shell	433	529	527	426	1	170.0
452	Shell	424	530	531	434	1	100.0
453	Shell	434	531	528	425	1	100.0
454	Shell	423	524	532	435	1	100.0
455	Shell	435	532	530	424	1	100.0
456	Shell	265	535	536	266	1	170.0
457	Shell	268	537	538	270	1	110.0
458	Shell	271	539	533	273	1	170.0
459	Shell	274	540	541	275	1	110.0
460	Shell	275	541	542	233	1	110.0
461	Shell	273	533	543	277	1	170.0
462	Shell	270	538	544	279	1	110.0
463	Shell	279	544	540	274	1	110.0
464	Shell	288	545	546	289	1	170.0
465	Shell	289	546	535	265	1	170.0
466	Shell	233	542	539	271	1	110.0
467	Shell	277	543	545	288	1	170.0
468	Shell	290	547	537	268	1	110.0
469	Shell	264	548	549	258	1	170.0
470	Shell	280	550	551	253	1	110.0
471	Shell	272	552	534	256	1	170.0
472	Shell	254	553	554	267	1	110.0

473	Shell	267	554	555	255	1	110.0
474	Shell	256	534	556	269	1	170.0
475	Shell	253	551	557	276	1	110.0
476	Shell	276	557	553	254	1	110.0
477	Shell	278	558	559	257	1	170.0
478	Shell	257	559	548	264	1	170.0
479	Shell	255	555	552	272	1	110.0
480	Shell	269	556	558	278	1	170.0
481	Shell	259	560	550	280	1	110.0
482	Shell	405	561	564	403	1	170.0
483	Shell	402	565	566	437	1	100.0
484	Shell	437	566	567	396	1	100.0
485	Shell	400	568	569	404	1	170.0
486	Shell	404	569	563	395	1	170.0
487	Shell	399	570	561	405	1	170.0
488	Shell	403	564	568	400	1	170.0
489	Shell	398	571	572	406	1	170.0
490	Shell	406	572	570	399	1	170.0
491	Shell	397	573	574	407	1	100.0
492	Shell	407	574	571	398	1	100.0
493	Shell	396	567	575	428	1	100.0
494	Shell	428	575	573	397	1	100.0
495	Shell	467	562	577	468	1	170.0
496	Shell	469	578	579	470	1	100.0
497	Shell	470	579	580	471	1	100.0
498	Shell	472	581	582	473	1	170.0
499	Shell	473	582	576	466	1	170.0
500	Shell	474	583	562	467	1	170.0
501	Shell	468	577	581	472	1	170.0
502	Shell	475	584	585	476	1	170.0
503	Shell	476	585	583	474	1	170.0
504	Shell	477	586	587	478	1	100.0
505	Shell	478	587	584	475	1	100.0
506	Shell	471	580	588	479	1	100.0
507	Shell	479	588	586	477	1	100.0
508	Shell	236	591	592	230	1	170.0
509	Shell	252	593	594	225	1	110.0
510	Shell	244	595	590	228	1	170.0
511	Shell	226	596	597	239	1	110.0
512	Shell	239	597	598	227	1	110.0
513	Shell	228	590	599	241	1	170.0
514	Shell	225	594	600	248	1	110.0
515	Shell	248	600	596	226	1	110.0
516	Shell	250	601	602	229	1	170.0
517	Shell	229	602	591	236	1	170.0
518	Shell	227	598	595	244	1	110.0
519	Shell	241	599	601	250	1	170.0
520	Shell	231	603	593	252	1	110.0
521	Shell	291	604	605	293	1	170.0
522	Shell	294	606	607	296	1	110.0
523	Shell	298	608	589	299	1	170.0
524	Shell	301	609	610	302	1	110.0
525	Shell	302	610	611	234	1	110.0
526	Shell	299	589	612	303	1	170.0
527	Shell	296	607	613	305	1	110.0
528	Shell	305	613	609	301	1	110.0
529	Shell	307	614	615	316	1	170.0
530	Shell	316	615	604	291	1	170.0
531	Shell	234	611	608	298	1	110.0
532	Shell	303	612	614	307	1	170.0
533	Shell	317	616	606	294	1	110.0
534	Shell	382	618	619	383	1	170.0
535	Shell	384	620	621	385	1	100.0
536	Shell	385	621	622	386	1	100.0
537	Shell	387	623	624	388	1	170.0
538	Shell	388	624	617	381	1	170.0
539	Shell	389	625	618	382	1	170.0
540	Shell	383	619	623	387	1	170.0
541	Shell	390	626	627	391	1	170.0
542	Shell	391	627	625	389	1	170.0
543	Shell	392	628	629	393	1	100.0
544	Shell	393	629	626	390	1	100.0
545	Shell	386	622	630	394	1	100.0
546	Shell	394	630	628	392	1	100.0
547	Shell	618	632	633	619	1	170.0
548	Shell	620	634	635	621	1	100.0
549	Shell	621	635	636	622	1	100.0
550	Shell	623	637	638	624	1	170.0
551	Shell	624	638	631	617	1	170.0
552	Shell	625	639	632	618	1	170.0
553	Shell	619	633	637	623	1	170.0
554	Shell	626	640	641	627	1	170.0
555	Shell	627	641	639	625	1	170.0
556	Shell	628	642	643	629	1	100.0
557	Shell	629	643	640	626	1	100.0
558	Shell	622	636	644	630	1	100.0

559	Shell	630	644	642	628	1	100.0
560	Shell	632	646	647	633	1	170.0
561	Shell	634	648	649	635	1	100.0
562	Shell	635	649	650	636	1	100.0
563	Shell	637	651	652	638	1	170.0
564	Shell	638	652	645	631	1	170.0
565	Shell	639	653	646	632	1	170.0
566	Shell	633	647	651	637	1	170.0
567	Shell	640	654	655	641	1	170.0
568	Shell	641	655	653	639	1	170.0
569	Shell	642	656	657	643	1	100.0
570	Shell	643	657	654	640	1	100.0
571	Shell	636	650	658	644	1	100.0
572	Shell	644	658	656	642	1	100.0

LOAD MODELLING

LEGEND OF DATA LOAD TABLE

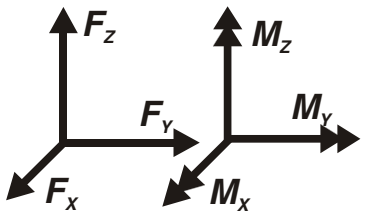
The present program allows the simulation of several types of load. The modeling loads have a symbol and a numeric identification code (in their description the structural elements refer to the numeric one).

Appropriate code, type and identification symbol are assigned to each load applied to the structure.

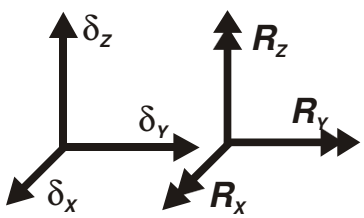
The tables below detail the typical values for each type of load.

Referring to the type, the tables actually show the following data:

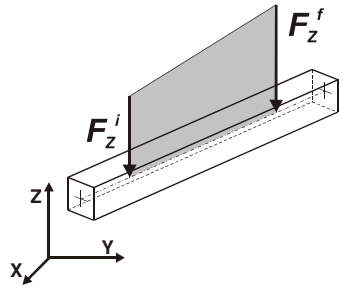
1	**nodal concentrated load** 6 values (force Fx, Fy, Fz, moment Mx, My, Mz)
2	**nodal imposed displacement** 6 values (displacement Tx,Ty,Tz, rotation Rx,Ry,Rz)
3	**global distributed load on a beam type element** 7 values (fx,fy,fz,mx,my,mz, initial position of load application) 7 values (fx,fy,fz,mx,my,mz, final position of load application)
4	**local distributed load on a beam type element** 7 values (f1,f2,f3,m1,m2,m3,initial position of load application) 7 values (f1,f2,f3,m1,m2,m3,final position of load application)
5	**global concentrated load on a beam type element** 7 values (Fx,Fy,Fz,Mx,My,Mz, load position)
6	**local concentrated load on a beam type element** 7 values (F1, F2, F3, M1, M2, M3, load position)
7	**temperature change applied on a beam type element** 7 values (temperature changes: uniform, average temperature change at the initial and final node - temperature change as per height and width of the section of the initial and final node)
8	**uniform pressure load on a plate type element** 1 value (pressure)
9	**variable pressure load on a plate type element** 4 values (pressure, quote, pressure, quote)
10	**temperature change applied to a plate type element** 2 values (temperature changes: average temperature change and temperature change through the thickness)
11	**generic variable load on plate/shell and beam type elements** 1 value for typology description 1 values for each segment where the function is defined (position, value, position, value) the typology specifies the abscissas of the definition domain, the direction of load, the loading mode and the influence width for beam type elements.
12	**group of loads on plate/shell area** 9 values (number of loads in X and Y direction, value of single force, center of first force, dimension of area and distance in X and Y of loads.



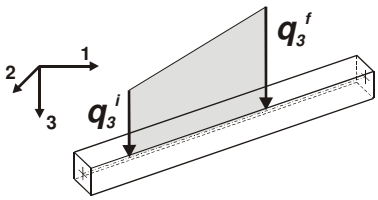
nodal concentrated load



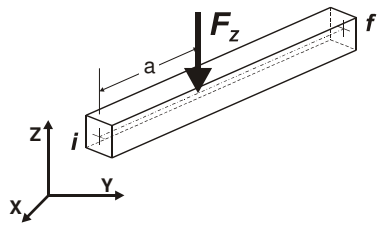
nodal imposed displacement



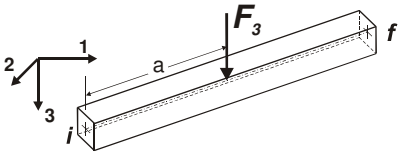
global distributed load on a beam type element



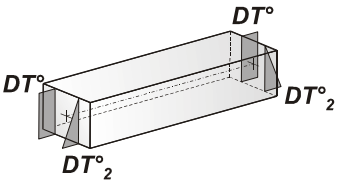
local distributed load on a beam type element



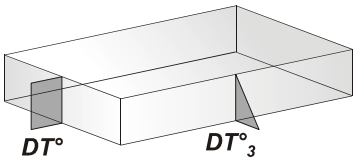
global concentrated load on a beam type element



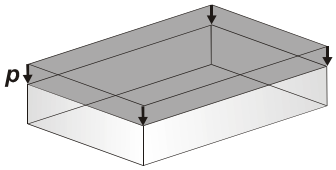
local concentrated load on a beam type element



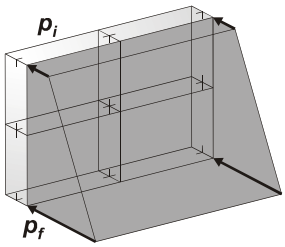
temperature change applied on a beam type element



uniform pressure load on a plate type element



uniform pressure load on a plate type element



variable pressure load on a plate type element

Type	**uniform pressure load on slab**

Id	**Type**	**pressure**
		daN/cm2
1	Pressione 15 ton/mq	-1.50

LOAD CASE SCHEMATIZATION
LEGEND OF LOAD CASE TABLE

The program allows the usage of various load cases.

The following 11 load cases are considered:

	Name	***Type***	***Description***
1	**Ggk**	A	load case including the structure dead weight
2	**Gk**	NA	load case including permanent loads
3	**Qk**	NA	load case including live loads
4	**Gsk**	A	load case including floor and roof permanent loads
5	**Qsk**	A	load case including floor and roof live loads
6	**Qnk**	A	load case including roof snow live loads
7	**Qtk**	SA	load case including structure temperature change
8	**Qvk**	NA	load case including structure wind loads
9	**Esk**	SA	seismic load case by the way of the equivalent static analysis
10	**Edk**	SA	seismic load case by the way of the dynamic analysis
11	**Pk**	NA	load case including loads due to constraints subsiding, and prestressing.

The automatic (A) load cases (i.e. the user won't be asked to enter data) are labeled as:
1-Ggk, 4-Gsk, 5-Qsk, 6-Qnk;

The semi-automatic (SA) load cases (i.e. the user will be asked to enter a minimum part of data) are labeled as:
7-Qtk, (only the temperature change value has to be entered);
9-Esk, 10-Edk, (only the input earthquake direction angle value and the load case identification has to be entered.

The remaining load cases are said non-automatic (NA) load cases (i.e. the user will be asked to enter generic loads for the structural elements).

The below table shows the load cases affecting the structure and their related data, i.e.:
the *Type Number*, the *Identification Code* and the *Load Case Reference Value* (where requested).

For the non-automatic load cases, the loaded nodes and elements are listed (the load identification code is included).

For the seismic load cases (9-Esk and 10-Edk), the input angle values, the seismic intensity, the structure and foundation coefficients are shown; finally, the related mass rate, for each load case participating to the seismic mass definition, is shown.

Let us point out that in the load cases 5-Qsk and 6-Qnk, each floor or roof element in the model is assumed wholly participating to the seismic mass definition (see the Sksol value in the floor element chapter) and therefore, their participating mass rate is assumed to be 1.

L.C.	Type	Code Id	Notes
1	Ggk	CDC=Ggk (peso proprio della struttura)	
2	Qk	CDC=Qk (variabile generico) Sovraccarico 15 ton/mq	D3 :from 1 to 572 Action : Pressione 15 ton/mq

LOAD COMBINATION DEFINITION
LEGEND OF LOAD COMBINATION DEFINITION TABLE

The program combines various load case types according to the regulations foreseen by the acting standards and norms currently in force.
The foreseen combinations are provided for the structure safety control, in the course of which the structure resistance to displacements and stresses is checked.

The below presented load combination table shows the following data:
Type Number and *Identification Symbol*
The table below shows the load cases affecting the structure and involved in the load combination, each one with respective own weight.

Cmb	Type	Code Id	effect P-delta
1	T.A.	Comb. T.AMM. 1	

Cmb	CDC 1/15...	CDC 2/16...	CDC 3/17...	CDC 4/18...	CDC 5/19...	CDC 6/20...	CDC 7/21...	CDC 8/22...	CDC 9/23...	CDC 10/24...	CDC 11/25...	CDC 12/26...	CDC 13/27...	CDC 14/28...
1	1.00	1.00												

NODAL ANALYSIS RESULTS
LEGEND OF NODAL ANALYSIS RESULTS

The analysis results of the structural nodes can be controlled on the basis of the below tables.

The first table indicates the nodal displacements for each combination.

The second table indicates the values of the actions exercised by the structure on the constraints (sign inverted constraint reactions) for each node to which special foundation or stiff and/or elastic constraints is attributed and for each combination.

Node	Cmb	X translation		Y translation		Z translation		X rotation	Y rotation	Z rotation
		cm	cm	cm						
1	1	6.19e-04	6.20e-04	-0.39	-2.68e-05	1.57e-04	0.0			
2	1	5.80e-04	6.18e-04	-0.40	-3.01e-05	1.52e-04	0.0			
3	1	5.50e-04	5.85e-04	-0.41	-1.03e-05	1.46e-04	0.0			
4	1	5.10e-04	5.53e-04	-0.41	5.91e-06	1.37e-04	0.0			
5	1	4.54e-04	5.45e-04	-0.41	1.07e-05	1.36e-04	0.0			
6	1	3.26e-04	5.56e-04	-0.41	0.0	1.43e-04	0.0			
7	1	4.78e-04	6.05e-04	-0.40	-5.60e-06	1.74e-04	0.0			
8	1	-2.35e-04	6.11e-04	-0.45	1.92e-05	-7.31e-05	0.0			
9	1	5.16e-04	6.14e-04	-0.38	-2.33e-05	1.40e-04	0.0			
10	1	5.10e-04	6.16e-04	-0.38	-2.07e-05	1.41e-04	0.0			
11	1	3.78e-04	5.37e-04	-0.40	1.29e-05	1.28e-04	0.0			
12	1	3.76e-04	5.29e-04	-0.40	1.07e-05	1.27e-04	0.0			
13	1	3.47e-04	5.19e-04	-0.40	6.08e-06	1.28e-04	0.0			
14	1	-3.72e-04	5.52e-04	-0.41	2.14e-05	-1.43e-04	0.0			
15	1	9.90e-05	6.29e-04	-0.43	-2.57e-05	-2.24e-05	0.0			
16	1	9.54e-05	6.38e-04	-0.44	-2.88e-05	-1.93e-05	0.0			
17	1	9.16e-05	6.15e-04	-0.45	-8.23e-06	-1.67e-05	0.0			
18	1	9.06e-05	5.95e-04	-0.45	8.03e-06	-1.05e-05	0.0			
19	1	9.53e-05	5.98e-04	-0.45	1.15e-05	-3.56e-06	0.0			
20	1	9.40e-05	6.11e-04	-0.45	-2.49e-06	-3.36e-06	0.0			
21	1	1.22e-04	6.13e-04	-0.44	0.0	-2.48e-05	0.0			
22	1	-9.90e-05	6.29e-04	-0.43	-2.57e-05	2.24e-05	0.0			
23	1	-9.54e-05	6.38e-04	-0.44	-2.88e-05	1.93e-05	0.0			
24	1	-9.16e-05	6.15e-04	-0.45	-8.23e-06	1.67e-05	0.0			
25	1	-9.06e-05	5.95e-04	-0.45	8.03e-06	1.05e-05	0.0			
26	1	-9.53e-05	5.98e-04	-0.45	1.15e-05	3.56e-06	0.0			
27	1	-9.40e-05	6.11e-04	-0.45	-2.49e-06	3.36e-06	0.0			
28	1	-1.22e-04	6.13e-04	-0.44	0.0	2.48e-05	0.0			
29	1	-6.19e-04	6.20e-04	-0.39	-2.68e-05	-1.57e-04	0.0			
30	1	-5.80e-04	6.18e-04	-0.40	-3.01e-05	-1.52e-04	0.0			
31	1	-5.50e-04	5.85e-04	-0.41	-1.03e-05	-1.46e-04	0.0			
32	1	-5.10e-04	5.53e-04	-0.41	5.91e-06	-1.37e-04	0.0			
33	1	-4.54e-04	5.45e-04	-0.41	1.07e-05	-1.36e-04	0.0			
34	1	-3.26e-04	5.56e-04	-0.41	0.0	-1.43e-04	0.0			
35	1	-4.78e-04	6.05e-04	-0.40	-5.60e-06	-1.74e-04	0.0			
36	1	3.72e-04	5.52e-04	-0.41	2.14e-05	1.43e-04	0.0			
37	1	3.83e-04	5.31e-04	-0.40	6.92e-06	1.28e-04	0.0			
38	1	4.29e-04	5.44e-04	-0.40	4.45e-06	1.17e-04	0.0			
39	1	9.44e-05	6.04e-04	-0.45	2.39e-05	-4.43e-06	0.0			
40	1	4.23e-04	5.55e-04	-0.40	-2.69e-06	1.27e-04	0.0			
41	1	4.62e-04	5.69e-04	-0.40	-1.28e-05	1.24e-04	0.0			
42	1	0.0	6.12e-04	-0.45	1.23e-05	0.0	0.0			
43	1	-3.56e-04	5.54e-04	-0.41	-1.16e-06	-1.41e-04	0.0			
44	1	4.51e-04	5.81e-04	-0.40	-2.41e-05	1.34e-04	0.0			
45	1	4.90e-04	5.89e-04	-0.39	-3.38e-05	1.31e-04	0.0			

46	1	-9.44e-05	6.04e-04	-0.45	2.39e-05	4.43e-06	0.0
47	1	4.79e-04	5.96e-04	-0.39	-3.81e-05	1.42e-04	0.0
48	1	-3.71e-04	5.56e-04	-0.42	1.08e-05	-1.44e-04	0.0
...							
658	1	0.01	3.00e-03	-0.45	-1.08e-04	2.87e-04	0.0

Node	**X translation**	**Y translation**	**Z translation**	**X rotation**	**Y rotation**	**Z rotation**
	-1.74e-03	5.19e-04	-0.58	-1.13e-04	-2.03e-04	0.0
	0.01	3.32e-03	-0.28	2.39e-05	4.47e-04	0.0

Node	**Cmb**	**Action X**	**Action Y**	**Action Z**	**Action RX**	**Action RY**	**Action RZ**
		daN	daN	daN	daN cm	daN cm	daN cm
1	1	-5879.01	-684.13	-1.577e+05	-1.094e+05	7.603e+05	0.0
2	1	-5707.42	-814.45	-1.615e+05	-1.256e+05	7.373e+05	0.0
3	1	-5499.80	-45.33	-1.637e+05	-2.799e+04	7.101e+05	0.0
4	1	-5166.67	580.30	-1.637e+05	5.162e+04	6.668e+05	0.0
5	1	-5123.55	768.15	-1.634e+05	7.547e+04	6.593e+05	0.0
15	1	955.41	-631.32	-1.728e+05	-1.031e+05	-1.159e+05	0.0
16	1	827.58	-750.21	-1.764e+05	-1.183e+05	-1.001e+05	0.0
17	1	725.06	55.00	-1.784e+05	-1.658e+04	-8.735e+04	0.0
18	1	474.71	690.99	-1.782e+05	6.389e+04	-5.602e+04	0.0
19	1	201.51	830.99	-1.778e+05	8.131e+04	-2.162e+04	0.0
22	1	-955.41	-631.32	-1.728e+05	-1.031e+05	1.159e+05	0.0
23	1	-827.58	-750.21	-1.764e+05	-1.183e+05	1.001e+05	0.0
24	1	-725.06	55.00	-1.784e+05	-1.658e+04	8.735e+04	0.0
25	1	-474.71	690.99	-1.782e+05	6.389e+04	5.602e+04	0.0
26	1	-201.51	830.99	-1.778e+05	8.131e+04	2.162e+04	0.0
29	1	5879.01	-684.13	-1.577e+05	-1.094e+05	-7.603e+05	0.0
30	1	5707.42	-814.45	-1.615e+05	-1.256e+05	-7.373e+05	0.0
31	1	5499.80	-45.33	-1.637e+05	-2.799e+04	-7.101e+05	0.0
32	1	5166.67	580.30	-1.637e+05	5.162e+04	-6.668e+05	0.0
33	1	5123.55	768.15	-1.634e+05	7.547e+04	-6.593e+05	0.0
155	1	-5900.50	-636.58	-1.225e+05	-1.504e+05	7.698e+05	0.0
156	1	-5819.45	-842.08	-1.280e+05	-1.762e+05	7.564e+05	0.0
157	1	-5668.11	-400.84	-1.327e+05	-1.201e+05	7.337e+05	0.0
158	1	-5915.77	179.72	-1.368e+05	-4.669e+04	7.587e+05	0.0
159	1	-5880.84	335.97	-1.386e+05	-2.717e+04	7.521e+05	0.0
197	1	-5390.21	-380.34	-1.458e+05	-1.197e+05	6.957e+05	0.0
198	1	-5261.60	-577.43	-1.507e+05	-1.454e+05	6.772e+05	0.0
199	1	-5108.42	-96.33	-1.547e+05	-8.515e+04	6.551e+05	0.0
200	1	-5252.63	410.85	-1.583e+05	-2.166e+04	6.684e+05	0.0
201	1	-5171.15	443.82	-1.598e+05	-1.804e+04	6.563e+05	0.0
225	1	-4093.77	-4.32	-1.644e+05	-7.246e+04	5.145e+05	0.0
226	1	-3853.61	-159.37	-1.684e+05	-9.362e+04	4.832e+05	0.0
227	1	-3453.04	392.89	-1.713e+05	-2.502e+04	4.315e+05	0.0
228	1	-3179.54	738.04	-1.741e+05	1.740e+04	3.946e+05	0.0
229	1	-3034.82	558.30	-1.750e+05	-6191.37	3.759e+05	0.0
253	1	3654.90	24.78	-1.644e+05	-6.812e+04	-4.933e+05	0.0
254	1	3459.69	-132.10	-1.682e+05	-8.955e+04	-4.670e+05	0.0
255	1	3108.05	421.46	-1.710e+05	-2.084e+04	-4.209e+05	0.0
256	1	2876.39	751.49	-1.737e+05	1.964e+04	-3.887e+05	0.0
257	1	2754.85	555.00	-1.746e+05	-6077.61	-3.723e+05	0.0
281	1	5328.62	-327.91	-1.448e+05	-1.114e+05	-7.227e+05	0.0
282	1	5213.46	-534.82	-1.495e+05	-1.384e+05	-7.052e+05	0.0
283	1	5065.13	-49.22	-1.533e+05	-7.774e+04	-6.830e+05	0.0
284	1	5226.25	425.88	-1.567e+05	-1.835e+04	-6.977e+05	0.0
285	1	5150.08	426.83	-1.582e+05	-1.878e+04	-6.856e+05	0.0
309	1	6418.42	-621.97	-1.187e+05	-1.460e+05	-8.707e+05	0.0
310	1	6307.25	-870.70	-1.240e+05	-1.773e+05	-8.527e+05	0.0
311	1	6065.39	-461.79	-1.288e+05	-1.253e+05	-8.176e+05	0.0
...							
586	1	2359.19	-1046.15	-1.216e+05	-1.928e+05	1.135e+04	0.0

Node	**Action X**	**Action Y**	**Action Z**	**Action RX**	**Action RY**	**Action RZ**
	-5915.77	-1595.65	-1.784e+05	-2.649e+05	-8.707e+05	0.0
	6418.42	830.99	-9.620e+04	8.131e+04	7.698e+05	0.0

Node	**Cmb**	**Action X**	**Action Y**	**Action Z**	**Action RX**	**Action RY**	**Action RZ**
		daN	daN	daN	daN cm	daN cm	daN cm
1	1	-5879.01	-684.13	-1.577e+05	-1.094e+05	7.603e+05	0.0
	1	-5879.01	-684.13	-1.577e+05	-1.094e+05	7.603e+05	0.0
	1	-5879.01	-684.13	-1.577e+05	-1.094e+05	7.603e+05	0.0
	1	-5879.01	-684.13	-1.577e+05	-1.094e+05	7.603e+05	0.0
	1	-5879.01	-684.13	-1.577e+05	-1.094e+05	7.603e+05	0.0
	1	-5879.01	-684.13	-1.577e+05	-1.094e+05	7.603e+05	0.0
2	1	-5707.42	-814.45	-1.615e+05	-1.256e+05	7.373e+05	0.0
	1	-5707.42	-814.45	-1.615e+05	-1.256e+05	7.373e+05	0.0
	1	-5707.42	-814.45	-1.615e+05	-1.256e+05	7.373e+05	0.0
	1	-5707.42	-814.45	-1.615e+05	-1.256e+05	7.373e+05	0.0
	1	-5707.42	-814.45	-1.615e+05	-1.256e+05	7.373e+05	0.0
	1	-5707.42	-814.45	-1.615e+05	-1.256e+05	7.373e+05	0.0
3	1	-5499.80	-45.33	-1.637e+05	-2.799e+04	7.101e+05	0.0
	1	-5499.80	-45.33	-1.637e+05	-2.799e+04	7.101e+05	0.0
	1	-5499.80	-45.33	-1.637e+05	-2.799e+04	7.101e+05	0.0
	1	-5499.80	-45.33	-1.637e+05	-2.799e+04	7.101e+05	0.0
	1	-5499.80	-45.33	-1.637e+05	-2.799e+04	7.101e+05	0.0
	1	-5499.80	-45.33	-1.637e+05	-2.799e+04	7.101e+05	0.0
4	1	-5166.67	580.30	-1.637e+05	5.162e+04	6.668e+05	0.0

	1	-5166.67	580.30	-1.637e+05	5.162e+04	6.668e+05	0.0
	1	-5166.67	580.30	-1.637e+05	5.162e+04	6.668e+05	0.0
	1	-5166.67	580.30	-1.637e+05	5.162e+04	6.668e+05	0.0
	1	-5166.67	580.30	-1.637e+05	5.162e+04	6.668e+05	0.0
	1	-5166.67	580.30	-1.637e+05	5.162e+04	6.668e+05	0.0
5	1	-5123.55	768.15	-1.634e+05	7.547e+04	6.593e+05	0.0
	1	-5123.55	768.15	-1.634e+05	7.547e+04	6.593e+05	0.0
	1	-5123.55	768.15	-1.634e+05	7.547e+04	6.593e+05	0.0
	1	-5123.55	768.15	-1.634e+05	7.547e+04	6.593e+05	0.0
	1	-5123.55	768.15	-1.634e+05	7.547e+04	6.593e+05	0.0
	1	-5123.55	768.15	-1.634e+05	7.547e+04	6.593e+05	0.0
15	1	955.41	-631.32	-1.728e+05	-1.031e+05	-1.159e+05	0.0
	1	955.41	-631.32	-1.728e+05	-1.031e+05	-1.159e+05	0.0
	1	955.41	-631.32	-1.728e+05	-1.031e+05	-1.159e+05	0.0
	1	955.41	-631.32	-1.728e+05	-1.031e+05	-1.159e+05	0.0
	1	955.41	-631.32	-1.728e+05	-1.031e+05	-1.159e+05	0.0
	1	955.41	-631.32	-1.728e+05	-1.031e+05	-1.159e+05	0.0
16	1	827.58	-750.21	-1.764e+05	-1.183e+05	-1.001e+05	0.0
	1	827.58	-750.21	-1.764e+05	-1.183e+05	-1.001e+05	0.0
	1	827.58	-750.21	-1.764e+05	-1.183e+05	-1.001e+05	0.0
	1	827.58	-750.21	-1.764e+05	-1.183e+05	-1.001e+05	0.0
	1	827.58	-750.21	-1.764e+05	-1.183e+05	-1.001e+05	0.0
	1	827.58	-750.21	-1.764e+05	-1.183e+05	-1.001e+05	0.0
17	1	725.06	55.00	-1.784e+05	-1.658e+04	-8.735e+04	0.0
	1	725.06	55.00	-1.784e+05	-1.658e+04	-8.735e+04	0.0
	1	725.06	55.00	-1.784e+05	-1.658e+04	-8.735e+04	0.0
	1	725.06	55.00	-1.784e+05	-1.658e+04	-8.735e+04	0.0
	1	725.06	55.00	-1.784e+05	-1.658e+04	-8.735e+04	0.0
	1	725.06	55.00	-1.784e+05	-1.658e+04	-8.735e+04	0.0
18	1	474.71	690.99	-1.782e+05	6.389e+04	-5.602e+04	0.0
	1	474.71	690.99	-1.782e+05	6.389e+04	-5.602e+04	0.0
	1	474.71	690.99	-1.782e+05	6.389e+04	-5.602e+04	0.0
	1	474.71	690.99	-1.782e+05	6.389e+04	-5.602e+04	0.0
	1	474.71	690.99	-1.782e+05	6.389e+04	-5.602e+04	0.0
	1	474.71	690.99	-1.782e+05	6.389e+04	-5.602e+04	0.0
19	1	201.51	830.99	-1.778e+05	8.131e+04	-2.162e+04	0.0
	1	201.51	830.99	-1.778e+05	8.131e+04	-2.162e+04	0.0
	1	201.51	830.99	-1.778e+05	8.131e+04	-2.162e+04	0.0
	1	201.51	830.99	-1.778e+05	8.131e+04	-2.162e+04	0.0
	1	201.51	830.99	-1.778e+05	8.131e+04	-2.162e+04	0.0
	1	201.51	830.99	-1.778e+05	8.131e+04	-2.162e+04	0.0
22	1	-955.41	-631.32	-1.728e+05	-1.031e+05	1.159e+05	0.0
	1	-955.41	-631.32	-1.728e+05	-1.031e+05	1.159e+05	0.0
	1	-955.41	-631.32	-1.728e+05	-1.031e+05	1.159e+05	0.0
	1	-955.41	-631.32	-1.728e+05	-1.031e+05	1.159e+05	0.0
	1	-955.41	-631.32	-1.728e+05	-1.031e+05	1.159e+05	0.0
	1	-955.41	-631.32	-1.728e+05	-1.031e+05	1.159e+05	0.0
23	1	-827.58	-750.21	-1.764e+05	-1.183e+05	1.001e+05	0.0
	1	-827.58	-750.21	-1.764e+05	-1.183e+05	1.001e+05	0.0
	1	-827.58	-750.21	-1.764e+05	-1.183e+05	1.001e+05	0.0
	1	-827.58	-750.21	-1.764e+05	-1.183e+05	1.001e+05	0.0
	1	-827.58	-750.21	-1.764e+05	-1.183e+05	1.001e+05	0.0
	1	-827.58	-750.21	-1.764e+05	-1.183e+05	1.001e+05	0.0
24	1	-725.06	55.00	-1.784e+05	-1.658e+04	8.735e+04	0.0
	1	-725.06	55.00	-1.784e+05	-1.658e+04	8.735e+04	0.0
	1	-725.06	55.00	-1.784e+05	-1.658e+04	8.735e+04	0.0
	1	-725.06	55.00	-1.784e+05	-1.658e+04	8.735e+04	0.0
	1	-725.06	55.00	-1.784e+05	-1.658e+04	8.735e+04	0.0
	1	-725.06	55.00	-1.784e+05	-1.658e+04	8.735e+04	0.0
25	1	-474.71	690.99	-1.782e+05	6.389e+04	5.602e+04	0.0
	1	-474.71	690.99	-1.782e+05	6.389e+04	5.602e+04	0.0
	1	-474.71	690.99	-1.782e+05	6.389e+04	5.602e+04	0.0
	1	-474.71	690.99	-1.782e+05	6.389e+04	5.602e+04	0.0
	1	-474.71	690.99	-1.782e+05	6.389e+04	5.602e+04	0.0
	1	-474.71	690.99	-1.782e+05	6.389e+04	5.602e+04	0.0
26	1	-201.51	830.99	-1.778e+05	8.131e+04	2.162e+04	0.0
	1	-201.51	830.99	-1.778e+05	8.131e+04	2.162e+04	0.0
	1	-201.51	830.99	-1.778e+05	8.131e+04	2.162e+04	0.0
	1	-201.51	830.99	-1.778e+05	8.131e+04	2.162e+04	0.0
	1	-201.51	830.99	-1.778e+05	8.131e+04	2.162e+04	0.0
	1	-201.51	830.99	-1.778e+05	8.131e+04	2.162e+04	0.0
29	1	5879.01	-684.13	-1.577e+05	-1.094e+05	-7.603e+05	0.0
	1	5879.01	-684.13	-1.577e+05	-1.094e+05	-7.603e+05	0.0
	1	5879.01	-684.13	-1.577e+05	-1.094e+05	-7.603e+05	0.0
	1	5879.01	-684.13	-1.577e+05	-1.094e+05	-7.603e+05	0.0
	1	5879.01	-684.13	-1.577e+05	-1.094e+05	-7.603e+05	0.0
	1	5879.01	-684.13	-1.577e+05	-1.094e+05	-7.603e+05	0.0
30	1	5707.42	-814.45	-1.615e+05	-1.256e+05	-7.373e+05	0.0
	1	5707.42	-814.45	-1.615e+05	-1.256e+05	-7.373e+05	0.0
	1	5707.42	-814.45	-1.615e+05	-1.256e+05	-7.373e+05	0.0
	1	5707.42	-814.45	-1.615e+05	-1.256e+05	-7.373e+05	0.0
	1	5707.42	-814.45	-1.615e+05	-1.256e+05	-7.373e+05	0.0
	1	5707.42	-814.45	-1.615e+05	-1.256e+05	-7.373e+05	0.0
31	1	5499.80	-45.33	-1.637e+05	-2.799e+04	-7.101e+05	0.0
	1	5499.80	-45.33	-1.637e+05	-2.799e+04	-7.101e+05	0.0
	1	5499.80	-45.33	-1.637e+05	-2.799e+04	-7.101e+05	0.0

	1	5499.80	-45.33	-1.637e+05	-2.799e+04	-7.101e+05	0.0
	1	5499.80	-45.33	-1.637e+05	-2.799e+04	-7.101e+05	0.0
	1	5499.80	-45.33	-1.637e+05	-2.799e+04	-7.101e+05	0.0
32	1	5166.67	580.30	-1.637e+05	5.162e+04	-6.668e+05	0.0
	1	5166.67	580.30	-1.637e+05	5.162e+04	-6.668e+05	0.0
	1	5166.67	580.30	-1.637e+05	5.162e+04	-6.668e+05	0.0
	1	5166.67	580.30	-1.637e+05	5.162e+04	-6.668e+05	0.0
	1	5166.67	580.30	-1.637e+05	5.162e+04	-6.668e+05	0.0
	1	5166.67	580.30	-1.637e+05	5.162e+04	-6.668e+05	0.0
33	1	5123.55	768.15	-1.634e+05	7.547e+04	-6.593e+05	0.0
	1	5123.55	768.15	-1.634e+05	7.547e+04	-6.593e+05	0.0
	1	5123.55	768.15	-1.634e+05	7.547e+04	-6.593e+05	0.0
	1	5123.55	768.15	-1.634e+05	7.547e+04	-6.593e+05	0.0
	1	5123.55	768.15	-1.634e+05	7.547e+04	-6.593e+05	0.0
	1	5123.55	768.15	-1.634e+05	7.547e+04	-6.593e+05	0.0
155	1	-5900.50	-636.58	-1.225e+05	-1.504e+05	7.698e+05	0.0
	1	-5900.50	-636.58	-1.225e+05	-1.504e+05	7.698e+05	0.0
	1	-5900.50	-636.58	-1.225e+05	-1.504e+05	7.698e+05	0.0
	1	-5900.50	-636.58	-1.225e+05	-1.504e+05	7.698e+05	0.0
	1	-5900.50	-636.58	-1.225e+05	-1.504e+05	7.698e+05	0.0
	1	-5900.50	-636.58	-1.225e+05	-1.504e+05	7.698e+05	0.0
156	1	-5819.45	-842.08	-1.280e+05	-1.762e+05	7.564e+05	0.0
	1	-5819.45	-842.08	-1.280e+05	-1.762e+05	7.564e+05	0.0
	1	-5819.45	-842.08	-1.280e+05	-1.762e+05	7.564e+05	0.0
	1	-5819.45	-842.08	-1.280e+05	-1.762e+05	7.564e+05	0.0
	1	-5819.45	-842.08	-1.280e+05	-1.762e+05	7.564e+05	0.0
	1	-5819.45	-842.08	-1.280e+05	-1.762e+05	7.564e+05	0.0
157	1	-5668.11	-400.84	-1.327e+05	-1.201e+05	7.337e+05	0.0
	1	-5668.11	-400.84	-1.327e+05	-1.201e+05	7.337e+05	0.0
	1	-5668.11	-400.84	-1.327e+05	-1.201e+05	7.337e+05	0.0
	1	-5668.11	-400.84	-1.327e+05	-1.201e+05	7.337e+05	0.0
	1	-5668.11	-400.84	-1.327e+05	-1.201e+05	7.337e+05	0.0
	1	-5668.11	-400.84	-1.327e+05	-1.201e+05	7.337e+05	0.0
158	1	-5915.77	179.72	-1.368e+05	-4.669e+04	7.587e+05	0.0
	1	-5915.77	179.72	-1.368e+05	-4.669e+04	7.587e+05	0.0
	1	-5915.77	179.72	-1.368e+05	-4.669e+04	7.587e+05	0.0
	1	-5915.77	179.72	-1.368e+05	-4.669e+04	7.587e+05	0.0
	1	-5915.77	179.72	-1.368e+05	-4.669e+04	7.587e+05	0.0
	1	-5915.77	179.72	-1.368e+05	-4.669e+04	7.587e+05	0.0
159	1	-5880.84	335.97	-1.386e+05	-2.717e+04	7.521e+05	0.0
	1	-5880.84	335.97	-1.386e+05	-2.717e+04	7.521e+05	0.0
	1	-5880.84	335.97	-1.386e+05	-2.717e+04	7.521e+05	0.0
	1	-5880.84	335.97	-1.386e+05	-2.717e+04	7.521e+05	0.0
	1	-5880.84	335.97	-1.386e+05	-2.717e+04	7.521e+05	0.0
	1	-5880.84	335.97	-1.386e+05	-2.717e+04	7.521e+05	0.0
197	1	-5390.21	-380.34	-1.458e+05	-1.197e+05	6.957e+05	0.0
	1	-5390.21	-380.34	-1.458e+05	-1.197e+05	6.957e+05	0.0
	1	-5390.21	-380.34	-1.458e+05	-1.197e+05	6.957e+05	0.0
	1	-5390.21	-380.34	-1.458e+05	-1.197e+05	6.957e+05	0.0
	1	-5390.21	-380.34	-1.458e+05	-1.197e+05	6.957e+05	0.0
	1	-5390.21	-380.34	-1.458e+05	-1.197e+05	6.957e+05	0.0
198	1	-5261.60	-577.43	-1.507e+05	-1.454e+05	6.772e+05	0.0
	1	-5261.60	-577.43	-1.507e+05	-1.454e+05	6.772e+05	0.0
	1	-5261.60	-577.43	-1.507e+05	-1.454e+05	6.772e+05	0.0
	1	-5261.60	-577.43	-1.507e+05	-1.454e+05	6.772e+05	0.0
	1	-5261.60	-577.43	-1.507e+05	-1.454e+05	6.772e+05	0.0
	1	-5261.60	-577.43	-1.507e+05	-1.454e+05	6.772e+05	0.0
199	1	-5108.42	-96.33	-1.547e+05	-8.515e+04	6.551e+05	0.0
	1	-5108.42	-96.33	-1.547e+05	-8.515e+04	6.551e+05	0.0
	1	-5108.42	-96.33	-1.547e+05	-8.515e+04	6.551e+05	0.0
	1	-5108.42	-96.33	-1.547e+05	-8.515e+04	6.551e+05	0.0
	1	-5108.42	-96.33	-1.547e+05	-8.515e+04	6.551e+05	0.0
	1	-5108.42	-96.33	-1.547e+05	-8.515e+04	6.551e+05	0.0
200	1	-5252.63	410.85	-1.583e+05	-2.166e+04	6.684e+05	0.0
	1	-5252.63	410.85	-1.583e+05	-2.166e+04	6.684e+05	0.0
	1	-5252.63	410.85	-1.583e+05	-2.166e+04	6.684e+05	0.0
	1	-5252.63	410.85	-1.583e+05	-2.166e+04	6.684e+05	0.0
	1	-5252.63	410.85	-1.583e+05	-2.166e+04	6.684e+05	0.0
	1	-5252.63	410.85	-1.583e+05	-2.166e+04	6.684e+05	0.0
201	1	-5171.15	443.82	-1.598e+05	-1.804e+04	6.563e+05	0.0
	1	-5171.15	443.82	-1.598e+05	-1.804e+04	6.563e+05	0.0
	1	-5171.15	443.82	-1.598e+05	-1.804e+04	6.563e+05	0.0
	1	-5171.15	443.82	-1.598e+05	-1.804e+04	6.563e+05	0.0
	1	-5171.15	443.82	-1.598e+05	-1.804e+04	6.563e+05	0.0
	1	-5171.15	443.82	-1.598e+05	-1.804e+04	6.563e+05	0.0
225	1	-4093.77	-4.32	-1.644e+05	-7.246e+04	5.145e+05	0.0
	1	-4093.77	-4.32	-1.644e+05	-7.246e+04	5.145e+05	0.0
	1	-4093.77	-4.32	-1.644e+05	-7.246e+04	5.145e+05	0.0
	1	-4093.77	-4.32	-1.644e+05	-7.246e+04	5.145e+05	0.0
	1	-4093.77	-4.32	-1.644e+05	-7.246e+04	5.145e+05	0.0
	1	-4093.77	-4.32	-1.644e+05	-7.246e+04	5.145e+05	0.0
226	1	-3853.61	-159.37	-1.684e+05	-9.362e+04	4.832e+05	0.0
	1	-3853.61	-159.37	-1.684e+05	-9.362e+04	4.832e+05	0.0
	1	-3853.61	-159.37	-1.684e+05	-9.362e+04	4.832e+05	0.0
	1	-3853.61	-159.37	-1.684e+05	-9.362e+04	4.832e+05	0.0
	1	-3853.61	-159.37	-1.684e+05	-9.362e+04	4.832e+05	0.0

	1	-3853.61	-159.37	-1.684e+05	-9.362e+04	4.832e+05	0.0
227	1	-3453.04	392.89	-1.713e+05	-2.502e+04	4.315e+05	0.0
	1	-3453.04	392.89	-1.713e+05	-2.502e+04	4.315e+05	0.0
	1	-3453.04	392.89	-1.713e+05	-2.502e+04	4.315e+05	0.0
	1	-3453.04	392.89	-1.713e+05	-2.502e+04	4.315e+05	0.0
	1	-3453.04	392.89	-1.713e+05	-2.502e+04	4.315e+05	0.0
	1	-3453.04	392.89	-1.713e+05	-2.502e+04	4.315e+05	0.0
228	1	-3179.54	738.04	-1.741e+05	1.740e+04	3.946e+05	0.0
	1	-3179.54	738.04	-1.741e+05	1.740e+04	3.946e+05	0.0
	1	-3179.54	738.04	-1.741e+05	1.740e+04	3.946e+05	0.0
	1	-3179.54	738.04	-1.741e+05	1.740e+04	3.946e+05	0.0
	1	-3179.54	738.04	-1.741e+05	1.740e+04	3.946e+05	0.0
	1	-3179.54	738.04	-1.741e+05	1.740e+04	3.946e+05	0.0
229	1	-3034.82	558.30	-1.750e+05	-6191.37	3.759e+05	0.0
	1	-3034.82	558.30	-1.750e+05	-6191.37	3.759e+05	0.0
	1	-3034.82	558.30	-1.750e+05	-6191.37	3.759e+05	0.0
	1	-3034.82	558.30	-1.750e+05	-6191.37	3.759e+05	0.0
	1	-3034.82	558.30	-1.750e+05	-6191.37	3.759e+05	0.0
	1	-3034.82	558.30	-1.750e+05	-6191.37	3.759e+05	0.0
253	1	3654.90	24.78	-1.644e+05	-6.812e+04	-4.933e+05	0.0
	1	3654.90	24.78	-1.644e+05	-6.812e+04	-4.933e+05	0.0
	1	3654.90	24.78	-1.644e+05	-6.812e+04	-4.933e+05	0.0
	1	3654.90	24.78	-1.644e+05	-6.812e+04	-4.933e+05	0.0
	1	3654.90	24.78	-1.644e+05	-6.812e+04	-4.933e+05	0.0
	1	3654.90	24.78	-1.644e+05	-6.812e+04	-4.933e+05	0.0
254	1	3459.69	-132.10	-1.682e+05	-8.955e+04	-4.670e+05	0.0
	1	3459.69	-132.10	-1.682e+05	-8.955e+04	-4.670e+05	0.0
	1	3459.69	-132.10	-1.682e+05	-8.955e+04	-4.670e+05	0.0
	1	3459.69	-132.10	-1.682e+05	-8.955e+04	-4.670e+05	0.0
	1	3459.69	-132.10	-1.682e+05	-8.955e+04	-4.670e+05	0.0
	1	3459.69	-132.10	-1.682e+05	-8.955e+04	-4.670e+05	0.0
255	1	3108.05	421.46	-1.710e+05	-2.084e+04	-4.209e+05	0.0
	1	3108.05	421.46	-1.710e+05	-2.084e+04	-4.209e+05	0.0
	1	3108.05	421.46	-1.710e+05	-2.084e+04	-4.209e+05	0.0
	1	3108.05	421.46	-1.710e+05	-2.084e+04	-4.209e+05	0.0
	1	3108.05	421.46	-1.710e+05	-2.084e+04	-4.209e+05	0.0
	1	3108.05	421.46	-1.710e+05	-2.084e+04	-4.209e+05	0.0
256	1	2876.39	751.49	-1.737e+05	1.964e+04	-3.887e+05	0.0
	1	2876.39	751.49	-1.737e+05	1.964e+04	-3.887e+05	0.0
	1	2876.39	751.49	-1.737e+05	1.964e+04	-3.887e+05	0.0
	1	2876.39	751.49	-1.737e+05	1.964e+04	-3.887e+05	0.0
	1	2876.39	751.49	-1.737e+05	1.964e+04	-3.887e+05	0.0
	1	2876.39	751.49	-1.737e+05	1.964e+04	-3.887e+05	0.0
257	1	2754.85	555.00	-1.746e+05	-6077.61	-3.723e+05	0.0
	1	2754.85	555.00	-1.746e+05	-6077.61	-3.723e+05	0.0
	1	2754.85	555.00	-1.746e+05	-6077.61	-3.723e+05	0.0
	1	2754.85	555.00	-1.746e+05	-6077.61	-3.723e+05	0.0
	1	2754.85	555.00	-1.746e+05	-6077.61	-3.723e+05	0.0
	1	2754.85	555.00	-1.746e+05	-6077.61	-3.723e+05	0.0
281	1	5328.62	-327.91	-1.448e+05	-1.114e+05	-7.227e+05	0.0
	1	5328.62	-327.91	-1.448e+05	-1.114e+05	-7.227e+05	0.0
	1	5328.62	-327.91	-1.448e+05	-1.114e+05	-7.227e+05	0.0
	1	5328.62	-327.91	-1.448e+05	-1.114e+05	-7.227e+05	0.0
	1	5328.62	-327.91	-1.448e+05	-1.114e+05	-7.227e+05	0.0
	1	5328.62	-327.91	-1.448e+05	-1.114e+05	-7.227e+05	0.0
282	1	5213.46	-534.82	-1.495e+05	-1.384e+05	-7.052e+05	0.0
	1	5213.46	-534.82	-1.495e+05	-1.384e+05	-7.052e+05	0.0
	1	5213.46	-534.82	-1.495e+05	-1.384e+05	-7.052e+05	0.0
	1	5213.46	-534.82	-1.495e+05	-1.384e+05	-7.052e+05	0.0
	1	5213.46	-534.82	-1.495e+05	-1.384e+05	-7.052e+05	0.0
	1	5213.46	-534.82	-1.495e+05	-1.384e+05	-7.052e+05	0.0
283	1	5065.13	-49.22	-1.533e+05	-7.774e+04	-6.830e+05	0.0
	1	5065.13	-49.22	-1.533e+05	-7.774e+04	-6.830e+05	0.0
	1	5065.13	-49.22	-1.533e+05	-7.774e+04	-6.830e+05	0.0
	1	5065.13	-49.22	-1.533e+05	-7.774e+04	-6.830e+05	0.0
	1	5065.13	-49.22	-1.533e+05	-7.774e+04	-6.830e+05	0.0
	1	5065.13	-49.22	-1.533e+05	-7.774e+04	-6.830e+05	0.0
284	1	5226.25	425.88	-1.567e+05	-1.835e+04	-6.977e+05	0.0
	1	5226.25	425.88	-1.567e+05	-1.835e+04	-6.977e+05	0.0
	1	5226.25	425.88	-1.567e+05	-1.835e+04	-6.977e+05	0.0
	1	5226.25	425.88	-1.567e+05	-1.835e+04	-6.977e+05	0.0
	1	5226.25	425.88	-1.567e+05	-1.835e+04	-6.977e+05	0.0
	1	5226.25	425.88	-1.567e+05	-1.835e+04	-6.977e+05	0.0
285	1	5150.08	426.83	-1.582e+05	-1.878e+04	-6.856e+05	0.0
	1	5150.08	426.83	-1.582e+05	-1.878e+04	-6.856e+05	0.0
	1	5150.08	426.83	-1.582e+05	-1.878e+04	-6.856e+05	0.0
	1	5150.08	426.83	-1.582e+05	-1.878e+04	-6.856e+05	0.0
	1	5150.08	426.83	-1.582e+05	-1.878e+04	-6.856e+05	0.0
	1	5150.08	426.83	-1.582e+05	-1.878e+04	-6.856e+05	0.0
309	1	6418.42	-621.97	-1.187e+05	-1.460e+05	-8.707e+05	0.0
	1	6418.42	-621.97	-1.187e+05	-1.460e+05	-8.707e+05	0.0
	1	6418.42	-621.97	-1.187e+05	-1.460e+05	-8.707e+05	0.0
	1	6418.42	-621.97	-1.187e+05	-1.460e+05	-8.707e+05	0.0
	1	6418.42	-621.97	-1.187e+05	-1.460e+05	-8.707e+05	0.0
	1	6418.42	-621.97	-1.187e+05	-1.460e+05	-8.707e+05	0.0
310	1	6307.25	-870.70	-1.240e+05	-1.773e+05	-8.527e+05	0.0

	1	6307.25	-870.70	-1.240e+05	-1.773e+05	-8.527e+05	0.0
	1	6307.25	-870.70	-1.240e+05	-1.773e+05	-8.527e+05	0.0
	1	6307.25	-870.70	-1.240e+05	-1.773e+05	-8.527e+05	0.0
	1	6307.25	-870.70	-1.240e+05	-1.773e+05	-8.527e+05	0.0
	1	6307.25	-870.70	-1.240e+05	-1.773e+05	-8.527e+05	0.0
311	1	6065.39	-461.79	-1.288e+05	-1.253e+05	-8.176e+05	0.0
	1	6065.39	-461.79	-1.288e+05	-1.253e+05	-8.176e+05	0.0
	1	6065.39	-461.79	-1.288e+05	-1.253e+05	-8.176e+05	0.0
	1	6065.39	-461.79	-1.288e+05	-1.253e+05	-8.176e+05	0.0
	1	6065.39	-461.79	-1.288e+05	-1.253e+05	-8.176e+05	0.0
	1	6065.39	-461.79	-1.288e+05	-1.253e+05	-8.176e+05	0.0
312	1	6203.70	136.39	-1.329e+05	-4.973e+04	-8.278e+05	0.0
	1	6203.70	136.39	-1.329e+05	-4.973e+04	-8.278e+05	0.0
	1	6203.70	136.39	-1.329e+05	-4.973e+04	-8.278e+05	0.0
	1	6203.70	136.39	-1.329e+05	-4.973e+04	-8.278e+05	0.0
	1	6203.70	136.39	-1.329e+05	-4.973e+04	-8.278e+05	0.0
	1	6203.70	136.39	-1.329e+05	-4.973e+04	-8.278e+05	0.0
313	1	6151.26	294.38	-1.347e+05	-3.005e+04	-8.183e+05	0.0
	1	6151.26	294.38	-1.347e+05	-3.005e+04	-8.183e+05	0.0
	1	6151.26	294.38	-1.347e+05	-3.005e+04	-8.183e+05	0.0
	1	6151.26	294.38	-1.347e+05	-3.005e+04	-8.183e+05	0.0
	1	6151.26	294.38	-1.347e+05	-3.005e+04	-8.183e+05	0.0
	1	6151.26	294.38	-1.347e+05	-3.005e+04	-8.183e+05	0.0
366	1	-3894.73	-1111.83	-1.486e+05	-2.190e+05	7.645e+05	0.0
	1	-3894.73	-1111.83	-1.486e+05	-2.190e+05	7.645e+05	0.0
	1	-3894.73	-1111.83	-1.486e+05	-2.190e+05	7.645e+05	0.0
	1	-3894.73	-1111.83	-1.486e+05	-2.190e+05	7.645e+05	0.0
	1	-3894.73	-1111.83	-1.486e+05	-2.190e+05	7.645e+05	0.0
	1	-3894.73	-1111.83	-1.486e+05	-2.190e+05	7.645e+05	0.0
367	1	-3436.01	-939.50	-1.571e+05	-1.977e+05	7.021e+05	0.0
	1	-3436.01	-939.50	-1.571e+05	-1.977e+05	7.021e+05	0.0
	1	-3436.01	-939.50	-1.571e+05	-1.977e+05	7.021e+05	0.0
	1	-3436.01	-939.50	-1.571e+05	-1.977e+05	7.021e+05	0.0
	1	-3436.01	-939.50	-1.571e+05	-1.977e+05	7.021e+05	0.0
	1	-3436.01	-939.50	-1.571e+05	-1.977e+05	7.021e+05	0.0
368	1	-2642.59	-79.61	-1.643e+05	-9.480e+04	5.997e+05	0.0
	1	-2642.59	-79.61	-1.643e+05	-9.480e+04	5.997e+05	0.0
	1	-2642.59	-79.61	-1.643e+05	-9.480e+04	5.997e+05	0.0
	1	-2642.59	-79.61	-1.643e+05	-9.480e+04	5.997e+05	0.0
	1	-2642.59	-79.61	-1.643e+05	-9.480e+04	5.997e+05	0.0
	1	-2642.59	-79.61	-1.643e+05	-9.480e+04	5.997e+05	0.0
369	1	-2549.29	502.34	-1.682e+05	-2.551e+04	5.801e+05	0.0
	1	-2549.29	502.34	-1.682e+05	-2.551e+04	5.801e+05	0.0
	1	-2549.29	502.34	-1.682e+05	-2.551e+04	5.801e+05	0.0
	1	-2549.29	502.34	-1.682e+05	-2.551e+04	5.801e+05	0.0
	1	-2549.29	502.34	-1.682e+05	-2.551e+04	5.801e+05	0.0
	1	-2549.29	502.34	-1.682e+05	-2.551e+04	5.801e+05	0.0
370	1	-2546.01	771.23	-1.701e+05	6631.49	5.717e+05	0.0
	1	-2546.01	771.23	-1.701e+05	6631.49	5.717e+05	0.0
	1	-2546.01	771.23	-1.701e+05	6631.49	5.717e+05	0.0
	1	-2546.01	771.23	-1.701e+05	6631.49	5.717e+05	0.0
	1	-2546.01	771.23	-1.701e+05	6631.49	5.717e+05	0.0
	1	-2546.01	771.23	-1.701e+05	6631.49	5.717e+05	0.0
386	1	220.20	-1346.10	-1.215e+05	-2.368e+05	2.740e+05	0.0
	1	220.20	-1346.10	-1.215e+05	-2.368e+05	2.740e+05	0.0
	1	220.20	-1346.10	-1.215e+05	-2.368e+05	2.740e+05	0.0
	1	220.20	-1346.10	-1.215e+05	-2.368e+05	2.740e+05	0.0
	1	220.20	-1346.10	-1.215e+05	-2.368e+05	2.740e+05	0.0
	1	220.20	-1346.10	-1.215e+05	-2.368e+05	2.740e+05	0.0
387	1	-965.83	610.35	-1.458e+05	-1530.13	3.840e+05	0.0
	1	-965.83	610.35	-1.458e+05	-1530.13	3.840e+05	0.0
	1	-965.83	610.35	-1.458e+05	-1530.13	3.840e+05	0.0
	1	-965.83	610.35	-1.458e+05	-1530.13	3.840e+05	0.0
	1	-965.83	610.35	-1.458e+05	-1530.13	3.840e+05	0.0
	1	-965.83	610.35	-1.458e+05	-1530.13	3.840e+05	0.0
389	1	-747.70	266.61	-1.438e+05	-4.255e+04	3.661e+05	0.0
	1	-747.70	266.61	-1.438e+05	-4.255e+04	3.661e+05	0.0
	1	-747.70	266.61	-1.438e+05	-4.255e+04	3.661e+05	0.0
	1	-747.70	266.61	-1.438e+05	-4.255e+04	3.661e+05	0.0
	1	-747.70	266.61	-1.438e+05	-4.255e+04	3.661e+05	0.0
	1	-747.70	266.61	-1.438e+05	-4.255e+04	3.661e+05	0.0
390	1	-478.60	-480.05	-1.395e+05	-1.314e+05	3.421e+05	0.0
	1	-478.60	-480.05	-1.395e+05	-1.314e+05	3.421e+05	0.0
	1	-478.60	-480.05	-1.395e+05	-1.314e+05	3.421e+05	0.0
	1	-478.60	-480.05	-1.395e+05	-1.314e+05	3.421e+05	0.0
	1	-478.60	-480.05	-1.395e+05	-1.314e+05	3.421e+05	0.0
	1	-478.60	-480.05	-1.395e+05	-1.314e+05	3.421e+05	0.0
392	1	-203.36	-1595.65	-1.307e+05	-2.649e+05	3.167e+05	0.0
	1	-203.36	-1595.65	-1.307e+05	-2.649e+05	3.167e+05	0.0
	1	-203.36	-1595.65	-1.307e+05	-2.649e+05	3.167e+05	0.0
	1	-203.36	-1595.65	-1.307e+05	-2.649e+05	3.167e+05	0.0
	1	-203.36	-1595.65	-1.307e+05	-2.649e+05	3.167e+05	0.0
	1	-203.36	-1595.65	-1.307e+05	-2.649e+05	3.167e+05	0.0
396	1	3054.67	104.73	-1.110e+05	-4.574e+04	-6.587e+04	0.0
	1	3054.67	104.73	-1.110e+05	-4.574e+04	-6.587e+04	0.0
	1	3054.67	104.73	-1.110e+05	-4.574e+04	-6.587e+04	0.0

	1	3054.67	104.73	-1.110e+05	-4.574e+04	-6.587e+04	0.0
	1	3054.67	104.73	-1.110e+05	-4.574e+04	-6.587e+04	0.0
	1	3054.67	104.73	-1.110e+05	-4.574e+04	-6.587e+04	0.0
397	1	2338.60	287.54	-1.139e+05	-2.382e+04	1.171e+04	0.0
	1	2338.60	287.54	-1.139e+05	-2.382e+04	1.171e+04	0.0
	1	2338.60	287.54	-1.139e+05	-2.382e+04	1.171e+04	0.0
	1	2338.60	287.54	-1.139e+05	-2.382e+04	1.171e+04	0.0
	1	2338.60	287.54	-1.139e+05	-2.382e+04	1.171e+04	0.0
	1	2338.60	287.54	-1.139e+05	-2.382e+04	1.171e+04	0.0
398	1	1508.01	558.34	-1.154e+05	8741.11	1.039e+05	0.0
	1	1508.01	558.34	-1.154e+05	8741.11	1.039e+05	0.0
	1	1508.01	558.34	-1.154e+05	8741.11	1.039e+05	0.0
	1	1508.01	558.34	-1.154e+05	8741.11	1.039e+05	0.0
	1	1508.01	558.34	-1.154e+05	8741.11	1.039e+05	0.0
	1	1508.01	558.34	-1.154e+05	8741.11	1.039e+05	0.0
399	1	1086.88	613.41	-1.166e+05	1.564e+04	1.468e+05	0.0
	1	1086.88	613.41	-1.166e+05	1.564e+04	1.468e+05	0.0
	1	1086.88	613.41	-1.166e+05	1.564e+04	1.468e+05	0.0
	1	1086.88	613.41	-1.166e+05	1.564e+04	1.468e+05	0.0
	1	1086.88	613.41	-1.166e+05	1.564e+04	1.468e+05	0.0
	1	1086.88	613.41	-1.166e+05	1.564e+04	1.468e+05	0.0
400	1	795.75	651.30	-1.172e+05	2.046e+04	1.737e+05	0.0
	1	795.75	651.30	-1.172e+05	2.046e+04	1.737e+05	0.0
	1	795.75	651.30	-1.172e+05	2.046e+04	1.737e+05	0.0
	1	795.75	651.30	-1.172e+05	2.046e+04	1.737e+05	0.0
	1	795.75	651.30	-1.172e+05	2.046e+04	1.737e+05	0.0
	1	795.75	651.30	-1.172e+05	2.046e+04	1.737e+05	0.0
458	1	-260.05	183.06	-9.620e+04	-2.573e+04	3.259e+05	0.0
	1	-260.05	183.06	-9.620e+04	-2.573e+04	3.259e+05	0.0
	1	-260.05	183.06	-9.620e+04	-2.573e+04	3.259e+05	0.0
	1	-260.05	183.06	-9.620e+04	-2.573e+04	3.259e+05	0.0
	1	-260.05	183.06	-9.620e+04	-2.573e+04	3.259e+05	0.0
	1	-260.05	183.06	-9.620e+04	-2.573e+04	3.259e+05	0.0
459	1	315.50	594.64	-1.018e+05	2.370e+04	2.299e+05	0.0
	1	315.50	594.64	-1.018e+05	2.370e+04	2.299e+05	0.0
	1	315.50	594.64	-1.018e+05	2.370e+04	2.299e+05	0.0
	1	315.50	594.64	-1.018e+05	2.370e+04	2.299e+05	0.0
	1	315.50	594.64	-1.018e+05	2.370e+04	2.299e+05	0.0
	1	315.50	594.64	-1.018e+05	2.370e+04	2.299e+05	0.0
461	1	479.36	604.22	-1.016e+05	2.449e+04	2.178e+05	0.0
	1	479.36	604.22	-1.016e+05	2.449e+04	2.178e+05	0.0
	1	479.36	604.22	-1.016e+05	2.449e+04	2.178e+05	0.0
	1	479.36	604.22	-1.016e+05	2.449e+04	2.178e+05	0.0
	1	479.36	604.22	-1.016e+05	2.449e+04	2.178e+05	0.0
	1	479.36	604.22	-1.016e+05	2.449e+04	2.178e+05	0.0
462	1	489.56	458.00	-1.007e+05	6933.72	2.233e+05	0.0
	1	489.56	458.00	-1.007e+05	6933.72	2.233e+05	0.0
	1	489.56	458.00	-1.007e+05	6933.72	2.233e+05	0.0
	1	489.56	458.00	-1.007e+05	6933.72	2.233e+05	0.0
	1	489.56	458.00	-1.007e+05	6933.72	2.233e+05	0.0
	1	489.56	458.00	-1.007e+05	6933.72	2.233e+05	0.0
464	1	-107.39	93.55	-9.872e+04	-3.637e+04	3.005e+05	0.0
	1	-107.39	93.55	-9.872e+04	-3.637e+04	3.005e+05	0.0
	1	-107.39	93.55	-9.872e+04	-3.637e+04	3.005e+05	0.0
	1	-107.39	93.55	-9.872e+04	-3.637e+04	3.005e+05	0.0
	1	-107.39	93.55	-9.872e+04	-3.637e+04	3.005e+05	0.0
	1	-107.39	93.55	-9.872e+04	-3.637e+04	3.005e+05	0.0
472	1	115.96	633.12	-1.271e+05	1.175e+04	2.546e+05	0.0
	1	115.96	633.12	-1.271e+05	1.175e+04	2.546e+05	0.0
	1	115.96	633.12	-1.271e+05	1.175e+04	2.546e+05	0.0
	1	115.96	633.12	-1.271e+05	1.175e+04	2.546e+05	0.0
	1	115.96	633.12	-1.271e+05	1.175e+04	2.546e+05	0.0
	1	115.96	633.12	-1.271e+05	1.175e+04	2.546e+05	0.0
474	1	482.08	446.96	-1.259e+05	-1.063e+04	2.190e+05	0.0
	1	482.08	446.96	-1.259e+05	-1.063e+04	2.190e+05	0.0
	1	482.08	446.96	-1.259e+05	-1.063e+04	2.190e+05	0.0
	1	482.08	446.96	-1.259e+05	-1.063e+04	2.190e+05	0.0
	1	482.08	446.96	-1.259e+05	-1.063e+04	2.190e+05	0.0
	1	482.08	446.96	-1.259e+05	-1.063e+04	2.190e+05	0.0
475	1	976.98	95.04	-1.234e+05	-5.279e+04	1.676e+05	0.0
	1	976.98	95.04	-1.234e+05	-5.279e+04	1.676e+05	0.0
	1	976.98	95.04	-1.234e+05	-5.279e+04	1.676e+05	0.0
	1	976.98	95.04	-1.234e+05	-5.279e+04	1.676e+05	0.0
	1	976.98	95.04	-1.234e+05	-5.279e+04	1.676e+05	0.0
	1	976.98	95.04	-1.234e+05	-5.279e+04	1.676e+05	0.0
580	1	3608.81	-875.52	-1.143e+05	-1.737e+05	-1.292e+05	0.0
	1	3608.81	-875.52	-1.143e+05	-1.737e+05	-1.292e+05	0.0
	1	3608.81	-875.52	-1.143e+05	-1.737e+05	-1.292e+05	0.0
	1	3608.81	-875.52	-1.143e+05	-1.737e+05	-1.292e+05	0.0
	1	3608.81	-875.52	-1.143e+05	-1.737e+05	-1.292e+05	0.0
	1	3608.81	-875.52	-1.143e+05	-1.737e+05	-1.292e+05	0.0
586	1	2359.19	-1046.15	-1.216e+05	-1.928e+05	1.135e+04	0.0
	1	2359.19	-1046.15	-1.216e+05	-1.928e+05	1.135e+04	0.0
	1	2359.19	-1046.15	-1.216e+05	-1.928e+05	1.135e+04	0.0
	1	2359.19	-1046.15	-1.216e+05	-1.928e+05	1.135e+04	0.0
	1	2359.19	-1046.15	-1.216e+05	-1.928e+05	1.135e+04	0.0

1 2359.19 -1046.15 -1.216e+05 -1.928e+05 1.135e+04 0.0

RESULTS OF FOUNDATION ANALYSIS

LEGEND OF FOUNDATION ANALYSIS RESULTS

Foundation analysis results can be checked with the help of the below presented table.

The first table refers to pile foundations and to isolated foundations on piles. For these foundations, six actions (expressed according to the global reference system of the structure) are indicated, one per each pile of the foundation.

In particular the following data are indicated in the table:

Nodo	node number to which foundation is attributed
Tipo	type of isolated foundation: 3) single pile 4) isolated foundation on single pile 5) isolated foundation on two piles 6) isolated foundation on three piles 7) isolated foundation on four piles 8) rectangular isolated foundation on five piles 9) pentagonal isolated foundation on five piles 10) isolated foundation on five piles
Palo	pile number
Comb.	Load combination of the six actions.
Quota	absolute Pile section level of the six actions.

Action Fz (relative to the normal force of the pile) is constant since the weight of the pile is not taken into consideration for simulation.

The second table refers to the isolated foundations laid in the elastic soil (footing).

For these foundation the imposed loads (PRESSURE) on four vertexes of the imprint on the soil are indicated.

In particular, the following data are indicated in the table:

Nodo		node number to which the isolated foundation is attributed
Tipo		isolated foundation code type
area		isolated foundation imprint area
Wink O	**Wink V**	assumed Winkler factors (horizontal and vertical)
Comb		print value load combination
Pt (P1 P2 P3 P4)		pressure value applied to the vertexes

The third table refers to the slab foundation laid in elastic soil.

The loads applied to each vertex of the elements composing the slab are indicated for these foundations.

The fourth table refers to the beam type foundation laid in the elastic soil.

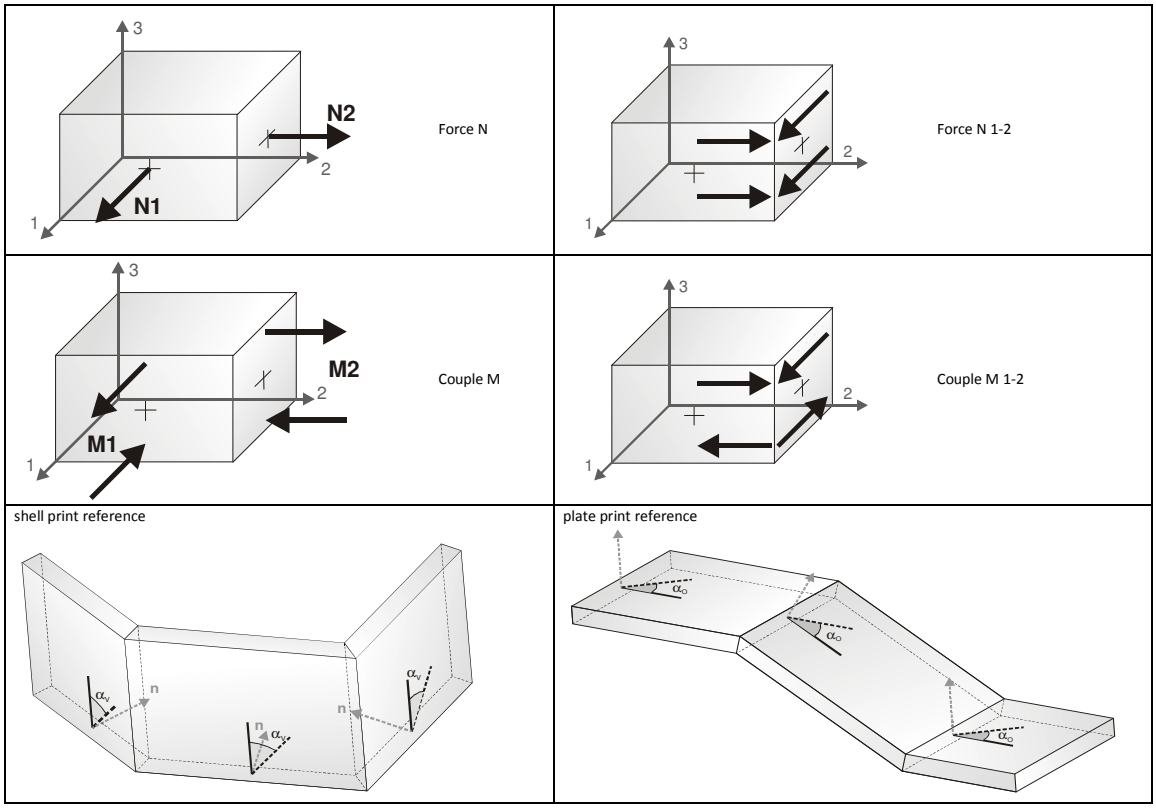
The loads imposed on the element extremities and the maximum load (absolute value) within the element are indicated for these foundations.

Node	Type	Pile	Cmb	Quote	Fx	Fy	Fz	Mx	My	Mz
				cm	daN	daN	daN	daN cm	daN cm	daN cm
1	PALO D 80.00	1	1	0.0	-5879.01	-684.13	-1.577e+05	1.094e+05	7.603e+05	0.0
2	PALO D 80.00	1	1	0.0	-5707.42	-814.45	-1.615e+05	1.256e+05	7.373e+05	0.0
3	PALO D 80.00	1	1	0.0	-5499.80	-45.33	-1.637e+05	2.799e+04	7.101e+05	0.0
4	PALO D 80.00	1	1	0.0	-5166.67	580.30	-1.637e+05	-5.162e+04	6.668e+05	0.0
5	PALO D 80.00	1	1	0.0	-5123.55	768.15	-1.634e+05	-7.547e+04	6.593e+05	0.0
15	PALO D 80.00	1	1	0.0	955.41	-631.32	-1.728e+05	1.031e+05	-1.159e+05	0.0
16	PALO D 80.00	1	1	0.0	827.58	-750.21	-1.764e+05	1.183e+05	-1.001e+05	0.0
17	PALO D 80.00	1	1	0.0	725.06	55.00	-1.784e+05	1.658e+04	-8.735e+04	0.0
18	PALO D 80.00	1	1	0.0	474.71	690.99	-1.782e+05	-6.389e+04	-5.602e+04	0.0
19	PALO D 80.00	1	1	0.0	201.51	830.99	-1.778e+05	-8.131e+04	-2.162e+04	0.0
22	PALO D 80.00	1	1	0.0	-955.41	-631.32	-1.728e+05	1.031e+05	1.159e+05	0.0
23	PALO D 80.00	1	1	0.0	-827.58	-750.21	-1.764e+05	1.183e+05	1.001e+05	0.0
24	PALO D 80.00	1	1	0.0	-725.06	55.00	-1.784e+05	1.658e+04	8.735e+04	0.0
25	PALO D 80.00	1	1	0.0	-474.71	690.99	-1.782e+05	-6.389e+04	5.602e+04	0.0
26	PALO D 80.00	1	1	0.0	-201.51	830.99	-1.778e+05	-8.131e+04	2.162e+04	0.0
29	PALO D 80.00	1	1	0.0	5879.01	-684.13	-1.577e+05	1.094e+05	-7.603e+05	0.0
30	PALO D 80.00	1	1	0.0	5707.42	-814.45	-1.615e+05	1.256e+05	-7.373e+05	0.0
31	PALO D 80.00	1	1	0.0	5499.80	-45.33	-1.637e+05	2.799e+04	-7.101e+05	0.0
32	PALO D 80.00	1	1	0.0	5166.67	580.30	-1.637e+05	-5.162e+04	-6.668e+05	0.0
33	PALO D 80.00	1	1	0.0	5123.55	768.15	-1.634e+05	-7.547e+04	-6.593e+05	0.0
155	PALO D 80.00	1	1	0.0	-5900.50	-636.58	-1.225e+05	1.504e+05	7.698e+05	0.0
156	PALO D 80.00	1	1	0.0	-5819.45	-842.08	-1.280e+05	1.762e+05	7.564e+05	0.0
157	PALO D 80.00	1	1	0.0	-5668.11	-400.84	-1.327e+05	1.201e+05	7.337e+05	0.0
158	PALO D 80.00	1	1	0.0	-5915.77	179.72	-1.368e+05	4.669e+04	7.587e+05	0.0
159	PALO D 80.00	1	1	0.0	-5880.84	335.97	-1.386e+05	2.717e+04	7.521e+05	0.0
197	PALO D 80.00	1	1	0.0	-5390.21	-380.34	-1.458e+05	1.197e+05	6.957e+05	0.0
198	PALO D 80.00	1	1	0.0	-5261.60	-577.43	-1.507e+05	1.454e+05	6.772e+05	0.0
199	PALO D 80.00	1	1	0.0	-5108.42	-96.33	-1.547e+05	8.515e+04	6.551e+05	0.0
200	PALO D 80.00	1	1	0.0	-5252.63	410.85	-1.583e+05	2.166e+04	6.684e+05	0.0
201	PALO D 80.00	1	1	0.0	-5171.15	443.82	-1.598e+05	1.804e+04	6.563e+05	0.0
225	PALO D 80.00	1	1	0.0	-4093.77	-4.32	-1.644e+05	7.246e+04	5.145e+05	0.0
226	PALO D 80.00	1	1	0.0	-3853.61	-159.37	-1.684e+05	9.362e+04	4.832e+05	0.0
227	PALO D 80.00	1	1	0.0	-3453.04	392.89	-1.713e+05	2.502e+04	4.315e+05	0.0
228	PALO D 80.00	1	1	0.0	-3179.54	738.04	-1.741e+05	-1.740e+04	3.946e+05	0.0
229	PALO D 80.00	1	1	0.0	-3034.82	558.30	-1.750e+05	6191.37	3.759e+05	0.0
253	PALO D 80.00	1	1	0.0	3654.90	24.78	-1.644e+05	6.812e+04	-4.933e+05	0.0
254	PALO D 80.00	1	1	0.0	3459.69	-132.10	-1.682e+05	8.955e+04	-4.670e+05	0.0
255	PALO D 80.00	1	1	0.0	3108.05	421.46	-1.710e+05	2.084e+04	-4.209e+05	0.0

Node	Type	Pile	Cmb	Quote	Fx	Fy	Fz	Mx	My	Mz
256	PALO D 80.00	1	1	0.0	2876.39	751.49	-1.737e+05	-1.964e+04	-3.887e+05	0.0
257	PALO D 80.00	1	1	0.0	2754.85	555.00	-1.746e+05	6077.61	-3.723e+05	0.0
281	PALO D 80.00	1	1	0.0	5328.62	-327.91	-1.448e+05	1.114e+05	-7.227e+05	0.0
282	PALO D 80.00	1	1	0.0	5213.46	-534.82	-1.495e+05	1.384e+05	-7.052e+05	0.0
283	PALO D 80.00	1	1	0.0	5065.13	-49.22	-1.533e+05	7.774e+04	-6.830e+05	0.0
284	PALO D 80.00	1	1	0.0	5226.25	425.88	-1.567e+05	1.835e+04	-6.977e+05	0.0
285	PALO D 80.00	1	1	0.0	5150.08	426.83	-1.582e+05	1.878e+04	-6.856e+05	0.0
309	PALO D 80.00	1	1	0.0	6418.42	-621.97	-1.187e+05	1.460e+05	-8.707e+05	0.0
310	PALO D 80.00	1	1	0.0	6307.25	-870.70	-1.240e+05	1.773e+05	-8.527e+05	0.0
311	PALO D 80.00	1	1	0.0	6065.39	-461.79	-1.288e+05	1.253e+05	-8.176e+05	0.0
...										
586	PALO D 70.00	1	1	0.0	2359.19	-1046.15	-1.216e+05	1.928e+05	1.135e+04	0.0
Node					**Fx**	**Fy**	**Fz**	**Mx**	**My**	**Mz**
					-5915.77	-1595.65	-1.784e+05	-8.131e+04	-8.707e+05	0.0
					6418.42	830.99	-9.620e+04	2.649e+05	7.698e+05	0.0

RESULTS OF SHELL TYPE ELEMENT ANALYSIS
LEGEND OF SHELL TYPE ELEMENT ANALYSIS RESULTS

The most significant results are indicated for each element and for each combination.



In particular the following data are indicated in each element node and each load combination:

Von Mises stress		(reassumed total stress value)
N max		max. principal membrane force
N min		min. principal membrane force
M max		max. principal bending action
M min		min. principal bending action
N1	**N2**	membrane and bending forces in local element direction 1 and 2 (force 2-1 is equal to force 1-2 due to mutual
N1-2	**M1**	compensation of the tangential stresses)
M2	**M1-2**	

At designer's choice the above results can be preceded to or replaced with values of actions no longer referred to the local element reference system, but to the global reference system.
In this case the elements are subdivided in groups (macro shells or macro shear walls, grouped according to material, thickness and physical position) to estimate the values relative to the nodes belonging to the elements of the same groups.
In this case the action values are referred to the global group system, turned by α_O around the Z axis in case of shells, and turned by α_V around the normal (which is horizontal by definition) of the wall plane.
For walls, if α_V is zero, axis '1-1 will represent the vertical, whereas axis '2-2 will represent the horizontal within the wall.

Macro	Type	Angle 1-X (degrees)
1	**Shell**	**0.0**

M_G	Cmb	Node	N max	N min	N 1	N 2	N 1-2	M max	M min	M 1	M 2	M 1-2
			daN/cm	daN/cm	daN/cm	daN/cm	daN/cm	daN	daN	daN	daN	daN

	1	1	5	4.67	1.67	4.28	2.05	1.00	2.911e+04	2.421e+04	2.436e+04	2.895e+04	-852.73
	1	1	6	-0.12	-14.16	-14.12	-0.16	0.80	1.471e+04	-412.91	1.471e+04	-412.84	-32.23
	1	1	8	0.94	-26.27	-26.23	0.90	1.03	-710.13	-4.979e+04	-4.979e+04	-710.16	32.25
	1	1	11	0.65	-2.02	0.14	-1.50	1.05	242.84	-943.31	-90.93	-609.54	-533.38
	1	1	12	-1.44	-8.74	-1.44	-8.74	0.11	3852.44	-266.15	-265.96	3852.25	-27.80
	1	1	13	1.68	0.62	1.67	0.63	-0.11	568.13	-916.33	-444.46	96.26	-691.24
	1	1	14	-2.04	-21.28	-18.71	-4.61	-6.54	1.686e+04	-2241.69	1.671e+04	-2094.80	1668.37
	1	1	19	-1.06	-21.59	-21.59	-1.06	-0.18	2.735e+04	2.051e+04	2.062e+04	2.724e+04	841.17
	1	1	20	-0.15	-24.61	-24.61	-0.15	-5.51e-02	1.342e+04	-604.01	1.341e+04	-601.94	-170.33
	1	1	26	-1.06	-21.59	-21.59	-1.06	0.18	2.735e+04	2.051e+04	2.062e+04	2.724e+04	-841.17
	1	1	27	-0.15	-24.61	-24.61	-0.15	5.51e-02	1.342e+04	-604.01	1.341e+04	-601.94	170.33
	1	1	33	4.67	1.67	4.28	2.05	-1.00	2.911e+04	2.421e+04	2.436e+04	2.895e+04	852.73
	1	1	34	-0.12	-14.16	-14.12	-0.16	-0.80	1.471e+04	-412.91	1.471e+04	-412.84	32.23
	1	1	36	-2.04	-21.28	-18.71	-4.61	6.54	1.686e+04	-2241.69	1.671e+04	-2094.80	-
1668.37													
	1	1	37	5.06	1.17	1.20	5.02	0.38	1366.76	-6784.58	1105.57	-6523.38	1435.58
	1	1	39	-4.01	-23.40	-23.38	-4.03	-0.61	1.447e+04	-980.60	1.426e+04	-777.66	1758.85
	1	1	42	-0.52	-23.70	-23.70	-0.52		73.58	-1.139e+04	-1.139e+04	73.58	
	1	1	43	1.57	-19.52	-19.37	1.43	1.74	1.700e+04	2095.05	1.698e+04	2112.10	503.74
	1	1	46	-4.01	-23.40	-23.38	-4.03	0.61	1.447e+04	-980.60	1.426e+04	-777.66	-
1758.85													
	1	1	48	-3.25	-10.41	-9.99	-3.67	1.68	1.256e+04	-1.140e+04	1.235e+04	-1.119e+04	2235.26
	1	1	50	0.14	-7.00	-6.95	8.87e-02	-0.59	6229.87	-228.65	6174.80	-173.59	593.81
	1	1	51	-0.15	-7.30	-7.24	-0.22	0.68	7373.03	-9435.93	7364.78	-9427.68	372.24
	1	1	52	1.57	-19.52	-19.37	1.43	-1.74	1.700e+04	2095.05	1.698e+04	2112.10	-503.74
	1	1	53	0.20	-22.73	-22.72	0.19	0.49	229.87	-4.903e+04	-4.903e+04	229.44	-145.75
	1	1	54	-0.56	-15.59	-15.58	-0.57	-0.36	-9654.34	-5.334e+04	-5.334e+04	-9654.55	-95.50
	1	1	55	3.15e-02	-19.85	-19.85	3.08e-02	-0.11	724.64	-4.780e+04	-4.780e+04	724.18	-148.63
	1	1	56	0.81	-23.75	-23.75	0.81	-0.26	1.490e+04	3647.92	1.490e+04	3648.33	67.83
	1	1	57	-3.25	-10.41	-9.99	-3.67	-1.68	1.256e+04	-1.140e+04	1.235e+04	-1.119e+04	-
2235.26													
	1	1	58	-2.17	-26.22	-26.22	-2.17	-0.15	-1418.64	-5.143e+04	-5.143e+04	-1420.25	-284.43
	1	1	60	-2.28	-23.10	-23.09	-2.29	-0.37	1.226e+04	-1.216e+04	1.210e+04	-1.200e+04	1973.21
	1	1	61	-1.31	-21.84	-21.84	-1.31		2056.59	-1.226e+04	-1.226e+04	2056.59	
	1	1	62	-0.27	-22.33	-22.33	-0.27		-6890.64	-1.696e+04	-1.696e+04	-6890.64	
	1	1	63	0.17	-19.48	-19.48	0.17		458.50	-1.152e+04	-1.152e+04	458.50	
	1	1	64	0.81	-23.75	-23.75	0.81	0.26	1.490e+04	3647.92	1.490e+04	3648.33	-67.83
	1	1	65	-1.65	-23.29	-23.29	-1.65		-3201.70	-8660.06	-8660.06	-3201.70	
	1	1	67	-2.28	-23.10	-23.09	-2.29	0.37	1.226e+04	-1.216e+04	1.210e+04	-1.200e+04	-
1973.21													
	1	1	68	0.20	-22.73	-22.72	0.19	-0.49	229.87	-4.903e+04	-4.903e+04	229.44	145.75
	1	1	69	-0.56	-15.59	-15.58	-0.57	0.36	-9654.34	-5.334e+04	-5.334e+04	-9654.55	95.50
	1	1	70	3.15e-02	-19.85	-19.85	3.08e-02	0.11	724.64	-4.780e+04	-4.780e+04	724.18	148.63
	1	1	71	-2.17	-26.22	-26.22	-2.17	0.15	-1418.64	-5.143e+04	-5.143e+04	-1420.25	284.43
	1	1	74	10.77	-8.19	2.64	-6.29e-02	9.39	8731.58	-2835.04	4452.23	1444.31	-
5584.33													
	1	1	88	2.70	-9.13	2.57	-9.00	1.24	7348.59	473.52	514.39	7307.72	-528.49
	1	1	89	10.66	-8.26	2.70	-0.29	-9.34	1.002e+04	212.38	4884.78	5349.60	4899.30
	1	1	125	0.94	-26.27	-26.23	0.90	-1.03	-710.13	-4.979e+04	-4.979e+04	-710.16	-32.25
	1	1	126	-3.48e-03	-3.47	-0.19	-3.29	-0.78	2559.15	177.44	181.80	2554.79	101.83
	1	1	127	-0.15	-7.30	-7.24	-0.22	-0.68	7373.03	-9435.93	7364.78	-9427.68	-372.24
	1	1	128	10.77	-8.19	2.64	-6.29e-02	-9.39	8731.58	-2835.04	4452.23	1444.31	5584.33
	1	1	132	2.70	-9.13	2.57	-9.00	-1.24	7348.59	473.52	514.39	7307.72	528.49
	...												
	1	1	146	-1.44	-8.74	-1.44	-8.74	-0.11	3852.44	-266.15	-265.96	3852.25	27.80
	M_G			**N max**	**N min**	**N 1**	**N 2**	**N 1-2**	**M max**	**M min**	**M 1**	**M 2**	**M 1-2**
					-26.27	-26.23	-9.00	-9.39		-5.334e+04	-5.334e+04	-1.200e+04	-
5584.33													
				10.77		4.28	5.02	9.39	2.911e+04		2.436e+04	2.895e+04	5584.33

Macro	Type	Angle 1-X (degrees)
2	**Shell**	**0.0**

	M_G	**Cmb**	**Node**	**N max**	**N min**	**N 1**	**N 2**	**N 1-2**	**M max**	**M min**	**M 1**	**M 2**	**M 1-2**
				daN/cm	daN/cm	daN/cm	daN/cm	daN/cm	daN	daN	daN	daN	daN
	2	1	1	4.14	-4.95	-3.41	2.60	3.41	2.636e+04	2.308e+04	2.468e+04	2.476e+04	-
1638.47													
	2	1	2	0.14	-7.55	-7.54	0.13	0.34	2.358e+04	1.767e+04	2.351e+04	1.775e+04	-681.17
	2	1	3	-1.07	-6.92	-6.91	-1.09	0.27	2.415e+04	1.714e+04	2.407e+04	1.723e+04	-767.71
	2	1	4	-0.38	-6.16	-6.16	-0.39	0.14	2.382e+04	1.851e+04	2.354e+04	1.879e+04	-
1193.96													
	2	1	7	-0.12	-16.09	-16.04	-0.17	-0.89	1.547e+04	-442.04	1.547e+04	-441.86	-52.74
	2	1	9	5.33e-02	-4.59	-0.13	-4.40	0.91	2894.10	-2.39	11.70	2880.00	-201.56
	2	1	10	1.60	0.75	1.60	0.75	3.47e-02	510.85	-871.42	-412.44	51.86	650.98
	2	1	15	-0.68	-21.71	-21.69	-0.69	-0.59	2.447e+04	2.265e+04	2.294e+04	2.418e+04	666.40
	2	1	16	-2.27	-21.43	-21.43	-2.27	-8.54e-02	2.115e+04	1.755e+04	2.112e+04	1.757e+04	287.86
	2	1	17	-3.28	-20.33	-20.32	-3.28	-0.13	2.114e+04	1.692e+04	2.109e+04	1.697e+04	437.98
	2	1	18	-2.41	-18.90	-18.90	-2.41	-0.29	2.079e+04	1.808e+04	2.031e+04	1.856e+04	1030.14
	2	1	21	-0.12	-25.12	-25.12	-0.12	0.17	1.640e+04	-597.95	1.640e+04	-594.42	244.83
	2	1	22	-0.68	-21.71	-21.69	-0.69	0.59	2.447e+04	2.265e+04	2.294e+04	2.418e+04	-666.40
	2	1	23	-2.27	-21.43	-21.43	-2.27	8.54e-02	2.115e+04	1.755e+04	2.112e+04	1.757e+04	-287.86
	2	1	24	-3.28	-20.33	-20.32	-3.28	0.13	2.114e+04	1.692e+04	2.109e+04	1.697e+04	-437.98
	2	1	25	-2.41	-18.90	-18.90	-2.41	0.29	2.079e+04	1.808e+04	2.031e+04	1.856e+04	-
1030.14													

	2	1	28	-0.12	-25.12	-25.12	-0.12	-0.17	1.640e+04	-597.95	1.640e+04	-594.42	-244.83
	2	1	29	4.14	-4.95	-3.41	2.60	-3.41	2.636e+04	2.308e+04	2.468e+04	2.476e+04	1638.47
	2	1	30	0.14	-7.55	-7.54	0.13	-0.34	2.358e+04	1.767e+04	2.351e+04	1.775e+04	681.17
	2	1	31	-1.07	-6.92	-6.91	-1.09	-0.27	2.415e+04	1.714e+04	2.407e+04	1.723e+04	767.71
	2	1	32	-0.38	-6.16	-6.16	-0.39	-0.14	2.382e+04	1.851e+04	2.354e+04	1.879e+04	1193.96
	2	1	35	-0.12	-16.09	-16.04	-0.17	0.89	1.547e+04	-442.04	1.547e+04	-441.86	52.74
	2	1	37	4.14	0.62	0.85	3.90	-0.88	-381.63	-4004.46	-383.58	-4002.52	83.86
	2	1	38	-1.02	-9.58	-1.03	-9.57	0.17	2589.05	51.85	65.71	2575.19	-187.01
	2	1	40	3.41	1.10	1.10	3.41	-5.65e-02	114.77	-5473.02	111.35	-5469.60	-138.22
	2	1	41	-1.14	-10.20	-1.14	-10.20	1.34e-02	1263.45	-99.49	-88.15	1252.11	-123.80
	2	1	44	4.46	1.15	1.15	4.46	3.99e-02	105.73	-5961.34	103.28	-5958.88	-121.99
	2	1	45	-1.17	-8.95	-1.17	-8.95	-0.11	1850.41	-58.92	-51.77	1843.26	-116.58
	2	1	47	5.69	1.24	1.25	5.69	9.37e-02	184.33	-3492.67	182.23	-3490.56	-88.01
	2	1	48	-1.25	-18.74	-14.92	-5.06	-7.22	4952.61	-1.720e+04	4467.85	-1.671e+04	3240.77
	2	1	49	-1.25	-9.38	-1.28	-9.34	-0.54	5386.10	-32.65	-25.24	5378.69	200.22
	2	1	51	6.40	-8.45	-5.82	3.77	-5.67	5528.95	-7704.19	4763.30	-6938.54	3089.62
	2	1	57	-1.25	-18.74	-14.92	-5.06	7.22	4952.61	-1.720e+04	4467.85	-1.671e+04	-
3240.77													
	2	1	58	-1.15	-23.22	-23.15	-1.22	-1.24	2900.69	-2.339e+04	-2.339e+04	2900.45	-78.59
	2	1	59	-2.29	-17.02	-17.02	-2.29	-0.15	-1.111e+04	-3.690e+04	-3.690e+04	-1.112e+04	-117.49
	2	1	60	-2.35	-19.01	-18.90	-2.46	-1.34	4904.37	-1.654e+04	4790.14	-1.642e+04	1560.88
	2	1	65	-1.94	-17.04	-17.04	-1.94		1556.12	-3885.61	-3885.61	1556.12	
	2	1	66	-2.98	-18.62	-18.62	-2.98		-5070.51	-1.610e+04	-1.610e+04	-5070.51	
	2	1	67	-2.35	-19.01	-18.90	-2.46	1.34	4904.37	-1.654e+04	4790.14	-1.642e+04	-
1560.88													
	2	1	71	-1.15	-23.22	-23.15	-1.22	1.24	2900.69	-2.339e+04	-2.339e+04	2900.45	78.59
	2	1	72	-2.29	-17.02	-17.02	-2.29	0.15	-1.111e+04	-3.690e+04	-3.690e+04	-1.112e+04	117.49
	2	1	73	-6.65	-14.30	-14.23	-6.72	-0.72	8490.76	-1.790e+04	8445.96	-1.786e+04	1086.43
	2	1	75	0.14	-8.16	-8.10	8.73e-02	0.68	6245.43	-225.84	6175.15	-155.56	-670.71
	2	1	76	11.07	-9.59	1.31	0.17	10.31	1.028e+04	-6.44	5270.47	5001.60	-
5140.72													
	2	1	77	-6.65	-14.30	-14.23	-6.72	0.72	8490.76	-1.790e+04	8445.96	-1.786e+04	-
1086.43													
	2	1	78	-2.84	-26.00	-26.00	-2.84	-0.11	-2146.97	-3.159e+04	-3.158e+04	-2147.26	-92.23
	2	1	79	-3.05	-18.71	-18.71	-3.05	-4.15e-02	-1.229e+04	-3.963e+04	-3.963e+04	-1.229e+04	-71.08
	2	1	80	-4.34	-20.13	-20.12	-4.35	-0.38	9308.17	-1.791e+04	9285.14	-1.788e+04	791.31
	...												
	2	1	154	5.69	1.24	1.25	5.69	-9.37e-02	184.33	-3492.67	182.23	-3490.56	88.01
	M_G			**N max**	**N min**	**N 1**	**N 2**	**N 1-2**	**M max**	**M min**	**M 1**	**M 2**	**M 1-2**
					-28.96	-28.96	-10.20	-10.31		-4.181e+04	-4.181e+04	-1.827e+04	-
5140.72													
				11.07		8.21	5.69	10.31	2.636e+04		2.468e+04	2.476e+04	5140.72

Macro	Type	Angle 1-X (degrees)
3	**Shell**	**0.0**

	M_G	**Cmb**	**Node**	**N max**	**N min**	**N 1**	**N 2**	**N 1-2**	**M max**	**M min**	**M 1**	**M 2**	**M 1-2**
				daN/cm	daN/cm	daN/cm	daN/cm	daN/cm	daN	daN	daN	daN	daN
	3	1	158	1.58	-10.60	-10.60	1.58	-0.14	2.067e+04	1.295e+04	2.048e+04	1.315e+04	-
1215.51													
	3	1	159	5.79	0.23	1.51	4.51	2.34	2.662e+04	2.199e+04	2.200e+04	2.662e+04	-155.39
	3	1	160	0.15	-13.71	-13.61	6.19e-02	1.13	1.139e+04	-286.45	1.139e+04	-284.00	-169.13
	3	1	162	0.28	-6.36	8.95e-02	-6.16	-1.11	3676.91	28.95	63.45	3642.42	353.06
	3	1	165	1.17	-2.40	0.32	-1.56	1.52	589.57	-475.50	27.33	86.74	-531.70
	3	1	166	-1.97	-14.55	-1.97	-14.54	0.12	6410.51	-153.14	-152.83	6410.20	45.48
	3	1	167	1.69	1.11	1.44	1.37	-0.29	447.23	-947.13	-371.44	-128.46	-686.51
	3	1	174	-0.27	-6.14	-6.07	-0.33	-0.60	5397.95	-202.41	5344.00	-148.46	547.01
	3	1	175	4.65	-7.51	-7.47	4.61	-0.73	4427.94	-1.016e+04	4416.55	-1.015e+04	407.54
	3	1	176	0.65	-20.31	-20.24	0.58	-1.22	1.406e+04	1221.05	1.404e+04	1242.83	-528.42
	3	1	177	5.89	-11.78	5.66	-11.55	1.98	9206.38	-567.13	-566.80	9206.06	-56.16
	3	1	178	13.50	-10.64	1.12	1.75	-12.07	1.029e+04	-868.31	4329.50	5090.41	5565.28
	3	1	180	17.08	-12.17	1.69	3.23	14.60	7975.07	-4179.11	3344.48	451.48	-
5902.43													
	3	1	181	-1.66	-14.41	-13.01	-3.06	3.98	4376.47	-1.379e+04	4274.82	-1.369e+04	-
1355.28													
	3	1	184	2.80	-23.64	-15.25	-5.59	-12.31	7698.67	-1.833e+04	7687.77	-1.832e+04	532.36
	3	1	185	9.35	-4.75	9.34	-4.74	-0.29	4465.23	-436.21	-288.58	4317.60	-837.74
	3	1	187	5.49	-11.99	-10.92	4.43	4.18	8004.17	-1.221e+04	7843.86	-1.205e+04	-
1792.82													
	3	1	190	5.69e-02	-22.69	-20.00	-2.63	7.34	1.276e+04	-3696.29	1.276e+04	-3695.16	136.12
	3	1	191	13.44	1.16	1.16	13.44	-1.38e-02	201.91	-8928.28	201.91	-8928.27	5.55
	3	1	192	-1.18	-8.89	-1.18	-8.89	9.71e-02	1573.54	-267.90	-253.53	1559.16	-162.08
	3	1	194	12.51	1.23	1.27	12.47	0.66	1086.17	-1.131e+04	1009.91	-1.123e+04	969.10
	3	1	200	-2.06	-40.75	-40.72	-2.09	-1.14	1.478e+04	6174.19	6498.49	1.446e+04	-
1639.12													
	3	1	201	-0.14	-35.08	-34.96	-0.26	2.01	2.645e+04	8271.53	8297.25	2.643e+04	-683.45
	3	1	202	-3.01e-02	-35.52	-35.51	-4.37e-02	0.69	704.19	-543.07	697.53	-536.40	-90.95
	3	1	205	-2.37	-28.34	-28.29	-2.42	1.18	-7331.04	-2.968e+04	-2.952e+04	-7483.35	1838.52
	3	1	206	16.79	2.15	2.50	16.44	2.22	3601.92	-9280.06	3586.49	-9264.63	-445.66
	3	1	208	0.61	-36.73	-36.22	0.10	-4.31	2961.11	2050.68	2052.17	2959.62	36.78
	3	1	210	19.87	-1.39	2.01	16.47	-7.79	6495.67	-1.132e+04	6477.99	-1.131e+04	-561.00
	3	1	212	-1.63	-27.73	-27.64	-1.71	1.50	-2870.75	-2.076e+04	-2.072e+04	-2914.80	886.70
	3	1	213	-1.71	-38.40	-38.28	-1.83	2.09	-5878.08	-1.489e+04	-6107.85	-1.466e+04	-
1420.14													

	3	1	215	0.22	-27.97	-27.77	1.76e-02	-2.38	-802.91	-2.533e+04	-2.531e+04	-828.70	794.86
	3	1	216	-1.75	-44.45	-42.91	-3.30	-7.97	-1628.00	-1.935e+04	-1642.18	-1.934e+04	-501.17
	3	1	218	-0.60	-24.27	-24.26	-0.62	-0.61	-6895.16	-3.064e+04	-3.063e+04	-6903.27	438.75
	3	1	219	17.15	-4.58	12.76	-0.19	-8.72	4613.36	-1844.71	529.15	2239.50	3113.74
	3	1	222	-1.15	-39.16	-37.30	-3.01	8.19	963.05	-2783.98	356.57	-2177.49	-
1380.11													
	3	1	228	-0.83	-61.00	-60.99	-0.84	-0.87	2.029e+04	-306.67	239.08	1.975e+04	-
3308.05													
	3	1	229	3.02	-47.55	-47.54	3.02	-0.36	3.832e+04	7235.39	7242.71	3.831e+04	-476.91
	3	1	230	-0.25	-54.56	-54.54	-0.28	1.15	-619.18	-1.758e+04	-1.756e+04	-639.17	-582.07
	3	1	236	-0.64	-56.97	-56.83	-0.78	2.83	460.80	-1.509e+04	-1.476e+04	125.25	-
2259.58													
	3	1	238	0.11	-24.70	-24.65	5.75e-02	-1.12	1644.69	-2.351e+04	-2.351e+04	1644.49	-70.35
	3	1	240	0.10	-22.98	-22.95	8.01e-02	-0.72	576.12	-2.250e+04	-2.250e+04	575.50	-119.96
	3	1	241	-2.73	-58.41	-58.30	-2.84	2.48	-1.559e+04	-2.881e+04	-2.844e+04	-1.597e+04	-
2198.70													
	3	1	244	0.85	-65.99	-64.66	-0.48	-9.33	-2.194e+04	-2.638e+04	-2.583e+04	-2.249e+04	-
1463.55													
	3	1	245	-2.62	-30.73	-30.68	-2.67	1.15	-2579.82	-2.230e+04	-2.209e+04	-2794.00	-
2044.07													
	3	1	246	-2.49	-27.12	-27.07	-2.54	-1.06	-7374.07	-2.669e+04	-2.658e+04	-7482.62	-
1444.01													
	3	1	250	-4.86	-57.98	-57.94	-4.90	1.44	-5392.64	-1.704e+04	-1.696e+04	-5474.82	974.92
	3	1	251	-1.49	-26.45	-26.37	-1.58	-1.45	-2923.75	-1.778e+04	-1.775e+04	-2954.51	-675.32
	3	1	256	-0.91	-61.82	-61.81	-0.93	0.94	2.018e+04	-1927.20	-1499.21	1.975e+04	3046.10
	...												
	3	1	615	2.05	-58.44	-58.44	2.05	-0.54	1647.72	-5.349e+04	-5.349e+04	1646.76	-229.92
	M_G			**N max**	**N min**	**N 1**	**N 2**	**N 1-2**	**M max**	**M min**	**M 1**	**M 2**	**M 1-2**
					-74.94	-74.94	-20.51	-12.31		-7.568e+04	-7.568e+04	-2.249e+04	-
6988.70													
				19.87		12.76	16.47	14.60	3.832e+04		2.200e+04	3.831e+04	6885.55

Macro	Type	Angle 1-X (degrees)
4	**Shell**	**0.0**

	M_G	**Cmb**	**Node**	**N max**	**N min**	**N 1**	**N 2**	**N 1-2**	**M max**	**M min**	**M 1**	**M 2**	**M 1-2**
				daN/cm	daN/cm	daN/cm	daN/cm	daN/cm	daN	daN	daN	daN	daN
	4	1	155	4.76	-8.59	-6.88	3.05	4.46	2.225e+04	1.895e+04	2.038e+04	2.083e+04	-
1630.84													
	4	1	156	0.22	-9.85	-9.84	0.21	0.13	2.010e+04	1.505e+04	1.997e+04	1.518e+04	-800.18
	4	1	157	-3.91e-02	-8.81	-8.67	-0.18	-1.09	2.063e+04	1.395e+04	2.049e+04	1.410e+04	-961.01
	4	1	161	-2.20e-02	-15.08	-15.01	-9.25e-02	-1.03	1.081e+04	-224.33	1.081e+04	-222.91	124.93
	4	1	163	0.44	-7.13	0.23	-6.91	1.27	3461.74	-101.62	-63.50	3423.62	-366.58
	4	1	164	1.41	1.30	1.32	1.39	3.86e-02	406.78	-796.07	-285.44	-103.84	594.53
	4	1	168	7.88	1.25	1.25	7.87	0.11	117.18	-6832.23	114.70	-6829.74	-131.28
	4	1	169	-1.30	-14.40	-1.30	-14.39	-0.13	4209.97	-72.94	-71.62	4208.64	-75.22
	4	1	170	9.60	-7.61	9.60	-7.61	0.11	7083.52	48.44	98.95	7033.01	-593.96
	4	1	171	9.64	1.36	1.36	9.64	8.13e-02	146.71	-4460.30	146.18	-4459.77	-49.58
	4	1	172	10.90	-11.52	9.58	-10.20	-5.28	1.001e+04	-292.83	-166.26	9883.71	1134.92
	4	1	173	-1.52	-14.80	-1.56	-14.77	-0.68	6850.57	23.63	26.80	6847.41	147.05
	4	1	179	-5.85	-13.23	-12.93	-6.14	-1.44	4415.18	-1.522e+04	4396.16	-1.520e+04	-610.72
	4	1	182	-0.13	-6.77	-6.69	-0.20	0.70	4792.50	-160.69	4740.96	-109.15	-502.61
	4	1	183	12.39	-12.13	-1.25	1.51	12.18	9173.50	-676.97	4303.73	4192.80	-
4924.93													
	4	1	184	-1.85	-15.36	-11.83	-5.38	5.93	880.91	-1.893e+04	412.54	-1.846e+04	-
3010.15													
	4	1	186	9.30	-7.78	9.27	-7.76	-0.60	5526.30	111.25	168.63	5468.92	-554.48
	4	1	187	7.66	-11.94	-8.17	3.90	-7.72	3635.40	-1.260e+04	3140.92	-1.211e+04	2790.19
	4	1	188	-4.46	-15.20	-15.01	-4.64	-1.39	4517.18	-1.269e+04	4500.52	-1.267e+04	-535.12
	4	1	189	2.38	-9.23	-9.22	2.37	0.37	5314.31	-9078.24	5275.80	-9039.72	-743.54
	4	1	193	4.84	-9.14	-9.14	4.84	0.15	5115.25	-6730.42	5087.56	-6702.73	-572.06
	4	1	194	11.45	1.21	1.32	11.34	-1.05	-711.04	-9802.11	-725.99	-9787.17	368.28
	4	1	195	-1.32	-15.08	-1.32	-15.08	-2.63e-02	2817.61	102.95	119.44	2801.13	-210.90
	4	1	196	1.35	-19.54	-19.31	1.12	2.19	1.338e+04	1096.47	1.336e+04	1112.13	438.36
	4	1	197	-0.27	-35.52	-35.50	-0.28	0.72	2.211e+04	1.727e+04	1.753e+04	2.185e+04	-
1090.05													
	4	1	198	-1.35	-33.42	-33.35	-1.43	-1.56	1.673e+04	1.536e+04	1.615e+04	1.594e+04	-675.18
	4	1	199	-2.20	-30.31	-30.11	-2.40	-2.35	1.611e+04	1.468e+04	1.584e+04	1.495e+04	-550.26
	4	1	203	-2.49e-02	-38.22	-38.21	-3.81e-02	-0.71	1.026e+04	-456.58	1.026e+04	-456.57	-3.67
	4	1	204	12.08	3.38	3.46	12.00	-0.83	4050.42	-6318.45	4028.78	-6296.81	473.21
	4	1	207	-1.62	-24.54	-24.46	-1.71	1.40	-5076.76	-2.113e+04	-2.110e+04	-5106.75	693.21
	4	1	209	-2.16	-25.17	-24.91	-2.41	2.42	-1808.74	-1.269e+04	-1.264e+04	-1862.01	759.62
	4	1	210	19.77	0.29	4.75	15.31	8.18	2294.11	-1.018e+04	2085.90	-9971.41	-
1598.07													
	4	1	211	-2.81	-31.69	-31.57	-2.93	-1.88	3470.28	-1.677e+04	3448.38	-1.675e+04	-665.38
	4	1	214	-1.19	-26.87	-26.77	-1.29	1.66	641.99	-1.247e+04	-1.245e+04	621.01	524.07
	4	1	216	-3.36	-28.18	-28.12	-3.42	1.28	-1457.12	-1.955e+04	-1573.42	-1.943e+04	-
1445.85													
	4	1	217	14.51	5.12	5.14	14.48	-0.49	3903.13	-3959.87	3892.90	-3949.64	283.36
	4	1	220	-1.05	-34.78	-34.72	-1.12	-1.50	4121.73	-1.420e+04	4096.59	-1.417e+04	-678.14
	4	1	221	5.04e-02	-27.06	-27.04	2.67e-02	-0.80	469.07	-1.639e+04	-1.639e+04	468.99	36.05
	4	1	223	11.54	-11.32	7.59	-7.37	-8.63	6903.66	-322.44	1018.47	5562.75	2809.18
	4	1	224	0.64	-37.69	-37.17	0.12	4.43	1.213e+04	2373.54	1.206e+04	2437.08	-784.71

	4	1	225	3.36	-52.30	-51.83	2.89	5.09	3.068e+04	2.564e+04	2.721e+04	2.911e+04	-2338.55
	4	1	226	0.26	-50.36	-50.36	0.25	-0.50	2.439e+04	1.910e+04	2.409e+04	1.940e+04	-1227.80
	4	1	227	-0.71	-45.14	-45.09	-0.76	-1.46	2.491e+04	1.858e+04	2.437e+04	1.912e+04	-1770.76
	4	1	231	-2.19e-02	-56.13	-56.10	-5.00e-02	-1.26	5002.06	-574.55	4972.49	-544.98	404.98
	4	1	232	-2.46	-20.84	-20.54	-2.76	-2.32	-6934.73	-2.024e+04	-2.021e+04	-6959.75	-576.37
	4	1	233	-1.14	-38.43	-38.32	-1.25	-2.08	-6672.13	-2.177e+04	-2.170e+04	-6749.44	-1077.77
	4	1	234	-1.98	-52.56	-52.56	-1.98	-4.98e-02	-7361.71	-2.984e+04	-2.984e+04	-7361.95	-72.54
	4	1	235	-1.06	-39.70	-39.58	-1.18	2.14	-6730.13	-2.256e+04	-2.250e+04	-6791.79	986.05
	...												
	4	1	616	-7.73e-02	-60.95	-60.95	-7.94e-02	-0.36	194.93	-1.769e+04	-1.769e+04	190.91	-267.91
	M_G			**N max**	**N min**	**N 1**	**N 2**	**N 1-2**	**M max**	**M min**	**M 1**	**M 2**	**M 1-2**
					-67.15	-66.92	-21.32	-8.63		-3.564e+04	-3.564e+04	-2.274e+04	-6939.51
				19.77		9.60	15.31	12.18	3.068e+04		2.721e+04	2.911e+04	6722.38

Macro	Type	Angle 1-X (degrees)
5	**Shell**	**0.0**

	M_G	**Cmb**	**Node**	**N max**	**N min**	**N 1**	**N 2**	**N 1-2**	**M max**	**M min**	**M 1**	**M 2**	**M 1-2**
				daN/cm	daN/cm	daN/cm	daN/cm	daN/cm	daN	daN	daN	daN	daN
	5	1	353	1.29e-03	-0.92	-3.79e-02	-0.88	0.19	89.75	-2425.30	67.82	-2403.37	-233.83
	5	1	354	1.32	0.71	1.20	0.82	-0.23	-803.55	-1866.86	-805.99	-1864.42	-50.91
	5	1	355	-4.90e-02	-0.66	-0.65	-5.63e-02	-6.61e-02	877.72	-1404.04	-1128.49	602.17	743.51
	5	1	356	-0.78	-2.44	-0.79	-2.42	0.17	62.80	-3700.46	53.82	-3691.48	-183.66
	5	1	357	0.59	-4.09	0.59	-4.09	1.08e-02	-68.79	-5075.17	-389.57	-4754.38	-1225.99
	5	1	358	-0.87	-5.61	-0.87	-5.61	-6.49e-02	1141.38	-3671.35	-1048.74	-1481.24	-2396.63
	5	1	359	0.99	-5.02	0.97	-5.00	0.40	8393.79	-3384.44	1449.64	3559.71	-5793.84
	5	1	364	0.35	-0.16	5.93e-02	0.13	-0.26	764.18	-603.53	101.84	58.81	683.52
	5	1	365	1.75	-0.46	1.52	-0.23	0.67	3.893e+04	-677.56	3.893e+04	-676.89	-163.66
	5	1	368	18.93	-17.04	7.87	-5.98	-16.60	7.937e+04	1.211e+04	7.930e+04	1.218e+04	-2171.65
	5	1	369	5.88	-3.85	5.65	-3.61	1.50	5.699e+04	1.666e+04	5.661e+04	1.703e+04	-3853.87
	5	1	370	5.00	-2.07	4.74	-1.81	1.34	5.959e+04	3.583e+04	5.957e+04	3.585e+04	-663.96
	5	1	371	3.01	-3.69	1.08	-1.76	3.03	-5321.83	-1.241e+04	-1.155e+04	-6188.16	-2322.13
	5	1	373	6.55	-5.47	6.06	-4.99	2.37	4.058e+04	-5308.38	4.056e+04	-5285.77	-1018.29
	5	1	374	3.12	1.25	2.97	1.40	0.50	4.232e+04	423.44	4.232e+04	427.50	-412.69
	5	1	375	6.04	-4.15	5.13	-3.24	2.90	3.014e+04	-1.673e+04	3.004e+04	-1.663e+04	-2155.74
	5	1	376	7.10	-4.75	6.88	-4.53	1.59	3.362e+04	-2.648e+04	3.277e+04	-2.562e+04	-7120.43
	5	1	381	8.11	-0.18	8.11	-0.17	0.24	3.400e+04	-454.85	3.400e+04	-454.84	9.93
	5	1	382	11.55	-3.13	11.20	-2.78	2.24	2.726e+04	-1.643e+04	2.720e+04	-1.636e+04	1678.51
	5	1	383	11.91	-4.27	11.69	-4.05	1.87	3.565e+04	-5776.75	3.561e+04	-5731.74	1364.88
	5	1	387	10.31	-1.67	10.16	-1.52	1.34	5.114e+04	2.963e+04	5.106e+04	2.971e+04	1262.42
	5	1	388	9.32	1.10	9.30	1.13	0.43	3.665e+04	286.17	3.662e+04	313.73	1000.57
	5	1	389	12.76	-3.82	12.45	-3.51	2.25	5.006e+04	1.085e+04	4.992e+04	1.099e+04	2343.48
	5	1	390	15.83	-11.35	15.81	-11.33	-0.71	6.903e+04	5423.28	6.880e+04	5655.65	3837.48
	5	1	391	15.13	-5.02	14.86	-4.75	2.34	3.071e+04	-2.716e+04	3.060e+04	-2.705e+04	2603.58
	5	1	395	2.20	-0.28	2.17	-0.25	-0.25	1.039e+04	-393.03	1.039e+04	-392.85	-43.35
	5	1	398	20.81	-7.68	7.19	5.94	14.23	2.951e+04	1.098e+04	2.642e+04	1.406e+04	6901.63
	5	1	399	6.53	-3.06	5.97	-2.50	2.25	2.376e+04	1.163e+04	2.138e+04	1.401e+04	4816.75
	5	1	400	5.33	-1.22	5.30	-1.19	0.44	2.874e+04	2.514e+04	2.776e+04	2.612e+04	1604.96
	5	1	403	6.33	-4.07	6.32	-4.05	0.33	1.176e+04	-4077.36	1.150e+04	-3818.87	2006.89
	5	1	404	3.33	0.99	3.27	1.04	-0.36	1.316e+04	15.38	1.305e+04	125.61	1198.58
	5	1	405	5.60	-2.70	5.57	-2.66	0.52	3835.60	-1.167e+04	3182.17	-1.102e+04	3115.35
	5	1	406	6.86	-3.70	6.15	-2.99	2.65	-95.77	-1.766e+04	-3743.36	-1.401e+04	7124.76
	5	1	408	2.27	2.02e-02	2.26	3.02e-02	-0.15	1.907e+04	49.39	1.907e+04	57.08	-382.41
	5	1	409	3.19	-4.93	2.92	-4.65	1.47	1.983e+04	-7856.96	1.952e+04	-7549.01	-2903.74
	5	1	410	3.14	-8.87	-3.28	-2.44	5.99	1.831e+04	821.10	1.784e+04	1288.88	2821.57
	5	1	414	2.29	-9.04e-02	0.12	2.07	0.68	1.150e+04	3425.43	1.148e+04	3446.32	-410.26
	5	1	415	0.65	-3.55	-2.50	-0.40	-1.82	1.937e+04	3693.46	1.841e+04	4654.12	-3759.91
	5	1	416	-0.97	-3.31	-2.44	-1.85	1.13	1.549e+04	-626.67	1.377e+04	1098.01	-4982.28
	5	1	417	-2.02	-4.01	-3.02	-3.01	-1.00	3.064e+04	-9779.30	1.860e+04	2258.50	-1.848e+04
	5	1	418	3.71	-8.58	3.68	-8.54	0.62	2.766e+04	-1.171e+04	2.459e+04	-8632.55	-1.056e+04
	5	1	422	11.54	1.96e-02	11.54	2.07e-02	0.11	6516.90	645.86	6510.92	651.84	-187.31
	5	1	425	18.70	-6.44	17.74	-5.49	4.80	1.105e+04	-9260.18	8144.62	-6350.25	7116.65
	5	1	426	13.85	-3.91	13.17	-3.23	3.40	1.062e+04	-7215.07	8727.79	-5324.73	5489.75
	5	1	427	10.78	-1.13	10.57	-0.92	1.57	7920.76	-270.09	6922.57	728.10	2679.48
	5	1	430	10.99	-1.59	10.65	-1.25	2.05	8969.70	-3856.17	7681.25	-2567.71	3855.57

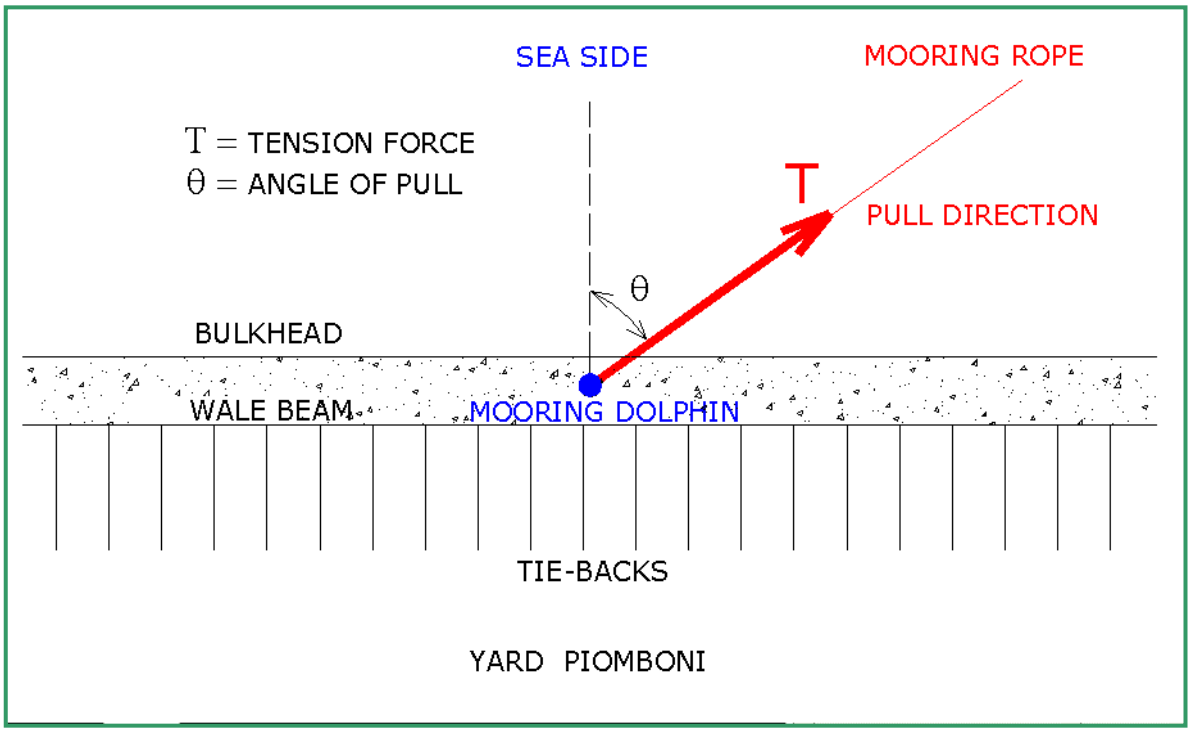
	5	1	431	10.65	-0.13	10.60	-8.29e-02	0.74	6963.35	593.97	6740.02	817.31	1171.58
	5	1	432	11.87	-2.48	11.30	-1.91	2.81	9929.03	-7193.37	9127.08	-6391.43	3617.75
	...												
	5	1	655	8.64	-1.14	8.62	-1.13	0.40	3.405e+04	-1.520e+04	3.386e+04	-1.502e+04	-3009.60
	M_G			**N max**	**N min**	**N 1**	**N 2**	**N 1-2**	**M max**	**M min**	**M 1**	**M 2**	**M 1-2**
					-17.04	-3.28	-11.33	-16.60		-2.943e+04	-2.908e+04	-2.705e+04	-1.848e+04
				20.81		18.80	5.94	14.23	7.937e+04		7.930e+04	3.585e+04	1.127e+04

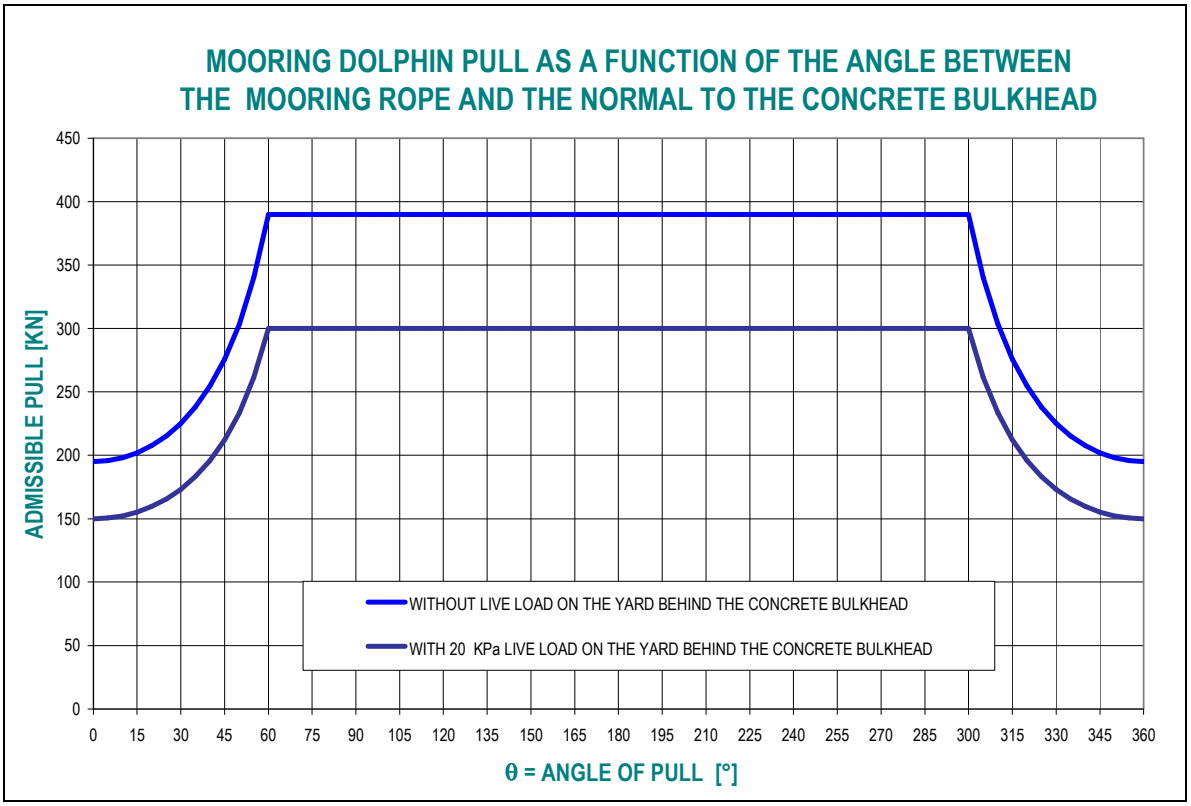
Macro	Type	Angle 1-X (degrees)
6	**Shell**	**0.0**

	M_G	**Cmb**	**Node**	**N max**	**N min**	**N 1**	**N 2**	**N 1-2**	**M max**	**M min**	**M 1**	**M 2**	**M 1-2**
				daN/cm	daN/cm	daN/cm	daN/cm	daN/cm	daN	daN	daN	daN	daN
	6	1	351	0.48	0.15	0.22	0.42	0.13	917.71	-569.92	446.62	-98.82	-692.01
	6	1	352	-7.30e-02	-0.90	-0.89	-7.78e-02	6.24e-02	864.25	-662.44	-338.40	540.21	-624.27
	6	1	359	0.36	-5.28	0.34	-5.25	-0.36	5039.93	-3143.03	-325.60	2222.50	-3888.06
	6	1	360	-0.71	-4.12	-0.72	-4.10	-0.21	2188.23	-6359.88	989.86	-5161.51	-2967.79
	6	1	361	0.86	-2.32	0.85	-2.31	0.12	801.19	-5832.47	108.26	-5139.54	-2028.93
	6	1	362	-0.98	-1.92	-1.00	-1.91	-0.12	959.04	-3142.49	578.01	-2761.46	-1190.64
	6	1	363	1.09	0.75	1.04	0.80	0.12	830.90	-2028.33	-144.51	-1052.91	-1355.54
	6	1	366	10.61	-3.00	8.95	-1.34	4.46	4.488e+04	2.618e+04	4.453e+04	2.653e+04	-2528.14
	6	1	367	7.27	-4.34	7.24	-4.31	0.59	4.138e+04	1.905e+04	4.078e+04	1.964e+04	-3598.95
	6	1	368	13.43	-13.12	4.56	-4.25	12.52	2.206e+04	9113.72	1.910e+04	1.207e+04	-5435.22
	6	1	372	4.27	-0.52	4.09	-0.34	-0.91	2.711e+04	-514.31	2.711e+04	-514.30	-21.56
	6	1	377	6.52	-5.26	6.39	-5.13	1.22	1.389e+04	-1.920e+04	1.338e+04	-1.869e+04	-4069.31
	6	1	378	8.12	-3.30	8.08	-3.26	0.65	1.751e+04	-1.614e+04	1.733e+04	-1.595e+04	-2471.33
	6	1	379	6.14	1.97	6.06	2.05	0.57	3.065e+04	278.75	3.062e+04	306.86	-923.67
	6	1	380	1.14	-2.86	-2.52e-02	-1.70	1.82	-3825.19	-9092.30	-5759.89	-7157.61	-2539.14
	6	1	384	12.58	-0.39	12.58	-0.39	0.11	2.432e+04	-362.97	2.432e+04	-361.80	169.84
	6	1	385	14.78	2.52	14.78	2.52	0.14	2.724e+04	709.84	2.720e+04	753.92	1080.57
	6	1	386	18.01	-1.97	18.01	-1.97	8.69e-02	3.787e+04	2.277e+04	3.782e+04	2.283e+04	904.61
	6	1	390	10.93	-3.16	9.23	-1.46	4.58	1.602e+04	4721.03	1.602e+04	4721.04	8.55
	6	1	392	15.33	-5.47	15.14	-5.28	1.96	3.315e+04	1.793e+04	3.313e+04	1.796e+04	625.47
	6	1	393	13.36	-6.34	12.97	-5.95	2.75	1.082e+04	-1.758e+04	1.081e+04	-1.758e+04	-467.46
	6	1	394	16.37	-3.73	16.26	-3.63	1.45	1.565e+04	-1.125e+04	1.560e+04	-1.120e+04	1167.97
	6	1	396	4.96	-1.49	3.34	0.12	-2.80	1.989e+04	1.208e+04	1.296e+04	1.901e+04	2468.25
	6	1	397	4.51	-3.37	2.91	-1.76	3.17	1.542e+04	9994.52	1.437e+04	1.104e+04	2136.95
	6	1	398	4.96	-9.20	3.96	-8.20	-3.63	1.606e+04	5991.23	7534.35	1.452e+04	3627.47
	6	1	401	0.48	-1.57	-0.97	-0.11	0.93	-5476.71	-7736.20	-7483.47	-5729.44	-712.16
	6	1	402	5.01	-0.10	4.90	1.14e-02	0.76	-253.52	-3104.97	-3062.07	-296.42	347.11
	6	1	407	4.33	-3.85	3.11	-2.64	2.91	-3633.62	-1.450e+04	-3895.71	-1.424e+04	1667.35
	6	1	411	4.02	1.13e-02	4.01	2.14e-02	0.20	1.373e+04	31.84	1.373e+04	37.19	270.90
	6	1	412	1.82	-4.57	-2.17	-0.57	3.09	1.331e+04	3584.57	1.291e+04	3985.00	1932.58
	6	1	413	3.76	-4.62	-3.36	2.49	-3.00	9318.23	3108.52	7250.50	5176.26	-2926.52
	6	1	417	-2.23	-3.11	-2.29	-3.04	0.24	1.037e+04	-4501.23	3810.70	2062.98	-7386.56
	6	1	419	-1.04	-3.77	-3.76	-1.05	-0.17	9358.72	-1102.00	5764.39	2492.33	-4967.90
	6	1	420	3.37	-8.50	3.10	-8.24	-1.75	1.232e+04	-1.041e+04	9995.00	-8088.89	-6881.68
	6	1	421	4.54	-7.26	3.99	-6.70	-2.50	1.466e+04	-5897.41	1.424e+04	-5469.27	-2936.00
	6	1	423	39.92	-8.64	39.92	-8.64	-8.01e-02	2.092e+04	1.318e+04	1.762e+04	1.648e+04	3830.87
	6	1	424	25.99	-6.28	25.96	-6.25	0.94	2.010e+04	8941.53	1.591e+04	1.313e+04	5402.66
	6	1	425	10.58	-6.60	9.54	-5.56	4.10	2730.37	-9075.79	564.37	-6909.79	4569.53
	6	1	428	3.50	-1.98	2.64	-1.13	1.99	-7592.93	-1.561e+04	-8368.32	-1.484e+04	2369.71
	6	1	429	9.36	0.21	9.33	0.25	-0.57	1.652e+04	2.67	1.646e+04	62.18	989.60
	6	1	434	9.47	-7.07	8.24	-5.84	4.34	6090.23	-1.248e+04	4421.23	-1.081e+04	5311.28
	6	1	435	7.17	-2.38	4.60	0.18	4.23	1.344e+04	-9910.23	1.279e+04	-9268.06	3818.34
	6	1	436	14.10	2.08	10.93	5.25	-5.30	2.081e+04	2.07	1.841e+04	2401.10	6645.93
	6	1	437	4.00	-0.72	3.66	-0.38	1.22	1419.71	-2457.01	-631.19	-406.11	1935.09
	6	1	438	0.49	-2.08	-1.62	2.25e-02	0.99	3308.94	-1.014e+04	-9623.42	2792.63	2584.00
	6	1	442	3.47e-02	-0.69	-0.46	-0.20	-0.34	530.24	-1.878e+04	-1.878e+04	530.24	-6.05
	6	1	443	1.03	-2.64	-2.32	0.70	-1.04	837.43	-1.921e+04	-1.920e+04	833.46	-281.96
	6	1	444	1.66	-4.17	-3.94	1.43	1.15	834.69	-1.927e+04	-1.918e+04	750.15	1300.90
	...												
	6	1	658	11.86	0.22	11.63	0.45	1.61	1.454e+04	-4435.71	1.438e+04	-4276.69	-1729.61

	M_G	N max	N min	N 1	N 2	N 1-2	M max	M min	M 1	M 2	M 1-2
			-13.12	-7.75	-8.64	-5.30		-1.927e+04	-1.920e+04	-1.869e+04	-
7386.56											
		39.92		39.92	5.25	12.52	4.488e+04		4.453e+04	2.653e+04	7778.64

RMI YPB BOLLARD FROM No 1 to No 12





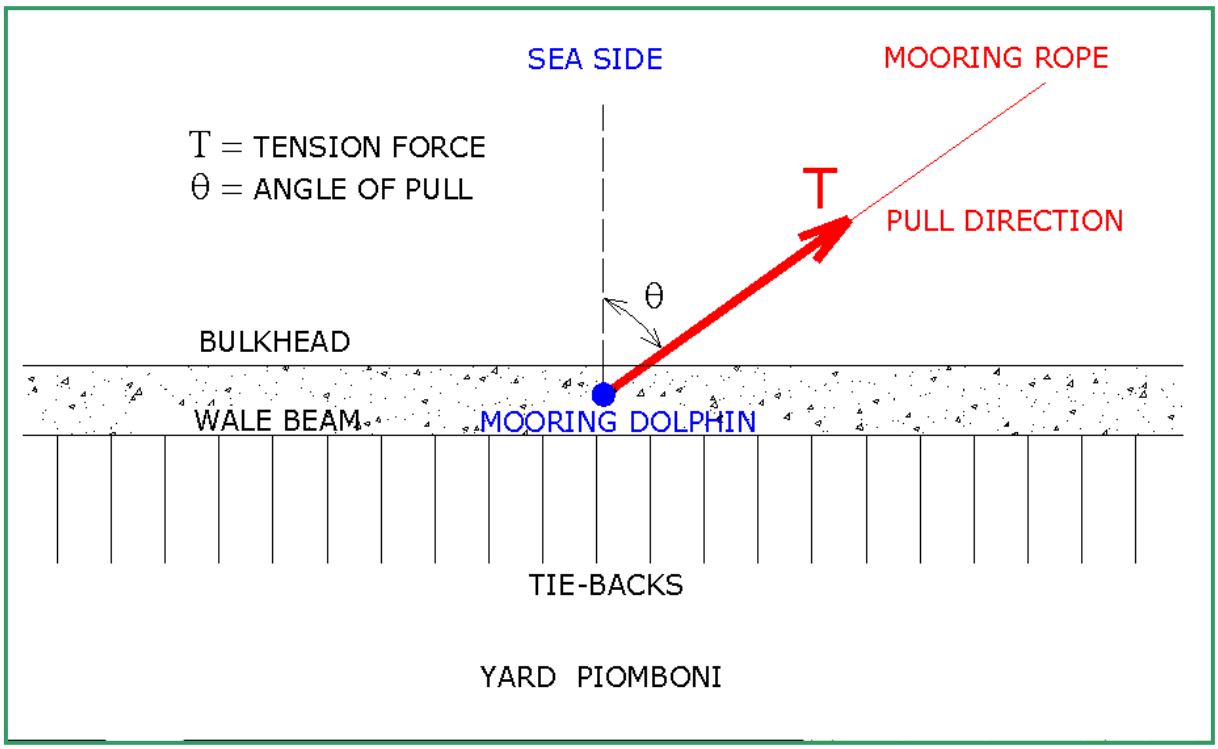
ADMISSIBLE PULL - CONCRETE BULKHEAD

θ	T	T*		θ	T	T*
(°)	(KN)	(KN)		(°)	(KN)	(KN)
0	150	195		180	300	390
5	151	196		185	300	390
10	152	198		190	300	390
15	155	202		195	300	390
20	160	208		200	300	390
25	166	215		205	300	390
30	173	225		210	300	390
35	183	238		215	300	390
40	196	255		220	300	390
45	212	276		225	300	390
50	233	303		230	300	390
55	262	340		235	300	390
60	300	390		240	300	390
65	300	390		245	300	390
70	300	390		250	300	390
75	300	390		255	300	390
80	300	390		260	300	390
85	300	390		265	300	390
90	300	390		270	300	390
95	300	390		275	300	390
100	300	390		280	300	390
105	300	390		285	300	390
110	300	390		290	300	390
115	300	390		295	300	390
120	300	390		300	300	390
125	300	390		305	262	340
130	300	390		310	233	303
135	300	390		315	212	276
140	300	390		320	196	255
145	300	390		325	183	238
150	300	390		330	173	225
155	300	390		335	166	215
160	300	390		340	160	208
165	300	390		345	155	202
170	300	390		350	152	198
175	300	390		355	151	196
180	300	390		360	150	195

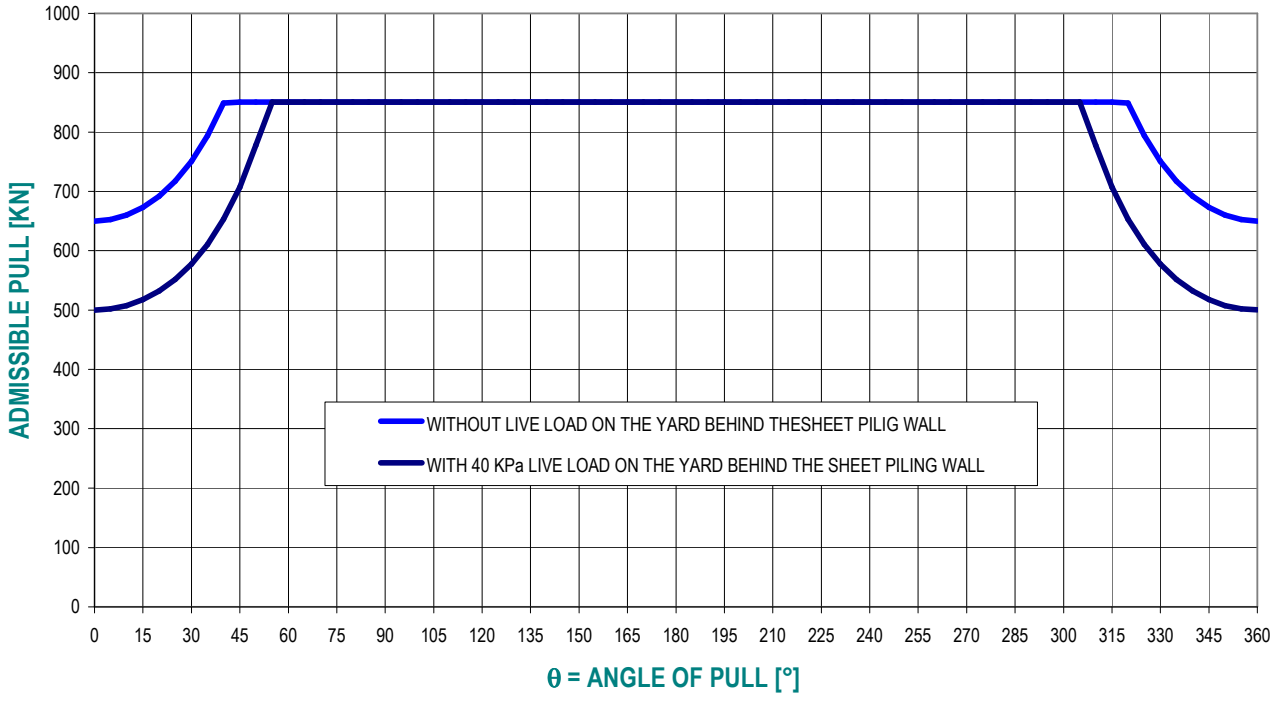
* without live load on the yard

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RMI YPB BOLLARD FROM No 13 to No 23



MOORING DOLPHIN PULL AS A FUNCTION OF THE ANGLE BETWEEN THE MOORING ROPE AND THE NORMAL TO THE SHEET PILING WALL



ADMISSIBLE PULL - STEEL SHEET PILING WALL

θ	T	T*		θ	T	T*
(°)	(KN)	(KN)		(°)	(KN)	(KN)
0	500	650		180	850	850
5	502	652		185	850	850
10	508	660		190	850	850
15	518	673		195	850	850
20	532	692		200	850	850
25	552	717		205	850	850
30	577	751		210	850	850
35	610	794		215	850	850
40	653	849		220	850	850
45	707	850		225	850	850
50	778	850		230	850	850
55	850	850		235	850	850
60	850	850		240	850	850
65	850	850		245	850	850
70	850	850		250	850	850
75	850	850		255	850	850
80	850	850		260	850	850
85	850	850		265	850	850
90	850	850		270	850	850
95	850	850		275	850	850
100	850	850		280	850	850
105	850	850		285	850	850
110	850	850		290	850	850
115	850	850		295	850	850
120	850	850		300	850	850
125	850	850		305	850	850
130	850	850		310	778	850
135	850	850		315	707	850
140	850	850		320	653	849
145	850	850		325	610	794
150	850	850		330	577	751
155	850	850		335	552	717
160	850	850		340	532	692
165	850	850		345	518	673
170	850	850		350	508	660
175	850	850		355	502	652
180	850	850		360	500	650

* without live load on the yard

Geotechnics Geology Structures Offshore

TECON S.r.l.

Marina di Ravenna (RA)

Piomboni Yard

Geotechnical report

Site characterization and shallow foundations geotechnical design

Doc. n.: **1988-X-A0-RE-001-B-11**			Number of pages 122		
C				LA	
B	11/18/2013	After Client's comments	FA	LA	LA
A	09/23/2013	Issued for comments	FA	LA	LA
Rev.	Date	Description	Prepared	checked	Approved

SOIL srl
via Pestalozzi, 10 int. 33/B - 20143 Milano - Italia
T +39 02 89121714 - **F** +39 02 89128765
E soil@soil.it - **W** www.soil.it

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1. Foreword

Present report deals with the geotechnical characterization of the foundation soils of the Piomboni Yard site, a construction facility property of Rosetti Marino S.p.A. located in Marina di Ravenna (RA, Italy).

After the examination of the so far available geotechnical information on the site (from previous investigation campaigns), the reference soil profile will be defined basing on the most reliable data only.

The geotechnical design of shallow foundations will then be provided (allowable bearing capacity, settlement evaluation); these are not to be intended as foundations of “permanent” structures but only as “temporary” supports to be used during construction activities to be carried out within the Yard.

2. References

2.1 Norms and recommendations

2.1.1 D.M. 11 Marzo 1988: "Norme tecniche riguardanti le indagini sui terreni e sulle rocce, la stabilità dei pendii naturali e delle scarpate, i criteri generali e le prescrizioni per la progettazione, l'esecuzione ed il collaudo delle opere di sostegno delle terre e delle opere di fondazione"

2.2 Design documents

2.2.1 Rosetti Marino S.p.A.: "Piombone Yard layout & technical characteristics" sheet 1/2, Rev.3, February 2011

2.2.2 Rosetti Marino S.p.A.: "Piombone Yard layout & technical characteristics" sheet 2/2, Rev.1, February 2011

2.2.3 Dr. Angelo Angeli: "Geognostic investigation on the ground of the temporary foundation for Halfadan BC accomodation living quarted and Halfadan CA jacket to be built at the 'via del Marchesato' site in Ravenna", July 2006

2.2.4 Dr. Angelo Angeli: "Indagine geognostica sul terreno di fondazione di una gru press oil Cantiere Navale in località Piomboni", June 1985

2.2.5 Dr. Angelo Angeli: "Esecuzione di n.2 sondaggi a carotaggio presso la banchina del Cantiere navale Rosetti in Ravenna – Loc. Piomboni", July 1984

2.3 Bibliography

2.3.1 Lunne T., Robertson P.K., Powell J.J.M. (1997): "Cone Penetration testing in geotechnical practice", published by Blackie Academic & Professional

2.3.2 Robertson, P.K. (2009): "Interpretation of cone penetration tests – a unified approach", Can. Geotech. J.

2.3.3 Robertson, P.K. (2012): "Interpretation of in-situ tests. Some insights", Mitchell Lecture, ISC4 Brazil

2.3.4 M. B. Jamiolkowski, D.C.F. Lo Presti, F. Froio (1998): “Design Parameters of Granular Soils from in Situ Tests”. Proc. XI Danube- European Conf. on S.M.F.E.

2.3.5 Brinch Hansen J. (1970): “A Revised and Extended Formula for Bearing Capacity”. Bull. n°28 - Danish Geotechnical Institute – Copenhagen

2.3.6 Duncan, M.J., and Buchignani, A.L. (1976): “An engineering manual for settlement studies” University of California, Berkeley

2.3.7 Schmertmann, J. (1975), “Measurement of in situ shear strength”, ASCE, SC-ISMP, SOA paper

2.3.8 Jamiolkowski M., Ghionna V.N., Lancellotta R., Pasqualini E. (1988) – “New correlations of penetration tests for design practice”, Proceedings of I International Symposium on Penetration Testing, ISOPT I, Orlando

2.3.9 Andersen, A., Berre, T., Kleven, A., Lunne, T. (1979): “Procedures used to obtain soil parameters for foundation engineering in the North sea”, Marine Geotechnology, 3(3):201-266

2.3.10 Naval Facilities Engineering Command (1986) “Design Manual 7.02 – Foundation & Earth Structures” 200 Stovall Street – Alexandria, Virginia 22332-2300

2.3.11 Skempton, A. W. (1986), “Standard penetration test procedures and the effects in sands of overburden pressure, relative density, particle size, ageing and overconsolidation”. Geotechnique 36, n°2

2.3.12 Joseph E. Bowles, “Fondazioni – Progetto e analisi” – McGraw-Hill

2.3.13 Meyerhof G. (1973) ”Ultimate Bearing Capacity of Footings on Sand Layer Overlying Clay”. Vol.2, N°2 - Canadian Geotechnical Journal – May 1974.

3. Geotechnical characterization of the site

3.1 Available data

No dedicated geotechnical investigation campaign has been carried out for the preparation of present report.

All the analyses herein presented are based on a geotechnical model defined considering (part of) the available geotechnical data coming from previous investigation campaigns carried out at site in the last 30÷40 years. The relevant reports are collected from Ref. 2.2.3 to Ref. 2.2.5 (not all the available documents have been quoted in the references, as the front page of some of them is missing).

It has to be stressed that all the available data have been provided to the writers as copies of the original (often dated) printed reports. With particular reference to the Cone Penetration Tests (CPTs) executed at site, the above means that in order to "digitalize" the significant data and proceed to their detailed interpretation, only the more reliable tests have been selected and will be considered in the following.

In particular, the CPT campaigns carried out in 2006 (Ref. 2.2.3 – CPT-1÷6_06 in the following) and 1985 (Ref. 2.2.4 – CPT-1÷2_85 in the following) have been selected. The former consisted in the execution of n.5 "short" CPTs (pushed to ≅12m below g.l.), while in the latter n.2 "long" CPTs were carried out (pushed to 32÷35m below grade).

It has to be noted that in both cases the Mechanical Cone Penetrometer was used at site; the interpretation methods adopted in the following (most suitable for data collected with the –nowadays standard- electronic device) could then be (slightly) affected.

In addition to the above quoted campaigns, the data coming from the other ones available have anyhow been examined in order to cross-check the adopted data and obtain other general information (e.g.: water table elevation, etc.).

The location of all the explored verticals is reported in the docs from Ref. 2.2.3to 2.2.5. No information about the absolute elevation of the ground level at the time of execution of the

explored verticals has been found in the available documentation; in the following the assumption of same elevation for all the tests will be made.

3.2 Local soil conditions and typical stratigraphy of the site

Local soil conditions encountered at site are typical of the Ravenna zone (where several recent, high quality site investigations are available, within ENI chemical plant).

The diagram of the cone resistance (q_c) along depth measured in all the considered explored verticals is reported in Figure n.3.1.

All quoted cone penetration tests have detected at shallow depth (down to 1.5÷2m below grade) the presence of a well compacted granular layer, very likely of "artificial" nature (probably related to the backfilling operations carried out in the past during the construction of the yard).

Underneath the above quoted stratum, in all the 2006 tests a thick sand layer is located, with bottom at around -10÷11m below grade. The same material is found also by the older CPTs (1985), even if in this case an "intermediate" soft cohesive layer (≅1m thick) was detected at the time of execution of the tests; also some of the recent tests show the presence of this intermediate soft layer, but with reduced (negligible) thickness (see CPT-04/05/06_06 in Figure n.3.1). It is likely that during the backfilling operations a top cohesive layer was left in place and covered with the granular material; after (many) years of life of the yard, the large applied loads could have caused its compression and thickness reduction.

The "base" layer is locally formed by soft to medium, almost normally consolidated silty clays, interbedded at significant depth by granular strata (1÷2m thick). The continuous thickness of the cohesive layer is important (10÷12m), leading to long times required for the development/completion of consolidation settlements (see details in the following paragraphs).

As far as the water table is concerned, basing on all the available documentation, its elevation is located between 1 and 2.5m below grade; on the safe side the water table elevation will be assumed at 1m below grade in the calculations herein carried out.

3.3 Detailed interpretation of CPT data

Attachment 1 shows the detailed interpretation of CPTs. Readings collected during penetration (q_c, f_s,) are plotted with depth for the 7 considered verticals.

The Robertson Index, I_c, (see Ref. 2.3.1, 2.3.2 and 2.3.3) was used to classify the encountered material making reference to the large experience supporting the correlations between measured data and soil type (grain size distribution).

The following ranges of I_c have been adopted:

- I_c > 3.6: organic soil peat (in grey);
- I_c = 2.95÷3.6: silty clay to clay (in red);
- I_c = 2.6÷2.95: clayey silt to silty clay (in black);
- I_c = 2.05÷2.6: silty sand to sandy silt (in sky blue);
- I_c = 1.31÷2.05: clean sand to silty sand (in green);
- I_c < 1.31: gravelly sand to clean sand (in magenta);

Once the single vertical readings have been interpreted in terms of the quoted Index, the q_c diagrams with depth have been re-plotted using different colours for the various materials defined as above. The detailed interpretation of all CPTUs in terms of geotechnical parameters is shown in Attachment 1; a dedicated figure shows also the distribution with depth of I_c for each explored vertical.

3.3.1 Cohesive materials

Undrained shear strength for cohesive soils, c_u, was evaluated by means of the following correlation:

$$c_u = \frac{q_c - \sigma_v}{N_k}$$

where:

c_u = undrained shear strength
σ_v = total vertical pressure at considered depth
N_k = empirical correction coefficient, generally ranging from 12 to 20. In the present case a value of N_k = 15 was (on the safe side) assumed for all encountered materials.
q_c = measured cone point resistance

Each diagram of c_u distribution with depth is also provided with a line indicating the reference strength of a normally consolidated material, evaluated as: $c_u=0.22\times\sigma'_{v0}$ (σ'_{v0}= effective vertical pressure at the considered elevation).

Cone point resistances (q_c) data can be interpreted also in terms of "constrained modulus", M_{DS}:

$$M_{DS} = 8.25 \times (q_t - \sigma_{vo}) \qquad \text{(Mayne et al, 1990)}$$

σ_{v0} = total vertical pressure at considered depth

The undrained modulus of the soft clay layer was everywhere assumed equal to: $E_u = 3 \times M_{DS}$.

3.3.2 Granular Materials

The relative density (D_r) of a granular soil can be evaluated by means of the following correlation (Jamiolkowski et al., 1985; see Ref. 2.3.4):

$$D_r(\%) = 68\left[\log_{10}\left(\frac{q_c}{\sqrt{p_a \sigma'_{v0}}}\right) - 1\right]$$

where:

p_a = atmospheric pressure (in atm);
σ'_{v0} = effective vertical pressure considered depth.

Basing on the above data, correlations suggested by Schmertmann (1977, see Ref. 2.3.7) can be used to obtain the peak angle of shearing resistance (ϕ'_p) for various types of granular soils.

1 - ϕ'_P=28+0.14D_R	(uniform fine sand)
2 - ϕ'_P=31.5+0.115D_R	(uniform medium sand/ well graded fine sand)
3 - ϕ'_P=34.5+0.10D_R	(uniform coarse sand/well graded medium sand)
4 - ϕ'_P=38+0.08D_R	(uniform gravel/well graded gravel-sand-silt)

In static cone data interpretation, correlation 1 (the most conservative) was systematically used in present site.

The compressibility of the material, (E', Young's modulus) can be evaluated directly from CPT measures by the following correlation (see Ref. 2.3.2):

$$E' = 0.015 \times [10^{(0.55 \times Ic + 1.68)}] \times (q_t - \sigma_{v0})$$

3.3.3 Diagrams of soil properties and parameters

All diagrams related to the interpretation of CPTs are grouped in Attachment 1. For each vertical, the following diagrams are provided:

- distribution with depth of cone point resistance, q_c, with different colors showing the soil type (in terms of grain size distribution), according to the local value of I_c;
- static cone point resistance, q_c;
- local friction, f_s;
- Robertson's Index, I_c;
- undrained shear strength, c_u;
- oedometric modulus for cohesive soils, M_{DS};
- relative density for granular soils or for granular soils with not negligible fine content, D_r;
- peak angle of shearing resistance, ϕ'_p;
- Young's modulus for granular materials, E';
- distribution within the "normalized" Robertson's chart (1990) providing the soil type of all points where q_c and f_s have been measured.

3.4 Reference soil profile and design geotechnical parameters

Basing on the detailed interpretation of the selected cone penetration tests (see previous Par. 3.3 and Attachment 1), the following reference soil profile will be considered for the allowable bearing capacity evaluation:

- 0÷2m b.g.l. **very dense sand** γ_{tot} = 18.5kN/m^3
  γ' = 8.5kN/m^3
  ϕ' = 40° (angle of shearing resistance, see Figure n.3.2, were the detailed interpretation af all CPTs in terms of ϕ' is provided)
- 2÷10m b.g.l. **silty sand** γ_{tot} = 18.5kN/m^3
  γ' = 8.5kN/m^3
  ϕ' = 35° (angle of shearing resistance, see Figure n.3.2, were the detailed interpretation af all CPTs in terms of ϕ' is provided)

- below 10m b.g.l. **silty clay** γ_{tot} = 18.5kN/m^3
  γ' = 8.5kN/m^3
  c_u = 30kPa (undrained shear strength, see Figure n.3.3 were the detailed interpretation af all CPTs in terms of c_u is provided)

As far as the settlement evaluation is concerned, reference will be made to direct interpretation of selected CPTs. In Figure n.3.4 the profile with depth of constrained modulus, M_{ds}, and Young's modulus, E', for cohesive and granular materials respectively is provided for all the 7 considered verticals. The "reference" profile shown on the same figure has been obtained by averaging the data coming from the 5 "2006" CPTs down to 12m b.g.l. and the remaining 2 "1985" CPTs at greater depths. The 1985 data within the first 12m have been neglected in the averaging process, in order not to considered the presence of the previously quoted soft interlayer within the top sand layer (not detected during the most recent site investigation campaign).

4. Shallow foundation design recommendations

4.1 General

In present paragraph the evaluation of the allowable bearing capacity and of the expected settlements for shallow foundations is provided.

"Shallow foundations" are to be intended as the "combination" of prefabricated reinforced concrete blocks, already available within the Yard; they will be arranged in order to constitute "equivalent" foundations with a "short" side (B) ranging from 3 to 6m and a "long to short" ratio (L/B) ranging from 1 to 3. As far as the foundation bearing level ($z_{b.l.}$) is concerned, both the conditions of $z_{b.l.}$ = 0 and 0.8m b.g.l. will be considered ($z_{b.l}$= depth of embedment of the base of the block below the surrounding soil surface).

In addition to the above defined "parametric" geometries, additional specific analyses will be provided for the following cases:

- B=1.5m; L=5.0m;
- B=3.0m, L=5.0m;
- B=3.0m, L=3.5m;
- B=1.7m, L=5.0m;
- B=2.0m, L=5.0m;
- B=4.0m, L=5.0m;
- B=1.0m, L=2.0m

Furthermore, in some cases different kind of structures are used as "foundation"; in particular: steel plates 0.5×0.5m and 1.0×1.0m; steel beams 1.65×8.00m (in this case, the bearing level will be assumed at present grade only).

A maximum eccentricity of the loads of 5% along the longer side of the foundation has on the save side been considered in all the analyses herein provided.

All calculations of the following paragraphs have been carried out under the assumption of continuous and rigid foundation. This implies that the way by which the loads are transferred from the supported structure to the foundation blocks shall be such as to ensure the above condition; a particular care shall be dedicated to grant the "co-planarity" of the blocks deformations and the

"involvement" of all the blocks of the foundation in the soil failure mechanism below the bearing level.

4.2 Allowable bearing capacity evaluation

For every considered case (geometry, bearing level), the bearing capacity of the shallow foundations has been evaluated as the minimum value of the results obtained with alternative failure criteria.

In particular, due to the stratified nature of the deposit within the depth of interest (3 layers: 2m of very dense sand, followed by 8m of silty sand, resting on silty clay, see Par. 3.4), three possible conditions have been checked:

a. failure within the very dense sand layer only (ϕ' = 40°), according to the "classic" Brinch-Hansen approach for granular materials (see details in the following Par. 4.2.1); to be considered as "upper limit" of the ultimate bearing capacity;

b. failure within the granular soils present down to 10m below grade. In this case, the "equivalent" granular material considered instead of the two-layer model (dense sand with ϕ'=40° resting on silty sand with ϕ'=35°) has been defined according to the procedure detailed in following Par. 4.2.2. Also in this case the Brinch-Hansen approach has been considered;

c. failure in presence of a layered profile (granular layer resting onto a cohesive one), in which the top layer (0÷10m b.g.l.) is formed by the "equivalent" granular material defined at previous point b. The Meyerhof approach (see details in the following Par. 4.2.3) has been here adopted.

In all the above cases, the allowable bearing capacity (q_{all}) of considered foundations has been evaluated applying a factor of safety, F_s = 3.0 (see Ref. 2.1.1):

$$q_{all} = \frac{q_u - q'}{F_s} + q'$$

where q' is the total overburden pressure acting at foundation level ($q' = \gamma \times D$) and q_u the ultimate bearing capacity of the foundation (evaluated with the approaches listed above and detailed in the following).

4.2.1 Single granular layer (very dense sand)

4.2.1.1 Calculation method

The ultimate bearing capacity of shallow foundations is evaluated, according to Meyerhof's criterion, with reference to the effective foundation area, defined as that part of the whole foundation for which the vertical resultant (N) at foundation level is centred.

The ultimate bearing capacity of a footing resting on a cohesionless layer is given by (see Ref. 2.3.5):

$$q_u = \tfrac{1}{2}\gamma' B' N_\gamma s_\gamma d_\gamma i_\gamma + \sigma'_{vo} N_q s_q d_q i_q$$

where:

B', L' = foundation, smaller, larger effective dimension

B, L= = actual dimension of smaller, larger foundation side

N_γ, N_q = bearing capacity factors, depending on the friction angle φ;

s_γ, s_q = correction factors depending on foundation shape;

d_γ, d_q = correction factors for the embedment of foundation within the bearing layer;

i_γ, i_q = correction factors taking into consideration the load inclination;

$\sigma'_{vo} \cong q'$ = effective vertical pressure acting outside the foundation at foundation elevation;

The above correction factors can be evaluated by means of the following formulae:

i_γ = $(1 - 0{,}7\ H/N)^5$

i_q = $(1 - 0{,}5\ H/N)^5$

s_γ = $1 - 0{,}4\ (B'/L')\ i_\gamma$

s_q = $1 + \sin\varphi'\ (B'/L')\ i_q$

d_γ = 1

d_q = $1 + 2 \tan\varphi' (1 - \sin\varphi')^2 \arctan(z_f/B')$

H = resultant of horizontal forces at foundation level (assumed equal to 0 in present case)

N = resultant of vertical forces at foundation level

$z_{b.l.}$ = depth of foundation embedment below the grade level.

4.2.1.2 Results

The results of the calculations are collected in Table n.4.1 for the "parametric" geometries quoted above; Table n.4.2 and Table n.4.3 collect the same results for the "specific" block geometries and for the steel supports, respectively.

Please note that the allowable bearing capacities there reported are already the one referred to the actual (not "effective") dimensions of the foundations. In other words: the effect of the possible eccentricity of the vertical load moving away from the rails where the structure under construction is running are already included on the allowable capacity calculated to be referred to the entire base area of each foundation.

4.2.2 "Equivalent" granular layer (very dense sand resting on silty sand)

The calculation method considered in present case is the same one described at previous Par. 4.2.1.1, but the angle of shearing resistance adopted in the calculation for the "equivalent" granular material (0÷10m below grade) has been defined in present case according to the "averaging" process defined at Par. 4.8 of Ref. 2.3.12.

As detailed in the quoted reference, the "average" angle of shearing resistance to be assumed for the "equivalent" granular material (ϕ'_{eq}) is evaluated as function of the angles of shearing resistance of the two considered layers (40° and 35° in present case), the foundation shorter dimension and the depth of the foundation bearing level with respect to the top layer thickness.

Table n.4.4 resumes the results of the averaging procedure.

4.2.2.1 Results

The results of the analyses are collected in Table n.4.5 for the "parametric" geometries quoted above; Table n.4.6 and Table n.4.7 collect the same results for the "specific" block geometries and for the steel supports, respectively. As far as the square steel plates are concerned, the calculations have not been carried out because of their limited dimensions (analyses provided at Par. 4.2.1 are still valid).

Again, the allowable bearing capacities there reported are already the one referred to the actual (not "effective") dimensions of the foundations.

As expected, the allowable bearing capacities evaluated with present model are always lower than the one obtained at Par. 4.2.1.

4.2.3 Layered model (granular material resting on cohesive soil)

4.2.3.1 Calculation method

In present case the bearing capacity of the shallow foundations has been evaluated according to the Meyerhof criterion (see Ref. 2.3.13), considering a footing resting on a subsoil consisting of two layers: dense sand on soft clay. Figure n.4.1 shows the corresponding model for foundation failure while Figure n.4.2 provides the coefficients needed to evaluate its limit bearing capacity.

The ultimate bearing capacity can be evaluated according to the formula:

$$q_u = (c_u \times N_c) \times \left(1 + 0.2 \times \frac{B'}{L'}\right) + \left(1 + \frac{B'}{L'}\right) \times (\gamma \times H^2) \times \left(1 + 2\frac{D}{H}\right) \times K_s \times \frac{\tan\phi}{B'} + \gamma D$$

where:

c_u = undrained shear strength of the soft clay (30kPa in present case, see Par. 3.4);

N_c = bearing capacity factor = 5.14 (in principle applicable to strip foundations);

γ = unit weight of granular layer (γ=18.5kN/m^3 in present case);

H = (residual) thickness of the sand layer between the top of the soft clay layer and the bearing plane of the foundation;

D = foundation bearing level depth below final grade;

B' = effective foundation smaller dimension;

L' = effective foundation larger dimension;

ϕ = sand angle of shearing resistance (in present case assumed equal to the "equivalent" one defined for each considered foundation geometry in already quoted Table n.4.4);

K_s = coefficient of punching shearing resistance, to be defined as function of ϕ according to Figure n.4.2; the assumed values of Ks are collected in Table n.4.8.

4.2.3.2 Results

The results of the analyses are collected in Table n.4.9 for the "parametric" geometries quoted above; Table n.4.10 and Table n.4.11 collect the same results for the "specific" block geometries and for the steel supports, respectively. As far as the square steel plates are concerned, the calculations have not been carried out because of their limited dimensions (analyses provided at Par. 4.2.1 are still valid).

It can be noted that only in case of large foundations with embedded bearing level the obtained allowable bearing capacity is lower than the one calculated (for the same geometry) with the approach described at Par. 4.2.2. This is logic, as larger foundation dimensions will "influence" a deeper portion of foundation soil, hence interesting also the (relatively deep) soft cohesive layer located below 10m b.g.l..

4.2.4 Allowable bearing capacity: final results

As anticipated, the allowable bearing capacity for the foundations foreseen at site is defined as the minimum obtained with the above defined approaches.

The results of this operation are collected in Table n.4.12, Table n.4.13 and Table n.4.14, presenting the allowable bearing capacities to be considered for design.

4.3 Settlement evaluation

4.3.1 Assumptions

In present paragraph the evaluation of expected settlements for the foreseen shallow foundations is provided.

The calculations will be carried out for all the considered "geometries" of the foundations (dimensions, bearing level). Total pressures ranging from 300 to 500kPa have been considered.

Both **immediate** and **delayed** settlements are evaluated in the following, being the former the ones due to the superficial granular layer (0÷10m b.g.l., dense sand and silty sand) plus the "undrained" portion of the settlement of the cohesive materials; the latter the one due to consolidation settlements only within the deep soft cohesive material.

The Young's modulus will be considered for the granular layers, after the averaging procedure described at previous Par. 3.4. The undrained modulus (E_u) of the cohesive materials will be assumed equal to 3 times the oedometric one: $E_u = 3 \times M_{ds}$ (again after averaging process).

The "immediate" deformations will develop in relatively short period, comparable with the construction time of the supported structures.

The long term "delayed" settlement will be of interest mainly for large foundations, able to induce significant vertical tension increases at depth, within the above quoted soft cohesive layer.

Due to the (relatively) large continuous thickness of the clay layer (say: greater than 10m), the completion of the primary consolidation settlement will very likely require several months (years) starting from the condition of final load applied; hence, in case the construction times will be reasonably short (i.e: few months only) and the permanence of the supported structure (once completed) will be limited, no significant influence of the delayed settlements on the total ones is to be expected.

4.3.2 Calculation method

The settlement δ can be evaluated by means of the following formula:

$$\delta = K_r \sum_i \frac{\Delta\sigma_{vi} \Delta h_i}{E_i}$$

where:

K_r = coefficient related to the foundation stiffness;

$\Delta\sigma_{vi}$ = average vertical stress increase in the sub-layer i due to foundation pressure

Δh_i = thickness of sub-layer i

E_i = average elastic modulus in sub-layer i (M_{ds}, E' or E_u, according to what stated above).

The stiffness coefficient K_r is assumed equal to 0.8 for perfectly "stiff" square/rectangular foundations.

The vertical stress increase due to the foundation pressure has been evaluated by means of the elastic theory. The sum of deformations has been extended to a depth where the average stress increase $\Delta\sigma_v$' is less than 10% of pre-existing average, effective vertical pressure (σ'_v).

4.3.3 Results

The results of the calculations are collected in Table n.4.15 (immediate settlements) and Table n.4.16 (delayed settlements) for the “parametric” geometries quoted above; Table n.4.17 and Table n.4.18 collect the same results for the “specific” block geometries, while Table n.4.19 and Table n.4.20 provide the results for the steel supports.

TABLES

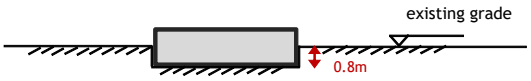
Piomboni Yard

Geotechnical report

Site characterization and shallow foundations geotechnical design

Allowable bearing capacity - Par.4.2.1 - Single granular layer (very dense sand)





$z_{b.l.}$ = 0.0 (m b.g.l.)

foundation footprint dimensions				allowable bearing capacity (F_s=3.0)
B	L		L' (*)	q_{all}
(m)	(-)	(m)	(m)	(kPa)
3.0	L=B	3.0	2.7	324
	L=1.5×B	4.5	4.1	410
	L=2×B	6.0	5.4	453
	L=3×B	9.0	8.1	496
4.0	L=B	4.0	3.6	426
	L=1.5×B	6.0	5.4	508
	L=2×B	8.0	7.2	562
	L=3×B	12.0	10.8	615
5.0	L=B	5.0	4.5	507
	L=1.5×B	7.5	6.8	606
	L=2×B	10.0	9.0	670
	L=3×B	15.0	13.5	734
6.0	L=B	6.0	5.4	587
	L=1.5×B	9.0	8.1	704
	L=2×B	12.0	10.8	779
	L=3×B	18.0	16.2	853

$z_{b.l.}$ = 0.8 (m b.g.l.)

foundation footprint dimensions				allowable bearing capacity (F_s=3.0)
B	L		L' (*)	q_{all}
(m)	(-)	(m)	(m)	(kPa)
3.0	L=B	3.0	2.7	805
	L=1.5×B	4.5	4.1	840
	L=2×B	6.0	5.4	849
	L=3×B	9.0	8.1	858
4.0	L=B	4.0	3.6	885
	L=1.5×B	6.0	5.4	938
	L=2×B	8.0	7.2	957
	L=3×B	12.0	10.8	977
5.0	L=B	5.0	4.5	966
	L=1.5×B	7.5	6.8	1036
	L=2×B	10.0	9.0	1066
	L=3×B	15.0	13.5	1096
6.0	L=B	6.0	5.4	1046
	L=1.5×B	9.0	8.1	1134
	L=2×B	12.0	10.8	1174
	L=3×B	18.0	16.2	1215

(*): HP eccentricity of 5% along L

Table n.4.1

Allowable bearing capacity - Par.4.2.1 - Single granular layer (very dense sand)





$z_{b.l.}$ = 0.0 (m b.g.l.)

foundation footprint dimensions			allowable bearing capacity (F_s=3.0)
B	L	L' (*)	q_{all}
(m)	(m)	(m)	(kPa)
1.0	**2.0**	1.8	**236**
1.5	**5.0**	4.5	**324**
1.7	**5.0**	4.5	**341**
2.0	**5.0**	4.5	**364**
3.0	**3.5**	3.2	**364**
3.0	**5.0**	4.5	**427**
4.0	**5.0**	4.5	**465**

$z_{b.l.}$ = 0.8 (m b.g.l.)

foundation footprint dimensions			allowable bearing capacity (F_s=3.0)
B	L	L' (*)	q_{all}
(m)	(m)	(m)	(kPa)
1.0	**2.0**	1.8	**632**
1.5	**5.0**	4.5	**679**
1.7	**5.0**	4.5	**704**
2.0	**5.0**	4.5	**740**
3.0	**3.5**	3.2	**830**
3.0	**5.0**	4.5	**843**
4.0	**5.0**	4.5	**922**

(*): HP eccentricity of 5% along L

Table n.4.2

Allowable bearing capacity - Par.4.2.1 - Single granular layer (very dense sand)



$z_{b.l.}$ = 0.0 (m b.g.l.)

foundation footprint dimensions			allowable bearing capacity (F_s=3.0)
B	**L**	**L' (*)**	**q_{all}**
(m)	(m)	(m)	(kPa)
0.5	**0.5**	0.5	**87**
1.0	**1.0**	0.9	**175**
1.7	**8.0**	7.2	**363**

(*): HP eccentricity of 5% along L

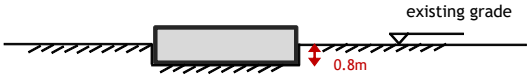
Table n.4.3

foundation shorter side	ϕ'_{eq}	
	$z_{b.l.}$=0.0m	$z_{b.l.}$=0.8m
(m)	(°)	(°)
0.5	**40.0**	**40.0**
1.0	**40.0**	**40.0**
1.5	**40.0**	**38.7**
1.7	**40.0**	**38.3**
2.0	**39.7**	**37.8**
2.7	**38.5**	**37.1**
3.0	**38.1**	**36.9**
3.6	**37.6**	**36.6**
4.0	**37.3**	**36.4**
4.5	**37.1**	**1.0**
5.0	**36.9**	**36.1**
5.4	**36.7**	**36.0**
6.0	**36.6**	**35.9**

Table n.4.4

Allowable bearing capacity - Par.4.2.2 - "Equivalent" granular layer (very dense sand resting on silty sand)





$z_{b.l.}$ = 0.0 (m b.g.l.)

foundation footprint dimensions				allowable bearing capacity (F_s=3.0)
B	L		L' (*)	q_{all}
(m)	(-)	(m)	(m)	(kPa)
3.0	L=B	**3.0**	2.7	**268**
	L=1.5×B	**4.5**	4.1	**299**
	L=2×B	**6.0**	5.4	**329**
	L=3×B	**9.0**	8.1	**360**
4.0	L=B	**4.0**	3.6	**285**
	L=1.5×B	**6.0**	5.4	**323**
	L=2×B	**8.0**	7.2	**357**
	L=3×B	**12.0**	10.8	**391**
5.0	L=B	**5.0**	4.5	**312**
	L=1.5×B	**7.5**	6.8	**362**
	L=2×B	**10.0**	9.0	**399**
	L=3×B	**15.0**	13.5	**437**
6.0	L=B	**6.0**	5.4	**338**
	L=1.5×B	**9.0**	8.1	**399**
	L=2×B	**12.0**	10.8	**441**
	L=3×B	**18.0**	16.2	**483**

$z_{b.l.}$ = 0.8 (m b.g.l.)

foundation footprint dimensions				allowable bearing capacity (F_s=3.0)
B	L		L' (*)	q_{all}
(m)	(-)	(m)	(m)	(kPa)
3.0	L=B	**3.0**	2.7	**520**
	L=1.5×B	**4.5**	4.1	**525**
	L=2×B	**6.0**	5.4	**529**
	L=3×B	**9.0**	8.1	**534**
4.0	L=B	**4.0**	3.6	**529**
	L=1.5×B	**6.0**	5.4	**542**
	L=2×B	**8.0**	7.2	**552**
	L=3×B	**12.0**	10.8	**562**
5.0	L=B	**5.0**	4.5	**542**
	L=1.5×B	**7.5**	6.8	**570**
	L=2×B	**10.0**	9.0	**585**
	L=3×B	**15.0**	13.5	**600**
6.0	L=B	**6.0**	5.4	**567**
	L=1.5×B	**9.0**	8.1	**603**
	L=2×B	**12.0**	10.8	**623**
	L=3×B	**18.0**	16.2	**642**

(*): HP eccentricity of 5% along L

Table n.4.5

Allowable bearing capacity - Par.4.2.2 - "Equivalent" granular layer (very dense sand resting on silty sand)





$z_{b.l.}$ = 0.0 (m b.g.l.)

foundation footprint dimensions			allowable bearing capacity (F_s=3.0)
B	L	L' (*)	q_{all}
(m)	(m)	(m)	(kPa)
1.0	**2.0**	1.8	**236**
1.5	**5.0**	4.5	**324**
1.7	**5.0**	4.5	**341**
2.0	**5.0**	4.5	**346**
3.0	**3.5**	3.2	**264**
3.0	**5.0**	4.5	**310**
4.0	**5.0**	4.5	**296**

$z_{b.l.}$ = 0.8 (m b.g.l.)

foundation footprint dimensions			allowable bearing capacity (F_s=3.0)
B	L	L' (*)	q_{all}
(m)	(m)	(m)	(kPa)
1.0	**2.0**	1.8	**632**
1.5	**5.0**	4.5	**557**
1.7	**5.0**	4.5	**543**
2.0	**5.0**	4.5	**529**
3.0	**3.5**	3.2	**520**
3.0	**5.0**	4.5	**527**
4.0	**5.0**	4.5	**534**

(*): HP eccentricity of 5% along L

Table n.4.6

Allowable bearing capacity - Par.4.2.2 - "Equivalent" granular layer (very dense sand resting on silty sand)



$z_{b.l.}$ = 0.0 (m b.g.l.)

foundation footprint dimensions			allowable bearing capacity (F_s=3.0)
B	**L**	**L' (*)**	**q_{all}**
(m)	(m)	(m)	(kPa)
1.7	**8.0**	7.2	**363**

(*): HP eccentricity of 5% along L

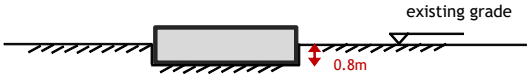
Table n.4.7

foundation shorter side	$z_{b.l.}$=0.0m		$z_{b.l.}$=0.8m	
	ϕ'_{eq}	K_s	ϕ'_{eq}	K_s
(m)	(°)	(-)	(°)	(-)
0.5	40.0	**7.1**	40.0	**7.1**
1.0	40.0	**7.1**	40.0	**7.1**
1.5	40.0	**7.1**	38.7	**7.1**
1.7	40.0	**7.1**	38.3	**6.8**
2.0	39.7	**7.1**	37.8	**6.5**
2.7	38.5	**6.5**	37.1	**5.1**
3.0	38.1	**6.2**	36.9	**5.1**
3.6	37.6	**6.0**	36.6	**5.0**
4.0	37.3	**5.5**	36.4	**5.0**
4.5	37.1	**5.5**	36.2	**4.8**
5.0	36.9	**5.5**	36.1	**4.8**
5.4	36.7	**5.0**	36.0	**4.8**
6.0	36.6	**5.0**	35.9	**4.8**

Table n.4.8

Allowable bearing capacity - Par.4.2.3 - Layered model (granular material resting on cohesive soil)





$z_{b.l.}$ = 0.0 (m b.g.l.)

foundation footprint dimensions				allowable bearing capacity (F_s=3.0)
B	L		L' (*)	q_{all}
(m)	(-)	(m)	(m)	(kPa)
3.0	L=B	**3.0**	2.7	**2074**
	L=1.5×B	**4.5**	4.1	**1619**
	L=2×B	**6.0**	5.4	**1450**
	L=3×B	**9.0**	8.1	**1282**
4.0	L=B	**4.0**	3.6	**1408**
	L=1.5×B	**6.0**	5.4	**1065**
	L=2×B	**8.0**	7.2	**956**
	L=3×B	**12.0**	10.8	**846**
5.0	L=B	**5.0**	4.5	**1029**
	L=1.5×B	**7.5**	6.8	**851**
	L=2×B	**10.0**	9.0	**764**
	L=3×B	**15.0**	13.5	**678**
6.0	L=B	**6.0**	5.4	**782**
	L=1.5×B	**9.0**	8.1	**651**
	L=2×B	**12.0**	10.8	**586**
	L=3×B	**18.0**	16.2	**520**

$z_{b.l.}$ = 0.8 (m b.g.l.)

foundation footprint dimensions				allowable bearing capacity (F_s=3.0)
B	L		L' (*)	q_{all}
(m)	(-)	(m)	(m)	(kPa)
3.0	L=B	**3.0**	2.7	**1565**
	L=1.5×B	**4.5**	4.1	**1292**
	L=2×B	**6.0**	5.4	**1160**
	L=3×B	**9.0**	8.1	**1028**
4.0	L=B	**4.0**	3.6	**1149**
	L=1.5×B	**6.0**	5.4	**951**
	L=2×B	**8.0**	7.2	**855**
	L=3×B	**12.0**	10.8	**759**
5.0	L=B	**5.0**	4.5	**886**
	L=1.5×B	**7.5**	6.8	**738**
	L=2×B	**10.0**	9.0	**665**
	L=3×B	**15.0**	13.5	**592**
6.0	L=B	**6.0**	5.4	**745**
	L=1.5×B	**9.0**	8.1	**622**
	L=2×B	**12.0**	10.8	**561**
	L=3×B	**18.0**	16.2	**501**

(*): HP eccentricity of 5% along L

Table n.4.9

Allowable bearing capacity - Par.4.2.3 - Layered model (granular material resting on cohesive soil)





$z_{b.l.}$ = 0.0 (m b.g.l.)

foundation footprint dimensions			allowable bearing capacity (F_s=3.0)
B	L	L' (*)	q_{all}
(m)	(m)	(m)	(kPa)
1.0	**2.0**	1.8	**5195**
1.5	**5.0**	4.5	**2988**
1.7	**5.0**	4.5	**2730**
2.0	**5.0**	4.5	**2413**
3.0	**3.5**	3.2	**1811**
3.0	**5.0**	4.5	**1551**
4.0	**5.0**	4.5	**1153**

$z_{b.l.}$ = 0.8 (m b.g.l.)

foundation footprint dimensions			allowable bearing capacity (F_s=3.0)
B	L	L' (*)	q_{all}
(m)	(m)	(m)	(kPa)
1.0	**2.0**	1.8	**5175**
1.5	**5.0**	4.5	**2851**
1.7	**5.0**	4.5	**2463**
2.0	**5.0**	4.5	**2072**
3.0	**3.5**	3.2	**1443**
3.0	**5.0**	4.5	**1239**
4.0	**5.0**	4.5	**1028**

(*): HP eccentricity of 5% along L

Table n.4.10

Allowable bearing capacity - Par.4.2.3 - Layered model (granular material resting on cohesive soil)



$z_{b.l.}$ = 0.0 (m b.g.l.)

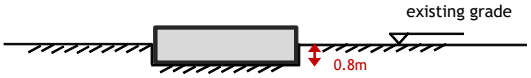
foundation footprint dimensions			allowable bearing capacity (F_s=3.0)
B	**L**	**L' (*)**	**q_{all}**
(m)	(m)	(m)	(kPa)
1.7	**8.0**	7.2	**2512**

(*): HP eccentricity of 5% along L

Table n.4.11

Design allowable bearing capacity





$z_{b.l.}$ =	0.0	(m b.g.l.)

foundation footprint dimensions				allowable bearing capacity (F_s=3.0)
B	L		L' (*)	q_{all}
(m)	(-)	(m)	(m)	(kPa)
3.0	L=B	**3.0**	2.7	**268**
	L=1.5×B	**4.5**	4.1	**299**
	L=2×B	**6.0**	5.4	**329**
	L=3×B	**9.0**	8.1	**360**
4.0	L=B	**4.0**	3.6	**285**
	L=1.5×B	**6.0**	5.4	**323**
	L=2×B	**8.0**	7.2	**357**
	L=3×B	**12.0**	10.8	**391**
5.0	L=B	**5.0**	4.5	**312**
	L=1.5×B	**7.5**	6.8	**362**
	L=2×B	**10.0**	9.0	**399**
	L=3×B	**15.0**	13.5	**437**
6.0	L=B	**6.0**	5.4	**338**
	L=1.5×B	**9.0**	8.1	**399**
	L=2×B	**12.0**	10.8	**441**
	L=3×B	**18.0**	16.2	**483**

$z_{b.l.}$ =	0.8	(m b.g.l.)

foundation footprint dimensions				allowable bearing capacity (F_s=3.0)
B	L		L' (*)	q_{all}
(m)	(-)	(m)	(m)	(kPa)
3.0	L=B	**3.0**	2.7	**520**
	L=1.5×B	**4.5**	4.1	**525**
	L=2×B	**6.0**	5.4	**529**
	L=3×B	**9.0**	8.1	**534**
4.0	L=B	**4.0**	3.6	**529**
	L=1.5×B	**6.0**	5.4	**542**
	L=2×B	**8.0**	7.2	**552**
	L=3×B	**12.0**	10.8	**562**
5.0	L=B	**5.0**	4.5	**542**
	L=1.5×B	**7.5**	6.8	**570**
	L=2×B	**10.0**	9.0	**585**
	L=3×B	**15.0**	13.5	**600**
6.0	L=B	**6.0**	5.4	**567**
	L=1.5×B	**9.0**	8.1	**603**
	L=2×B	**12.0**	10.8	**561**
	L=3×B	**18.0**	16.2	**501**

(*): HP eccentricity of 5% along L

Table n.4.12

Design allowable bearing capacity





$z_{b.l.}$ = 0.0 (m b.g.l.)

foundation footprint dimensions			allowable bearing capacity (F_s=3.0)
B	L	L' (*)	q_{all}
(m)	(m)	(m)	(kPa)
1.0	**2.0**	1.8	**236**
1.5	**5.0**	4.5	**324**
1.7	**5.0**	4.5	**341**
2.0	**5.0**	4.5	**346**
3.0	**3.5**	3.2	**264**
3.0	**5.0**	4.5	**310**
4.0	**5.0**	4.5	**296**

$z_{b.l.}$ = 0.8 (m b.g.l.)

foundation footprint dimensions			allowable bearing capacity (F_s=3.0)
B	L	L' (*)	q_{all}
(m)	(m)	(m)	(kPa)
1.0	**2.0**	1.8	**632**
1.5	**5.0**	4.5	**557**
1.7	**5.0**	4.5	**543**
2.0	**5.0**	4.5	**529**
3.0	**3.5**	3.2	**520**
3.0	**5.0**	4.5	**527**
4.0	**5.0**	4.5	**534**

(*): HP eccentricity of 5% along L

Table n.4.13

Design allowable bearing capacity



$z_{b.l.}$ = 0.0 (m b.g.l.)

foundation footprint dimensions			allowable bearing capacity (F_s=3.0)
B	**L**	**L' (*)**	**q_{all}**
(m)	(m)	(m)	(kPa)
0.5	**0.5**	0.5	**87**
1.0	**1.0**	0.9	**175**
1.7	**8.0**	7.2	**363**

(*): HP eccentricity of 5% along L

Table n.4.14

Expected IMMEDIATE settlement

Bearing level at existing grade



Bearing level 0.80m below grade



Foundation dimensions			Expected IMMEDIATE settlement due to an applied TOTAL pressure equal to:		
B	L		300kPa	400kpa	500kPa
(m)	(-)	(m)	(cm)	(cm)	(cm)
3.0	L=B	3.0	1.8	2.5	3.3
	L=1.5×B	4.5	2.3	3.1	4.0
	L=2×B	6.0	2.6	3.7	4.7
	L=3×B	9.0	3.2	4.5	5.7
4.0	L=B	4.0	2.5	3.5	4.5
	L=1.5×B	6.0	3.2	4.4	5.7
	L=2×B	8.0	3.7	5.2	6.6
	L=3×B	12.0	4.7	6.4	8.3
5.0	L=B	5.0	3.3	4.6	5.9
	L=1.5×B	7.5	4.2	5.9	7.5
	L=2×B	10.0	5.0	6.9	8.9
	L=3×B	15.0	6.2	8.7	11.2
6.0	L=B	6.0	4.2	5.8	7.4
	L=1.5×B	9.0	5.4	7.5	9.6
	L=2×B	12.0	6.4	8.9	11.4
	L=3×B	18.0	8.0	11.1	14.0

Foundation dimensions			Expected IMMEDIATE settlement due to an applied TOTAL pressure equal to:		
B	L		300kPa	400kpa	500kPa
(m)	(-)	(m)	(cm)	(cm)	(cm)
3.0	L=B	3.0	1.5	2.1	2.8
	L=1.5×B	4.5	1.9	2.7	3.6
	L=2×B	6.0	2.3	3.3	4.2
	L=3×B	9.0	2.9	4.1	5.3
4.0	L=B	4.0	2.2	3.1	4.0
	L=1.5×B	6.0	2.9	4.0	5.2
	L=2×B	8.0	3.4	4.8	6.2
	L=3×B	12.0	4.3	6.0	7.9
5.0	L=B	5.0	3.0	4.2	5.4
	L=1.5×B	7.5	3.9	5.5	7.1
	L=2×B	10.0	4.7	6.5	8.5
	L=3×B	15.0	5.9	8.3	10.8
6.0	L=B	6.0	3.8	5.4	6.9
	L=1.5×B	9.0	5.0	7.1	9.2
	L=2×B	12.0	6.0	8.5	11.1
	L=3×B	18.0	6.9	10.7	13.7

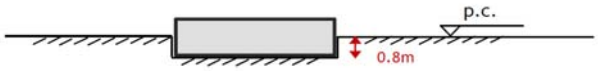
Table n.4.15

Expected DELAYED settlement

Bearing level at existing grade



Bearing level 0.80m below grade



Foundation dimensions			Expected DELAYED settlement due to an applied TOTAL pressure equal to:		
B	L		300kPa	400kpa	500kPa
(m)	(-)	(m)	(cm)	(cm)	(cm)
3.0	L=B	3.0	0.1	0.4	0.8
	L=1.5×B	4.5	0.6	1.0	1.6
	L=2×B	6.0	1.0	1.8	2.5
	L=3×B	9.0	2.0	3.2	4.4
4.0	L=B	4.0	0.8	1.5	2.2
	L=1.5×B	6.0	1.8	2.8	3.9
	L=2×B	8.0	2.6	4.1	5.6
	L=3×B	12.0	4.4	6.5	8.4
5.0	L=B	5.0	1.9	2.9	4.1
	L=1.5×B	7.5	3.4	5.1	6.8
	L=2×B	10.0	4.9	7.0	9.1
	L=3×B	15.0	7.1	10.4	13.5
6.0	L=B	6.0	3.2	4.9	6.6
	L=1.5×B	9.0	5.5	7.6	10.1
	L=2×B	12.0	7.2	10.4	8.5
	L=3×B	18.0	10.4	14.4	18.1

Foundation dimensions			Expected DELAYED settlement due to an applied TOTAL pressure equal to:		
B	L		300kPa	400kpa	500kPa
(m)	(-)	(m)	(cm)	(cm)	(cm)
3.0	L=B	3.0	0.1	0.5	0.9
	L=1.5×B	4.5	0.6	1.1	1.8
	L=2×B	6.0	1.0	1.9	2.8
	L=3×B	9.0	2.1	3.4	4.7
4.0	L=B	4.0	0.9	1.6	2.4
	L=1.5×B	6.0	1.8	3.0	4.2
	L=2×B	8.0	2.8	4.4	6.0
	L=3×B	12.0	4.6	6.9	9.0
5.0	L=B	5.0	2.0	3.2	4.5
	L=1.5×B	7.5	3.6	5.4	7.3
	L=2×B	10.0	5.1	7.4	9.8
	L=3×B	15.0	7.4	10.8	14.3
6.0	L=B	6.0	3.4	5.2	7.1
	L=1.5×B	9.0	5.7	8.1	10.9
	L=2×B	12.0	7.5	11.0	14.4
	L=3×B	18.0	10.7	15.1	19.0

Table n.4.16

Expected IMMEDIATE settlement

Bearing level at existing grade



Foundation dimensions		Expected IMMEDIATE settlement due to an applied TOTAL pressure equal to:		
B	L	300kPa	400kpa	500kPa
(m)	(m)	(cm)	(cm)	(cm)
1.0	**2.0**	0.9	1.2	1.6
1.5	**5.0**	1.5	2.1	2.7
1.7	**5.0**	1.6	2.3	2.9
2.0	**5.0**	1.8	2.5	3.3
3.0	**3.5**	2.0	2.8	3.5
	5.0	2.4	3.3	4.3
4.0	**5.0**	2.9	4.0	5.1

Bearing level 0.80m below grade



Foundation dimensions		Expected IMMEDIATE settlement due to an applied TOTAL pressure equal to:		
B	L	300kPa	400kpa	500kPa
(m)	(m)	(cm)	(cm)	(cm)
1.0	**2.0**	0.7	1.0	1.2
1.5	**5.0**	1.2	1.7	2.3
1.7	**5.0**	1.3	1.9	2.5
2.0	**5.0**	1.5	2.2	2.8
3.0	**3.5**	1.6	2.3	3.1
	5.0	2.0	2.9	3.8
4.0	**5.0**	2.5	3.6	4.6

Table n.4.17

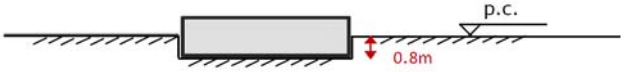
Expected DELAYED settlement

Bearing level at existing grade



Foundation dimensions		Expected DELAYED settlement due to an applied TOTAL pressure equal to:		
B	L	300kPa	400kpa	500kPa
(m)	(m)	(cm)	(cm)	(cm)
1.0	**2.0**	0.0	0.0	0.0
1.5	**5.0**	0.0	0.2	0.5
1.7	**5.0**	0.0	0.3	0.7
2.0	**5.0**	0.2	0.6	0.9
3.0	**3.5**	0.2	0.7	1.0
	5.0	0.7	1.3	1.9
4.0	**5.0**	1.3	2.1	3.0

Bearing level 0.80m below grade



Foundation dimensions		Expected DELAYED settlement due to an applied TOTAL pressure equal to:		
B	L	300kPa	400kpa	500kPa
(m)	(m)	(cm)	(cm)	(cm)
1.0	**2.0**	0.0	0.0	0.0
1.5	**5.0**	0.0	0.2	0.6
1.7	**5.0**	0.0	0.4	0.8
2.0	**5.0**	0.2	0.6	1.0
3.0	**3.5**	0.3	0.7	1.1
	5.0	0.8	1.4	2.2
4.0	**5.0**	1.3	2.3	3.2

Table n.4.18

Expected IMMEDIATE settlement

Bearing level at existing grade



Foundation dimensions		Expected IMMEDIATE settlement due to an applied TOTAL pressure equal to:				
B	**L**	**100kPa**	**200kPa**	**300kPa**	**400kpa**	**500kPa**
(m)	(m)	(cm)	(cm)	(cm)	(cm)	(cm)
0.5	**0.5**	0.1	0.3	0.4	0.5	0.7
1.0	**1.0**	0.2	0.5	0.7	1.0	1.2
1.7	**8.0**	0.5	1.2	1.9	2.7	3.5

Table n.4.19

Expected DELAYED settlement

Bearing level at existing grade



Foundation dimensions		Expected DELAYED settlement due to an applied TOTAL pressure equal to:				
B	**L**	**100kPa**	**200kpa**	**500kPa**	**300kPa**	**400kpa**
(m)	(m)	(cm)	(cm)	(cm)	(cm)	(cm)
0.5	**0.5**	0.0	0.0	0.0	0.0	0.0
1.0	**1.0**	0.0	0.0	0.0	0.0	0.0
1.7	**8.0**	0.0	0.0	0.5	0.9	1.4

Table n.4.20

FIGURES

Piomboni Yard

Geotechnical report

Site characterization and shallow foundations geotechnical design

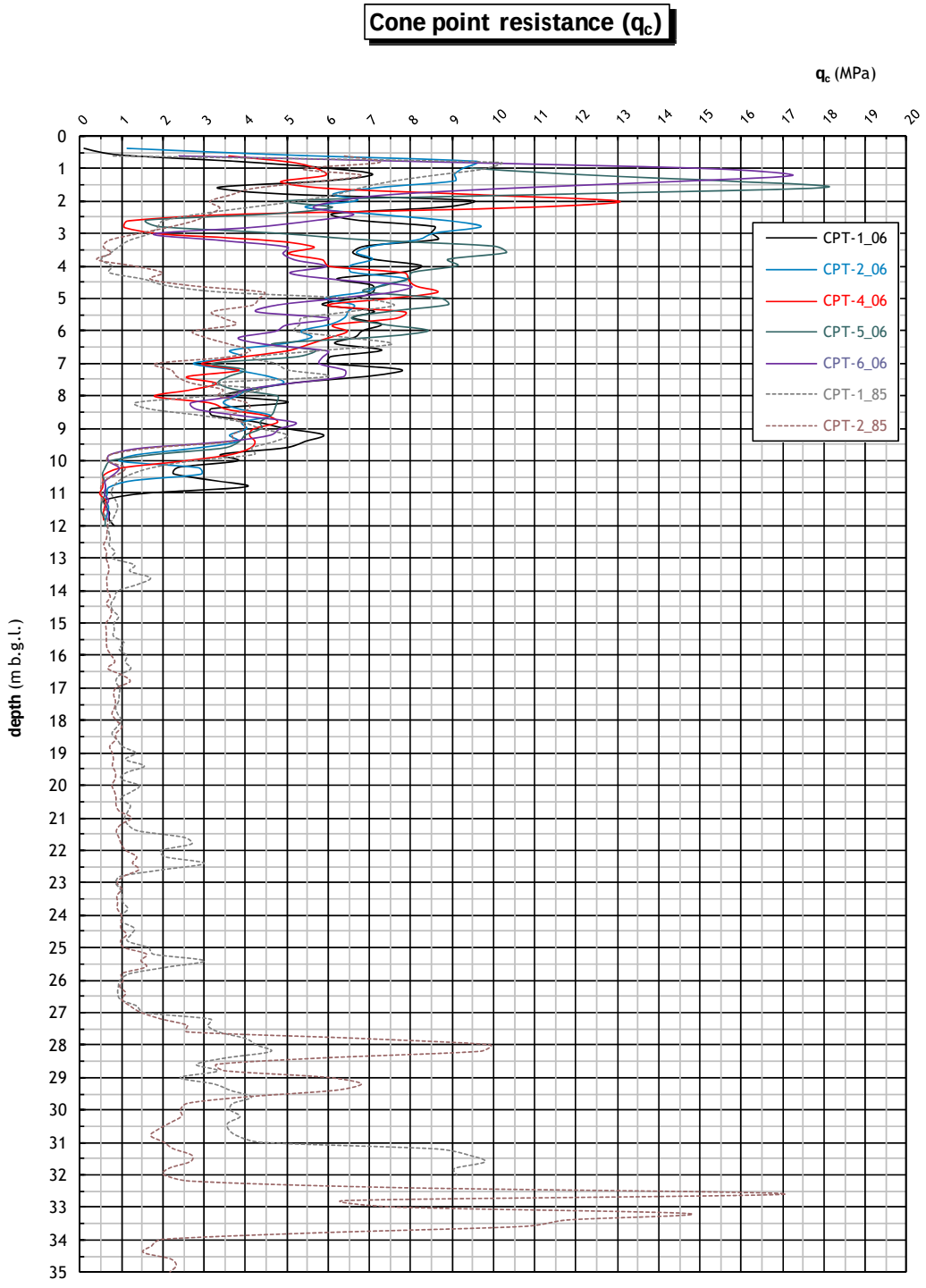

Cone point resistance (q_c)
q_c (MPa)
depth (m b.g.l.)
CPT-1_06
CPT-2_06
CPT-4_06
CPT-5_06
CPT-6_06
CPT-1_85
CPT-2_85

Figure n.3.1

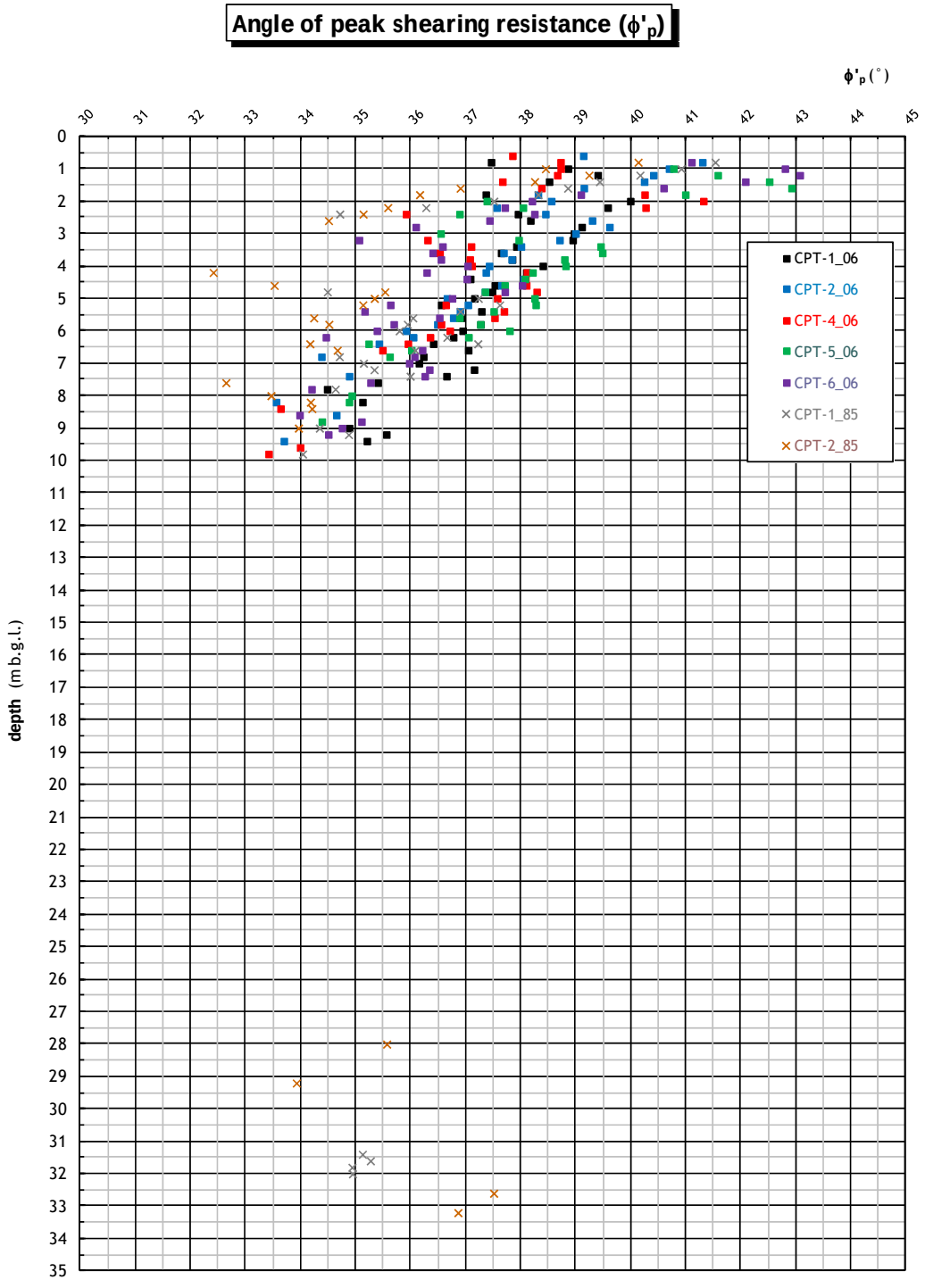

Angle of peak shearing resistance (ϕ'p)
ϕ'p (°)
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
depth (m.b.g.l.)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
CPT-1_06
CPT-2_06
CPT-4_06
CPT-5_06
CPT-6_06
CPT-1_85
CPT-2_85

Figure n.3.2

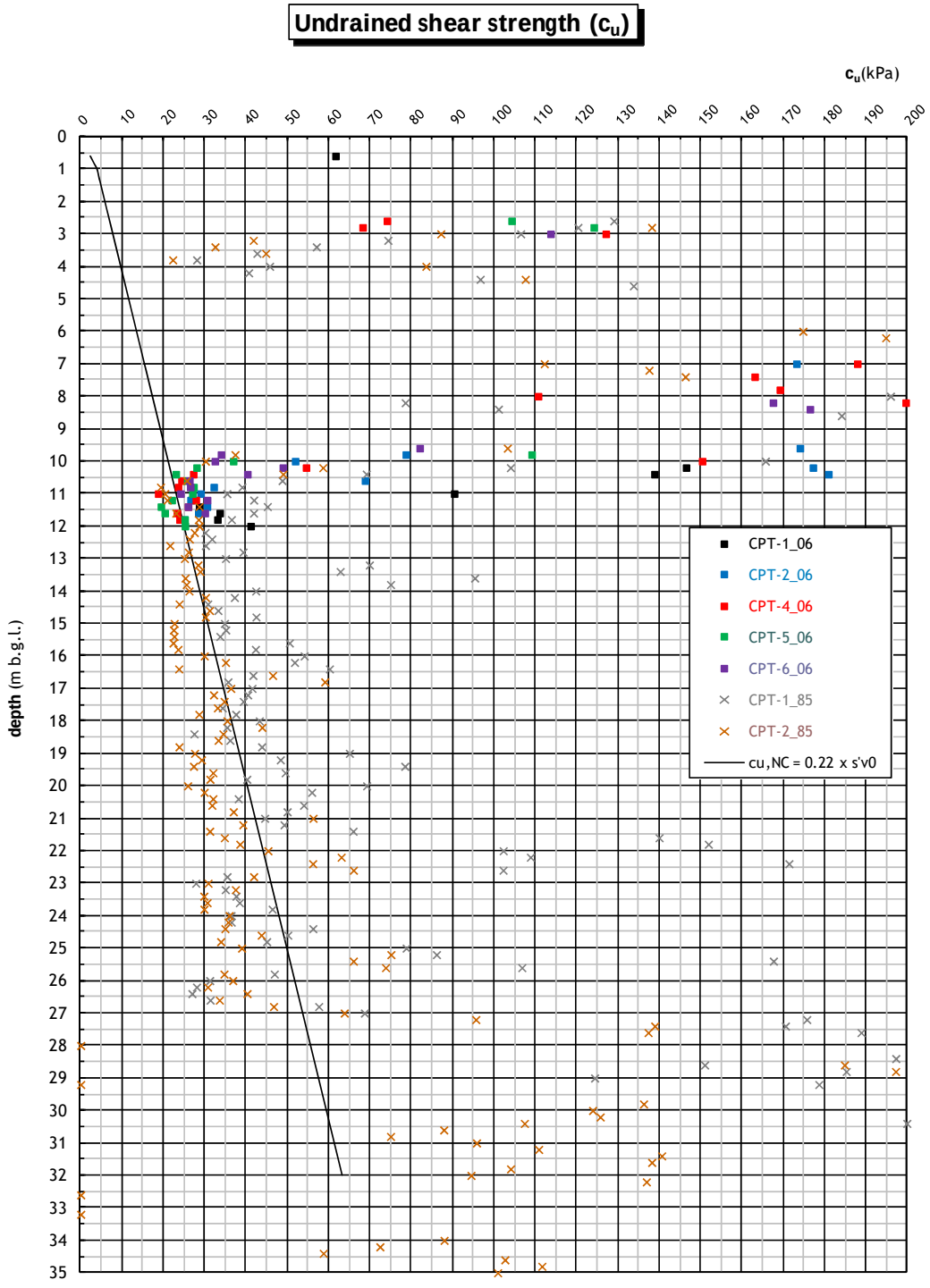

Undrained shear strength (c_u)
c_u(kPa)
depth (m b.g.l.)
CPT-1_06
CPT-2_06
CPT-4_06
CPT-5_06
CPT-6_06
CPT-1_85
CPT-2_85
cu,NC = 0.22 x s'v0

Figure n.3.3

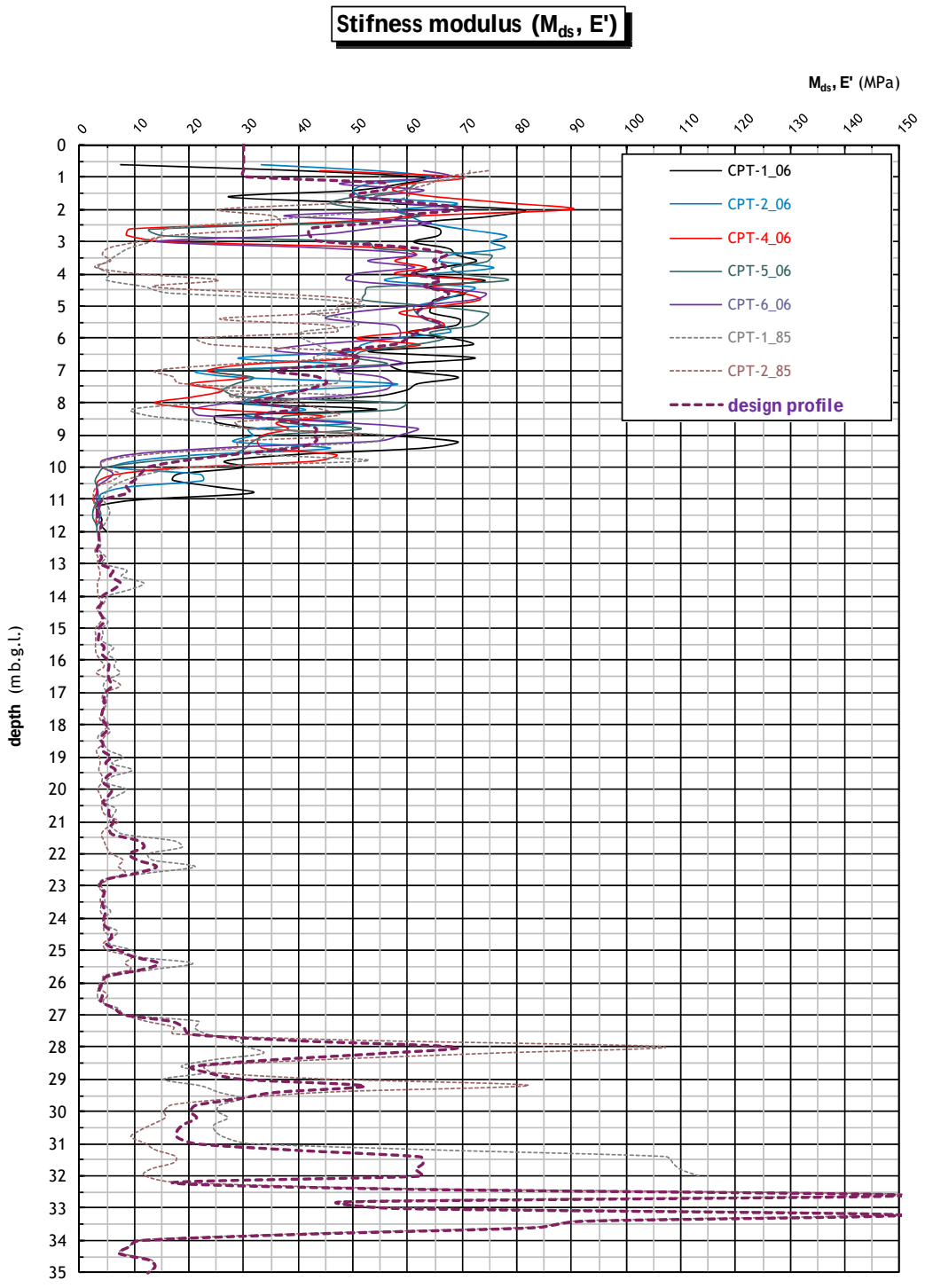

Stifness modulus (Mds, E')
Mds, E' (MPa)
depth (m.b.g.l.)
CPT-1_06
CPT-2_06
CPT-4_06
CPT-5_06
CPT-6_06
CPT-1_85
CPT-2_85
design profile

Figure n.3.4

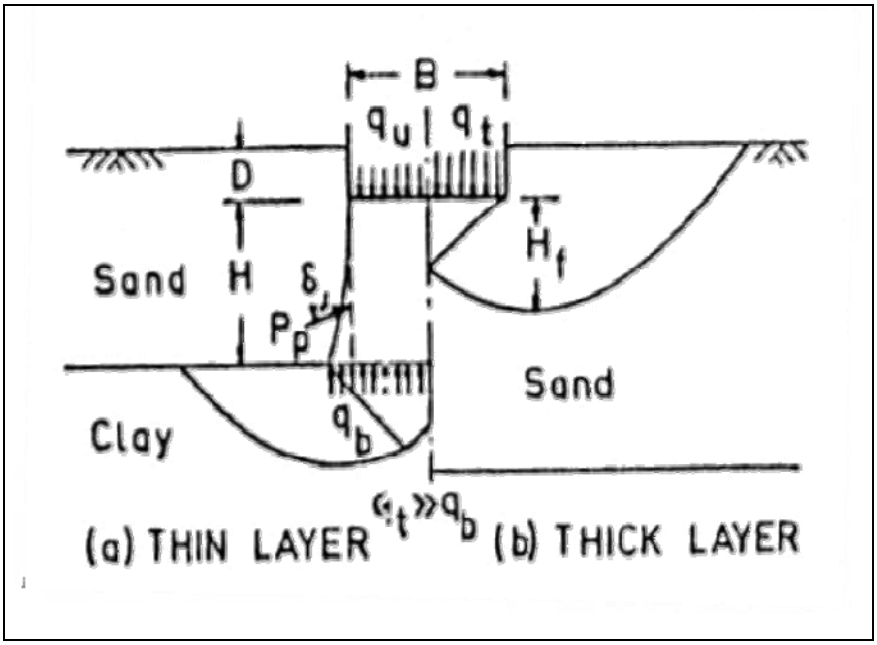


Figure n.4.1

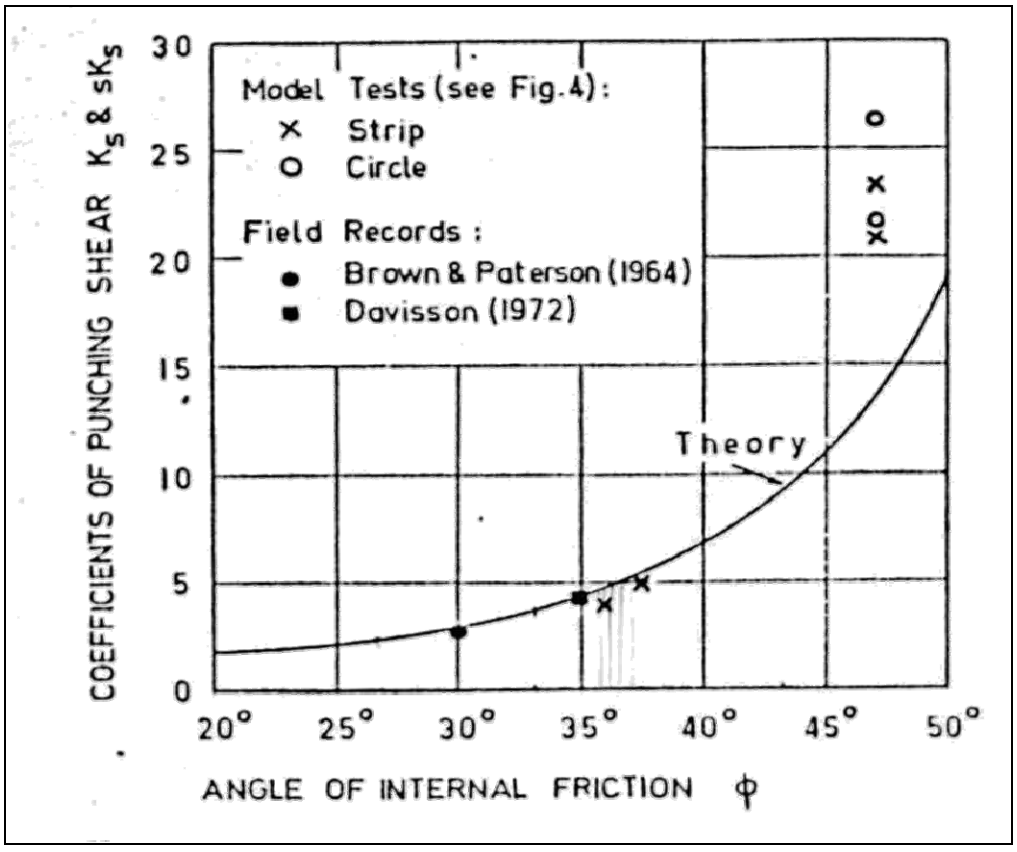


Figure n.4.2

ATTACHEMENT 1 – Detailed interpretation of CPTs

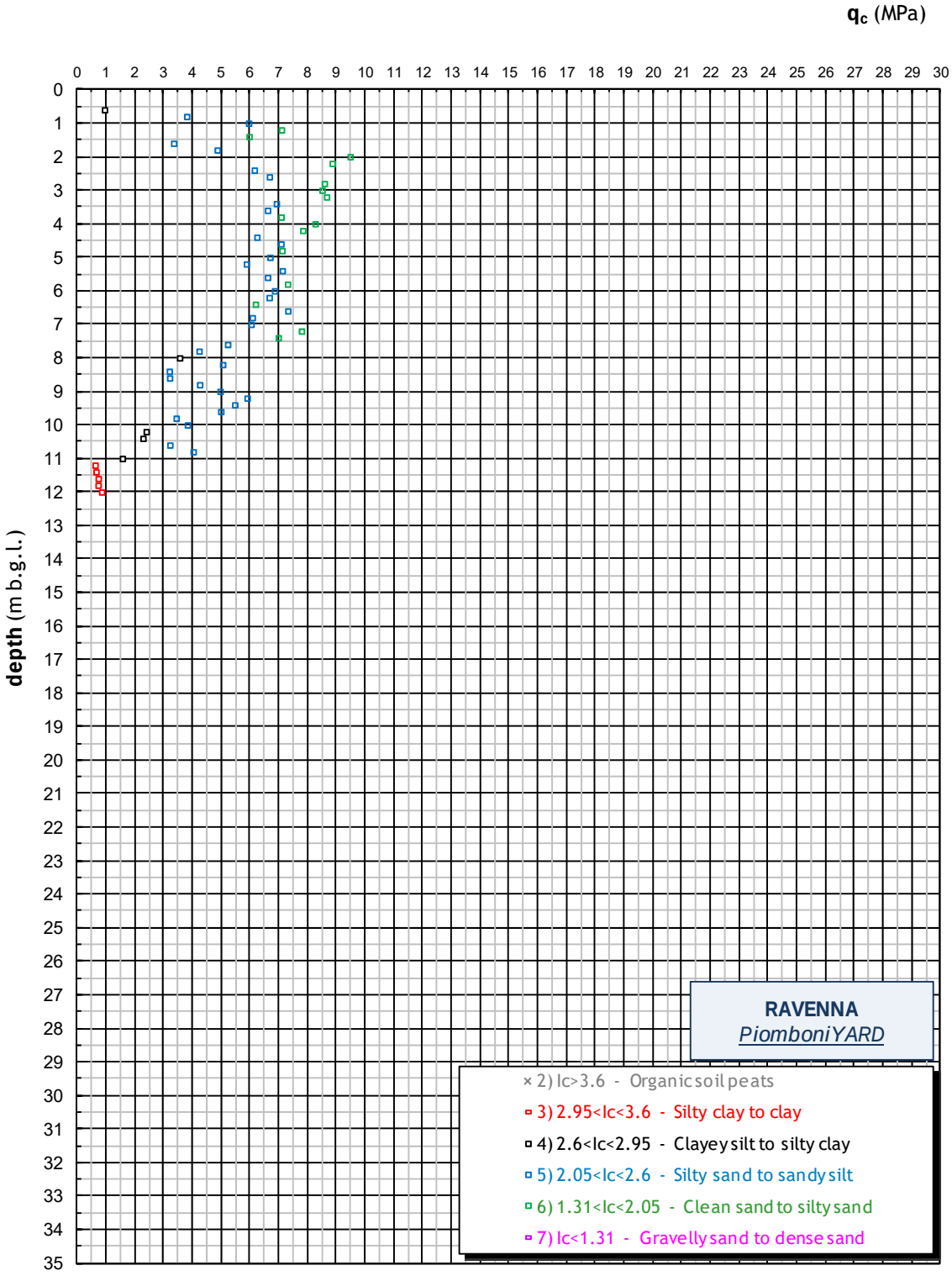
Piomboni Yard

Geotechnical report

Site characterization and shallow foundations geotechnical design

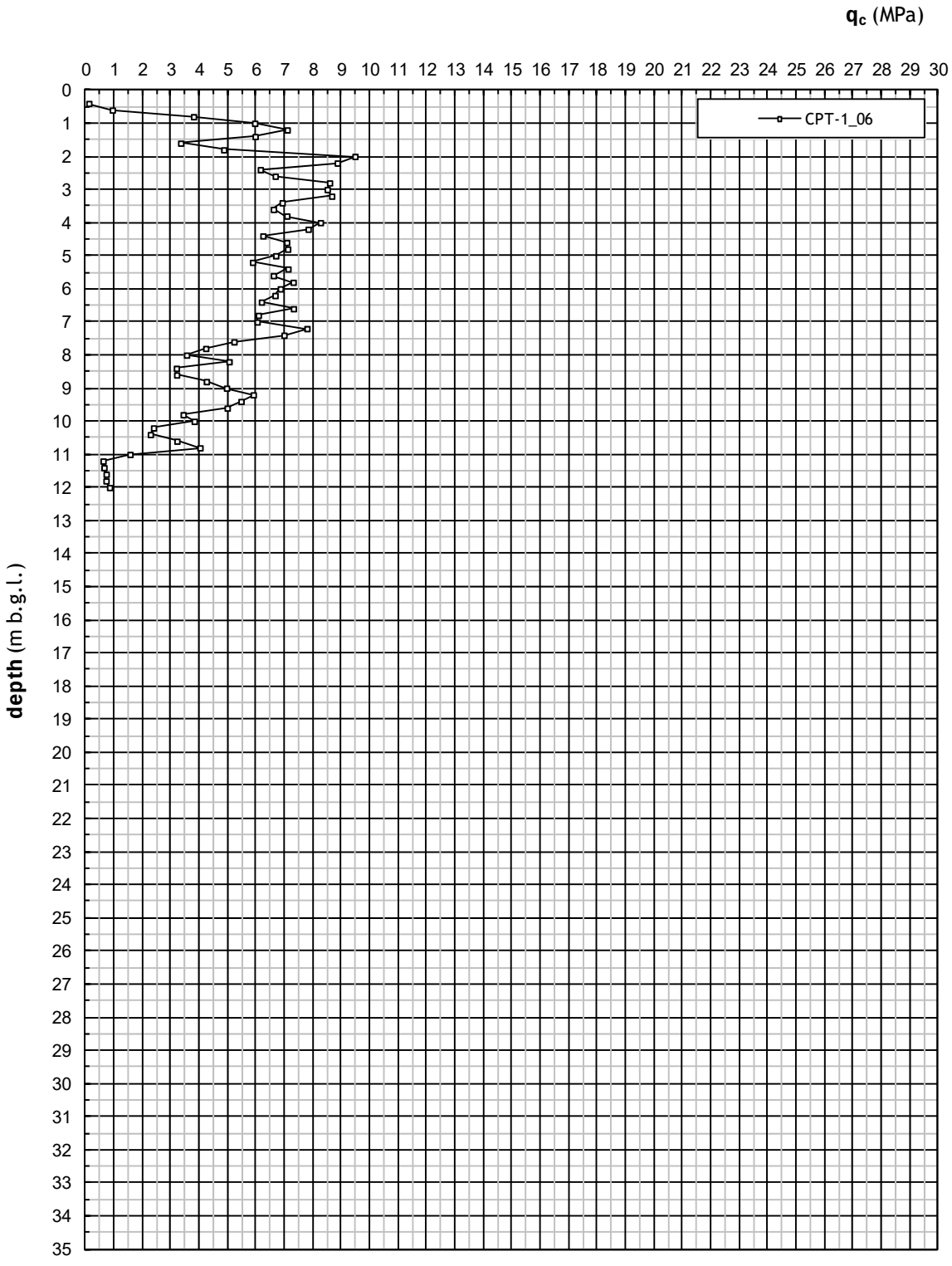
CPT-01 (2006)

Cone point resistance
CPT-1 (2006)



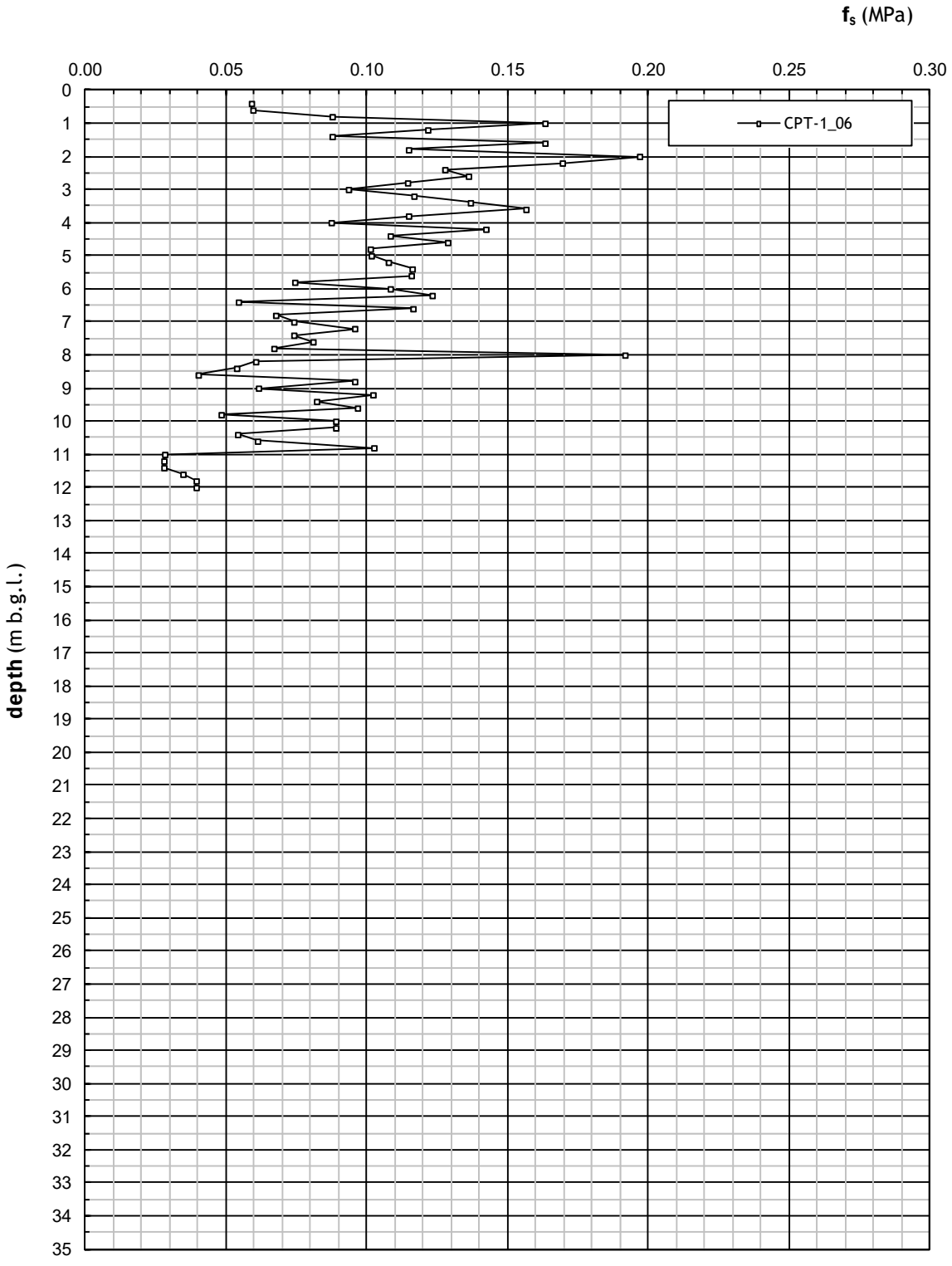
RAVENNA
PiomboniYARD

Cone point resistance



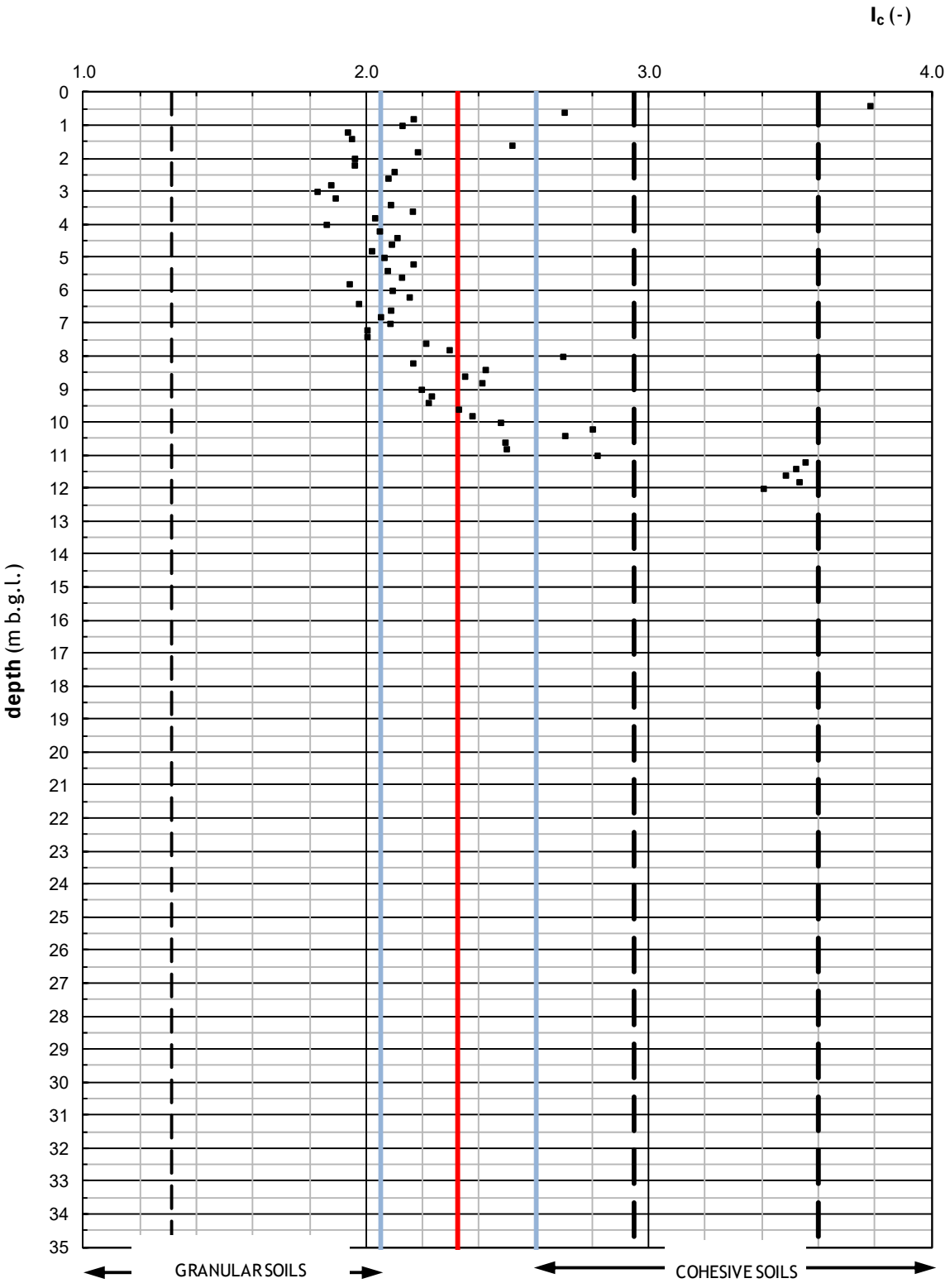
RAVENNA
PiomboniYARD

Local friction

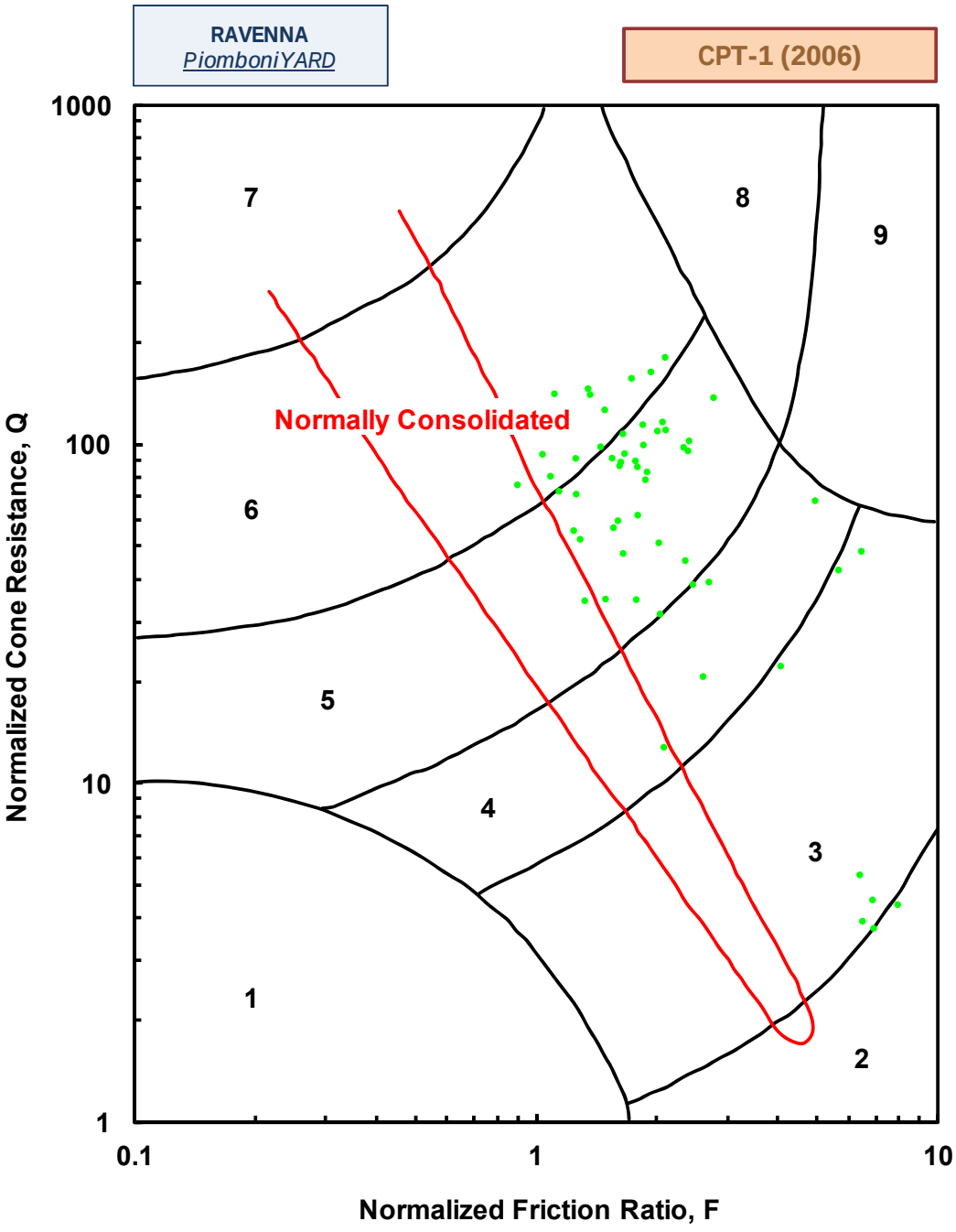


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Robertson's Index: I_c (1998)
CPT-1 (2006)



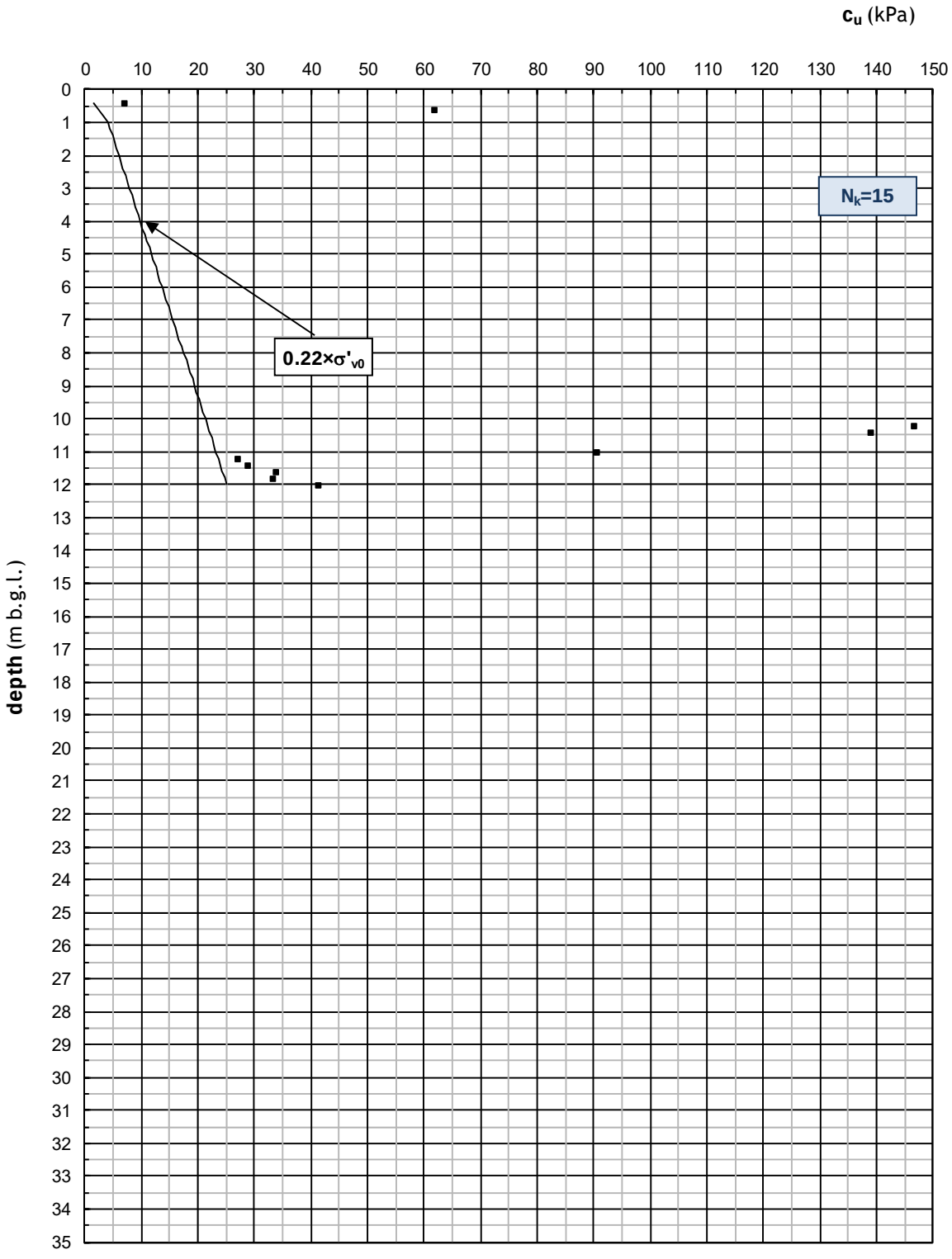
Normalized CPT soil behaviour type chart, as proposed by Robertson (1990)



Soil types: 1) sensitive, fine grained; 2)peats; 3) Silty clay to clay; 4) Clayey silt to silty clay; 5) Silty sand to sandy silt; 6) Clean sand to silty sand; 7) gravelly sand to dense sand; 8) Very stiff sand to clayey sand (heavily overconsolidated or cemented); 9) Very stiff, fine grained (heavily overconsolidated or cemented)

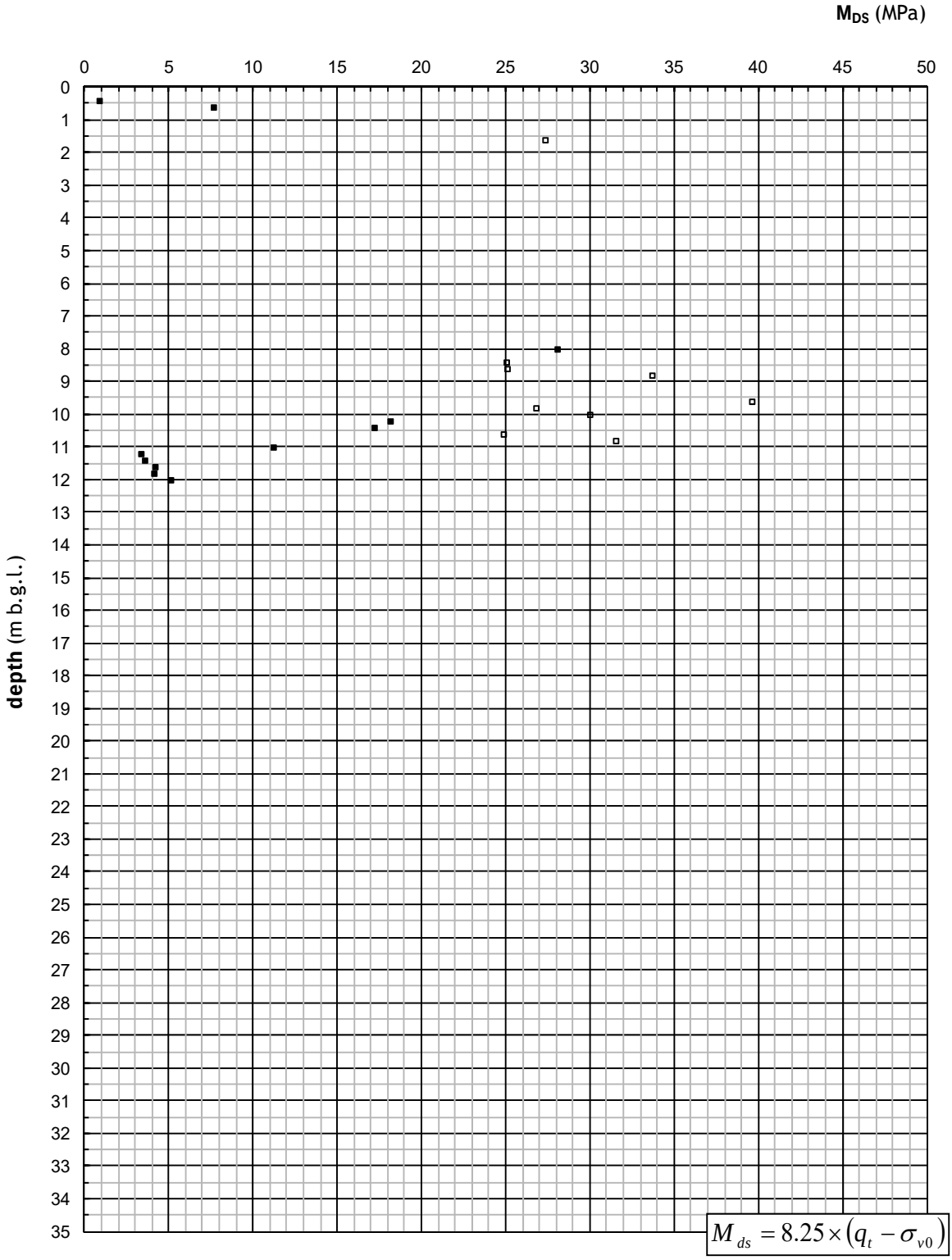
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Undrained shear strength
CPT-1 (2006)



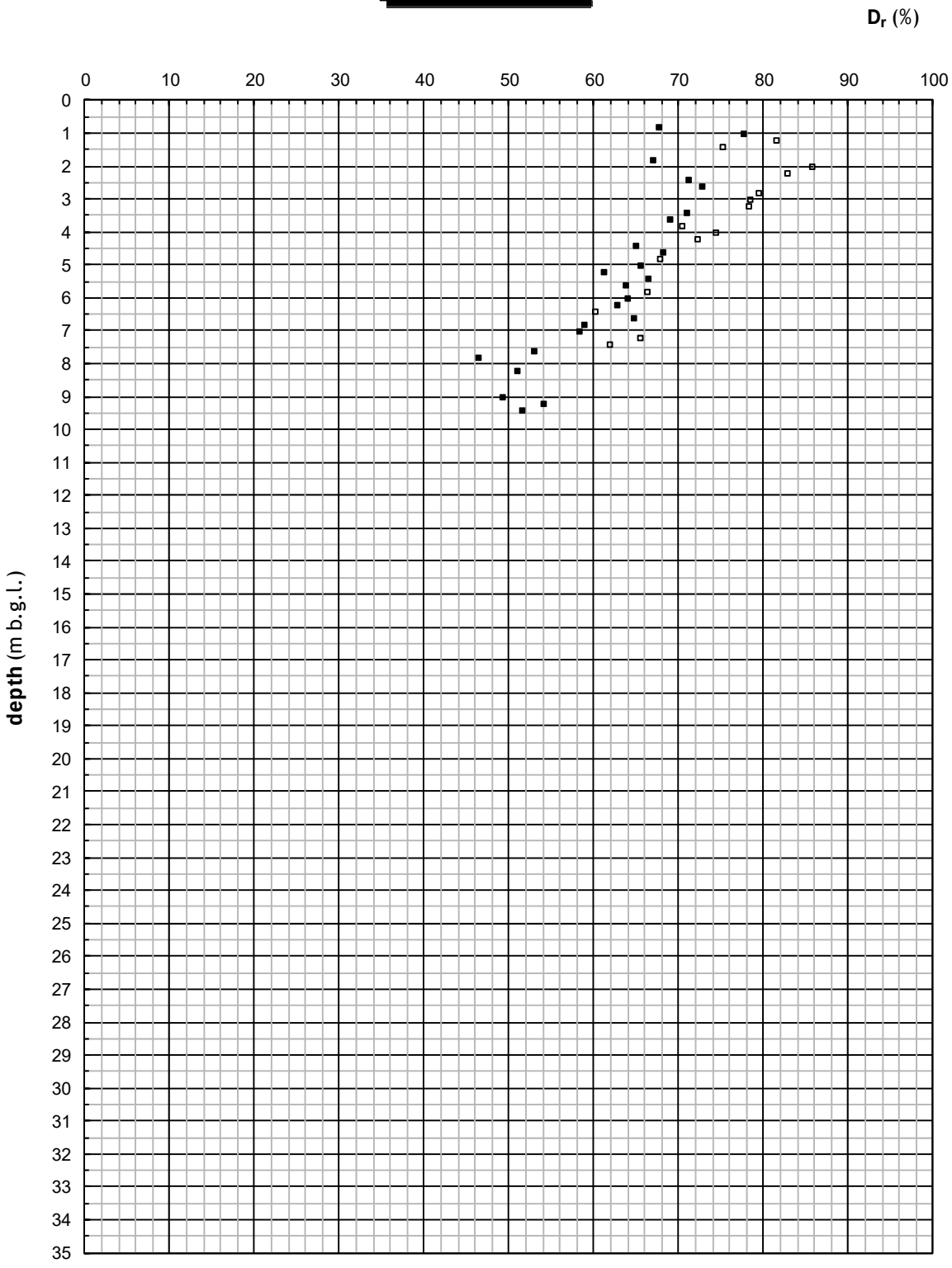
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Oedometric modulus
CPT-1 (2006)



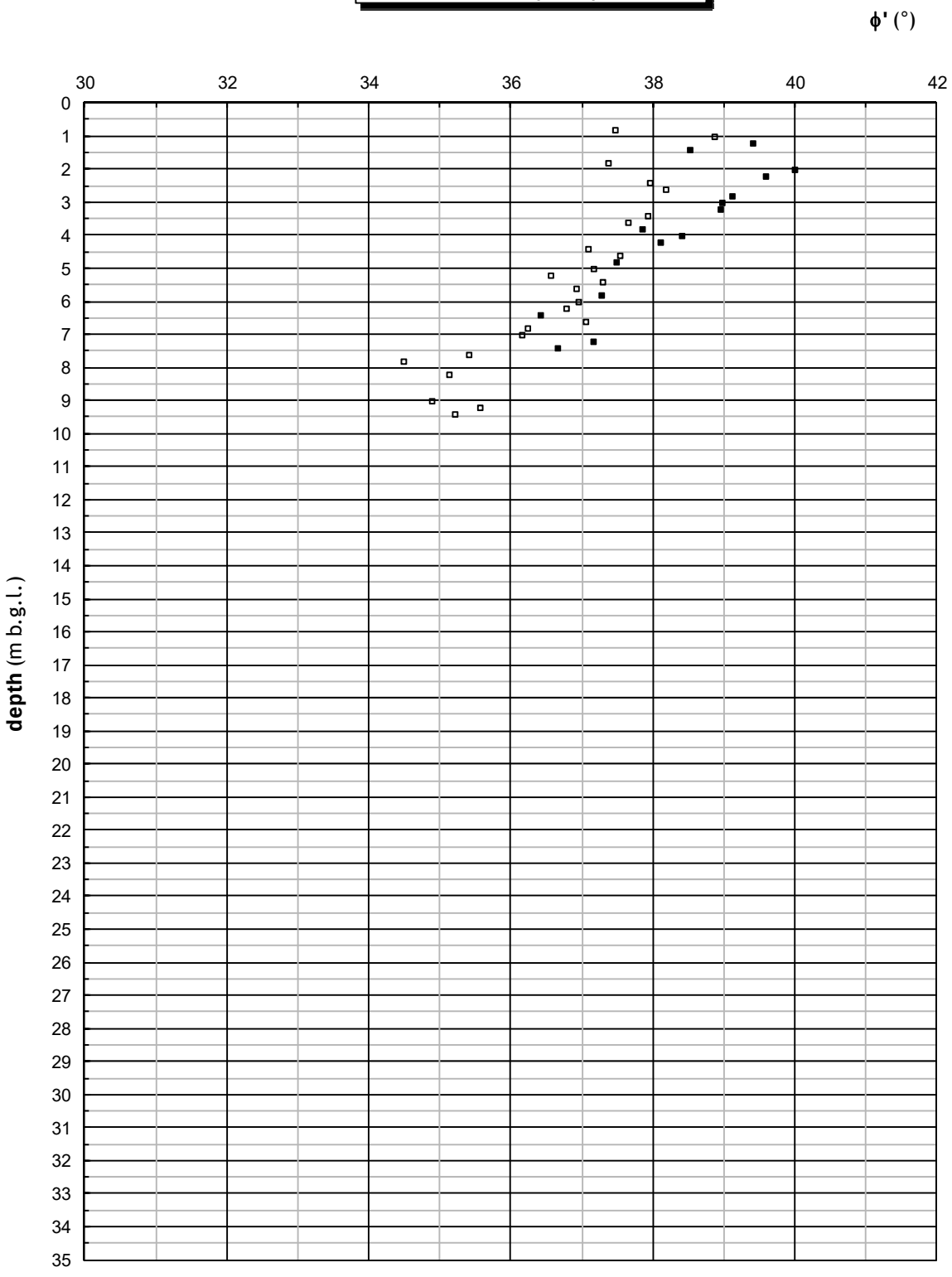
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Relative density
CPT-1 (2006)



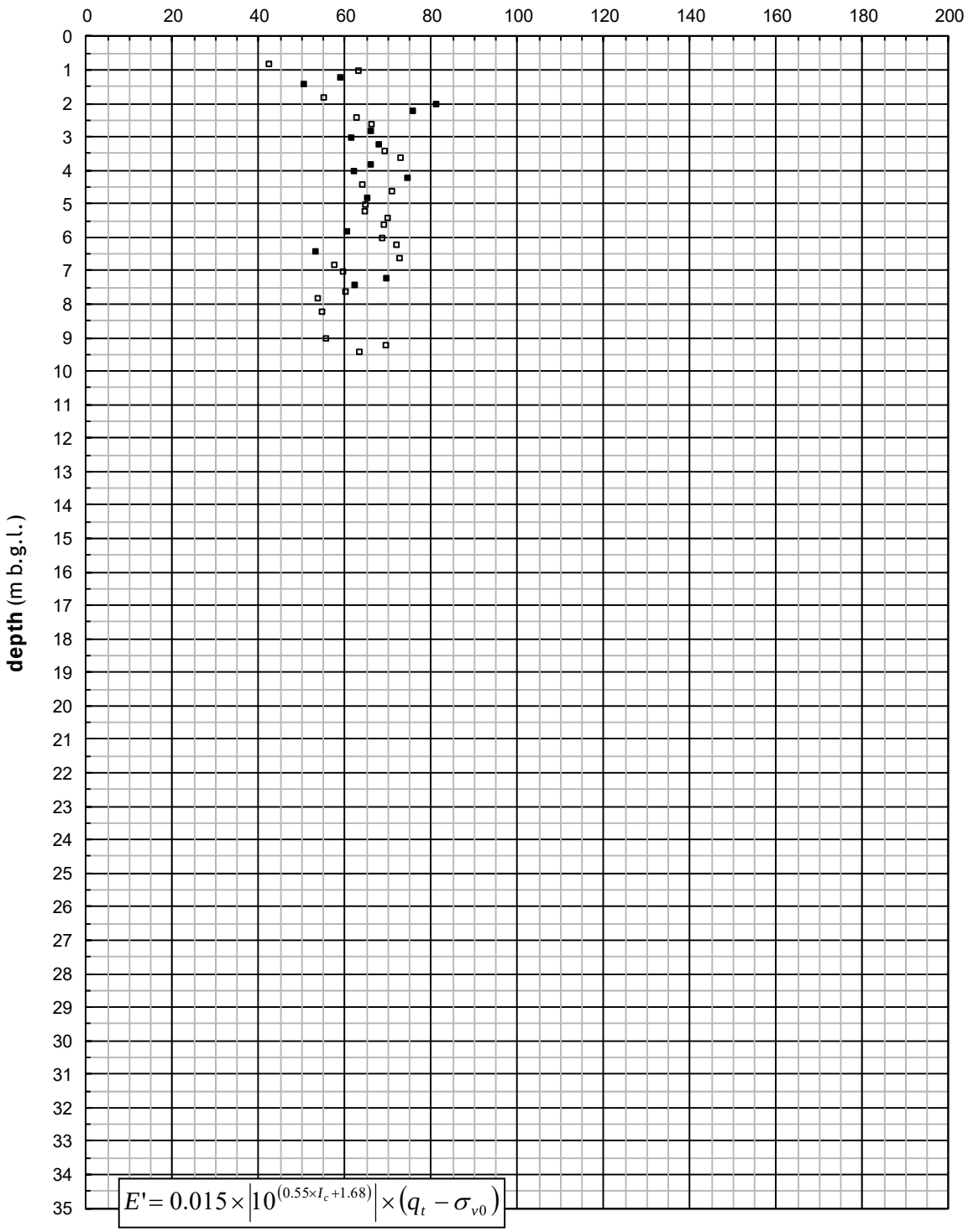
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Angle of shearing resistance
CPT-1 (2006)



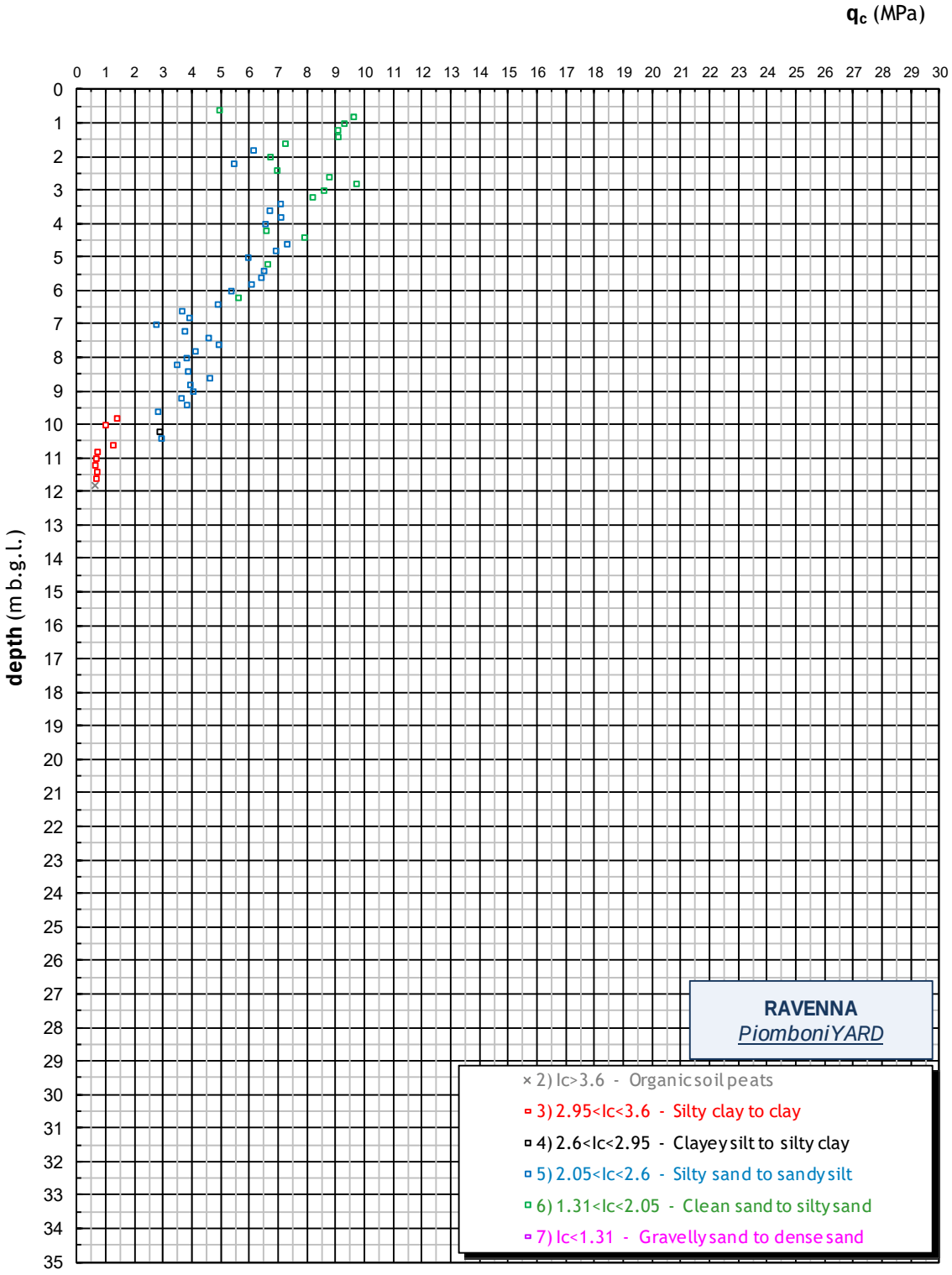
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Young's Modulus
CPT-1 (2006)



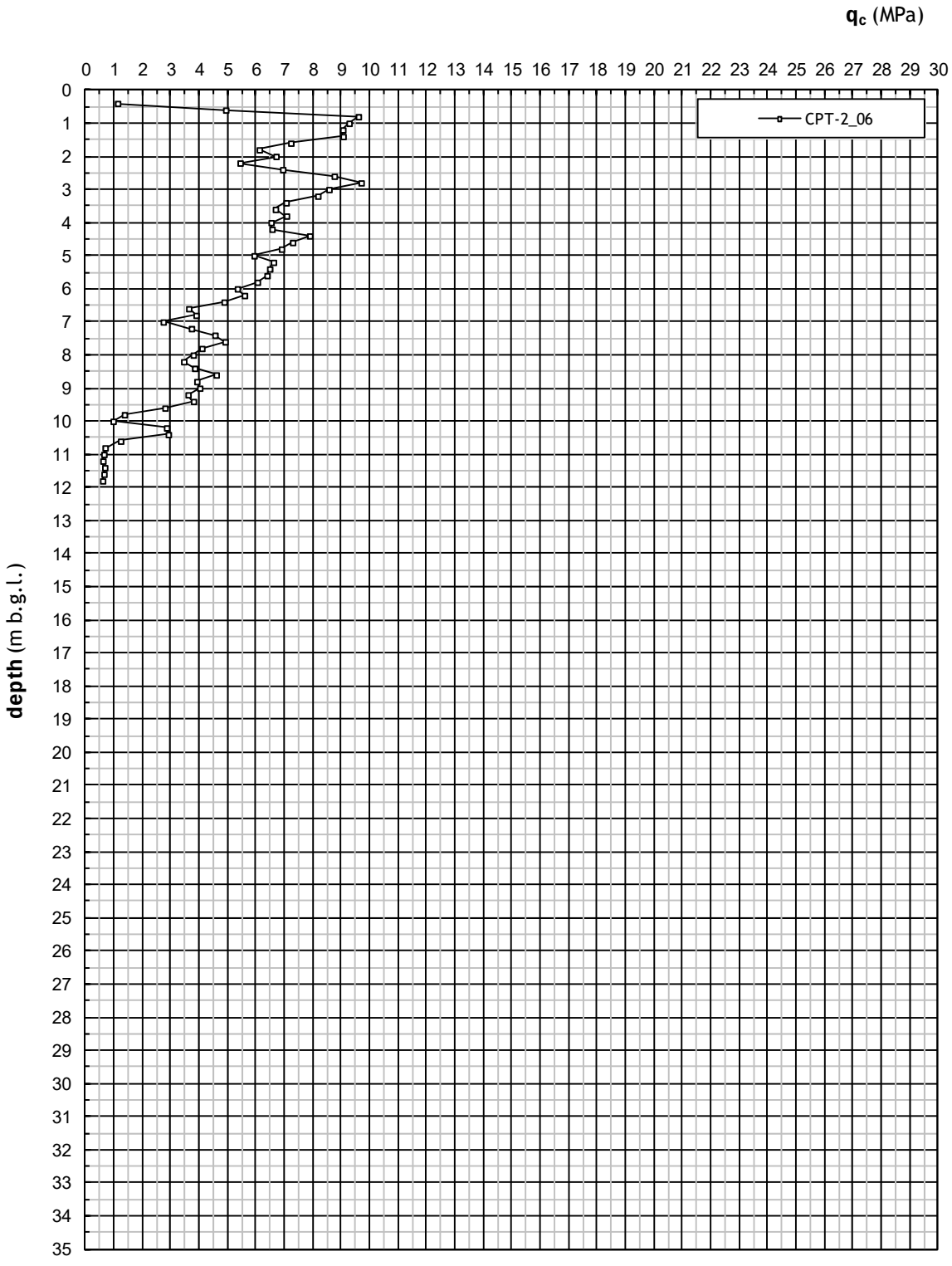
CPT-02 (2006)

Cone point resistance
CPT-2 (2006)



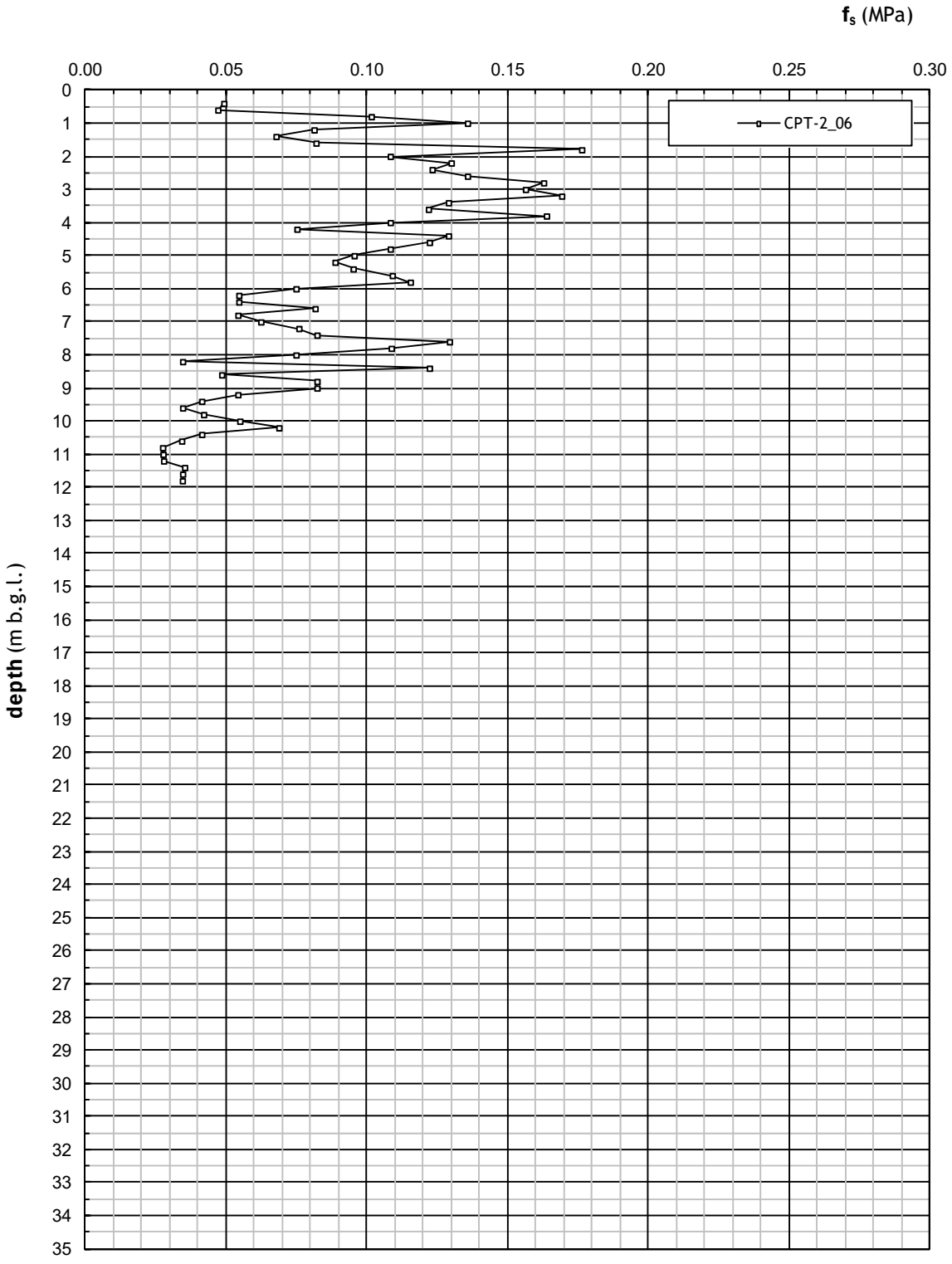
RAVENNA
PiomboniYARD

Cone point resistance



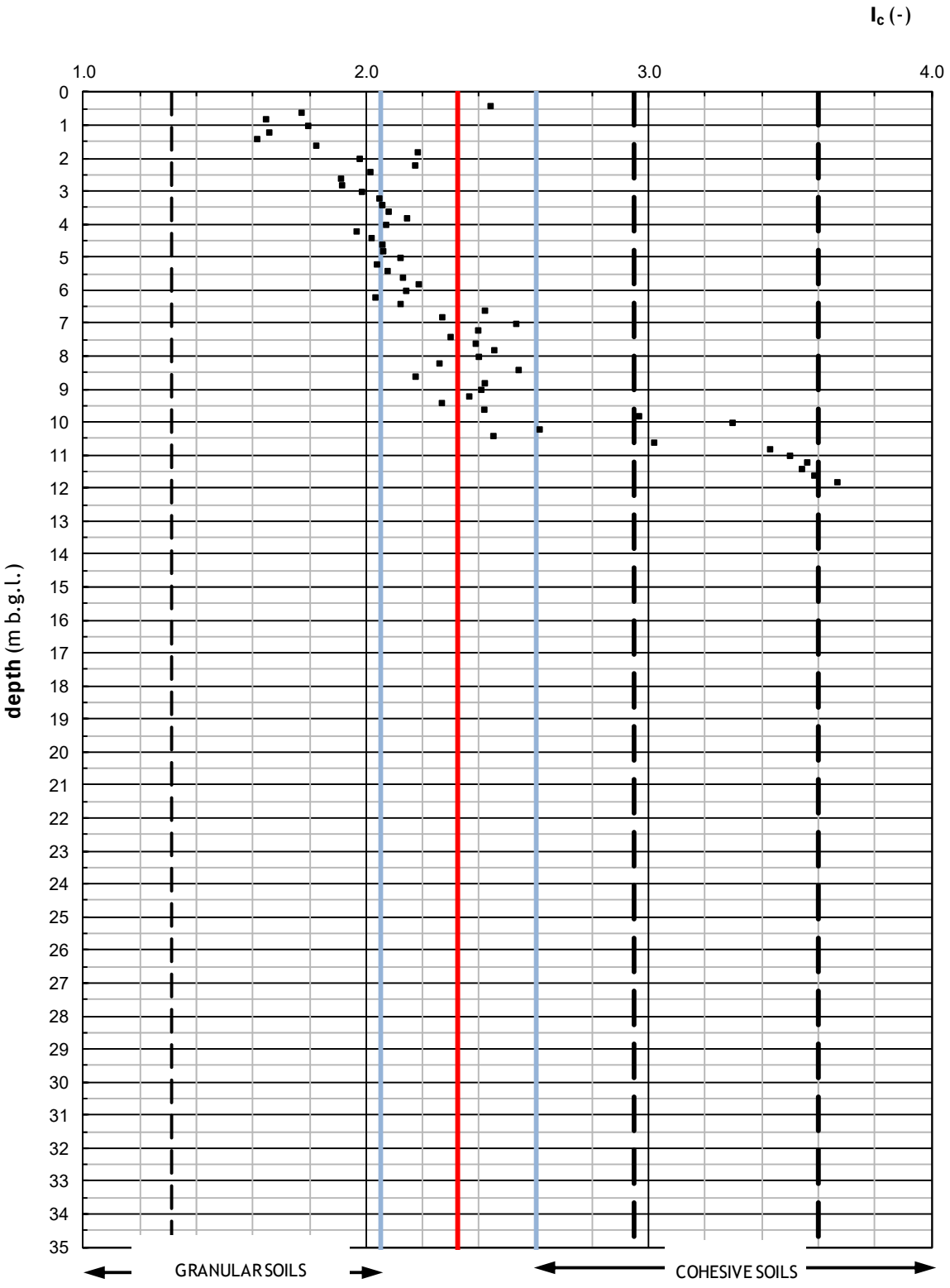
RAVENNA
PiomboniYARD

Local friction

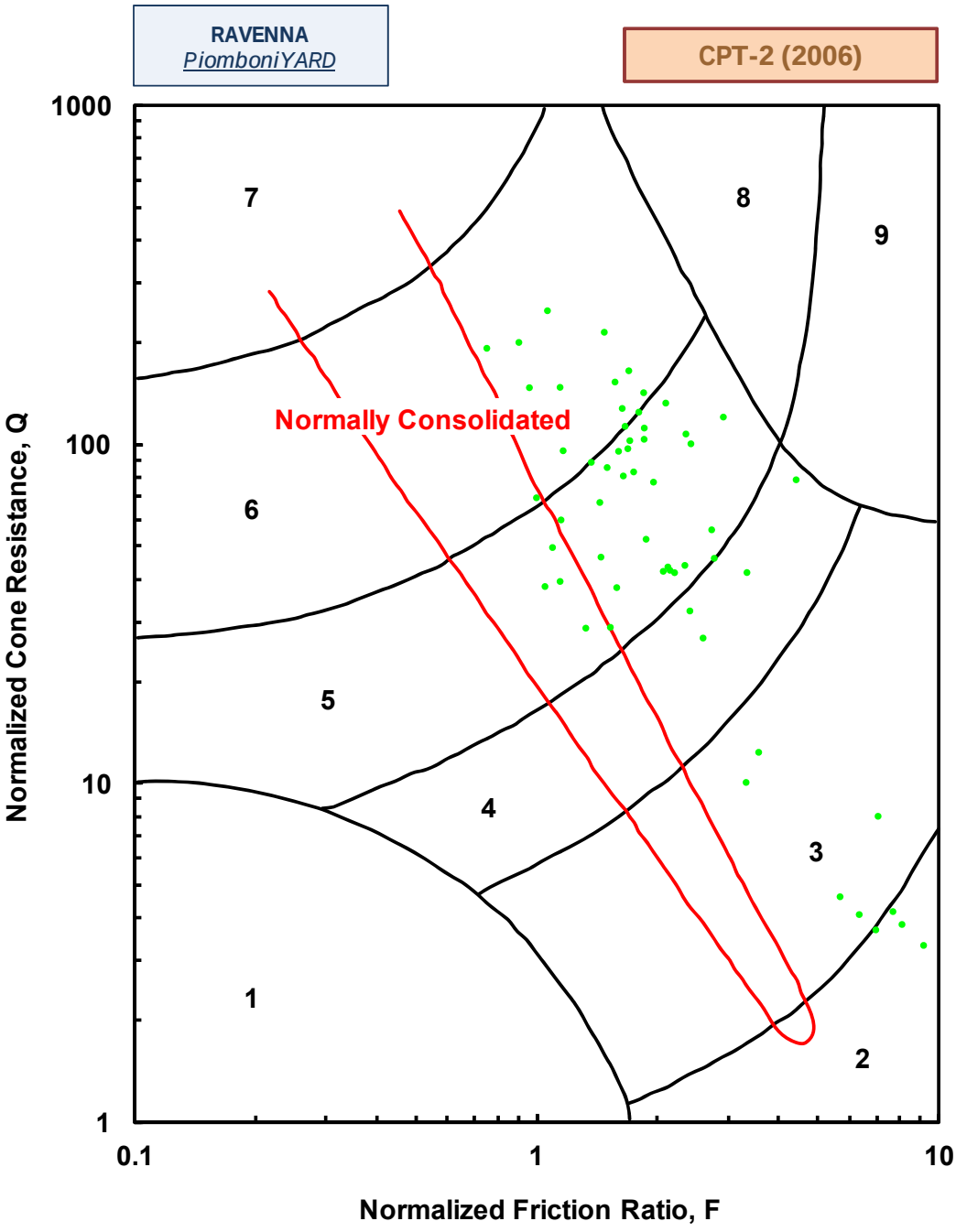


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Robertson's Index: I_c (1998)
CPT-2 (2006)



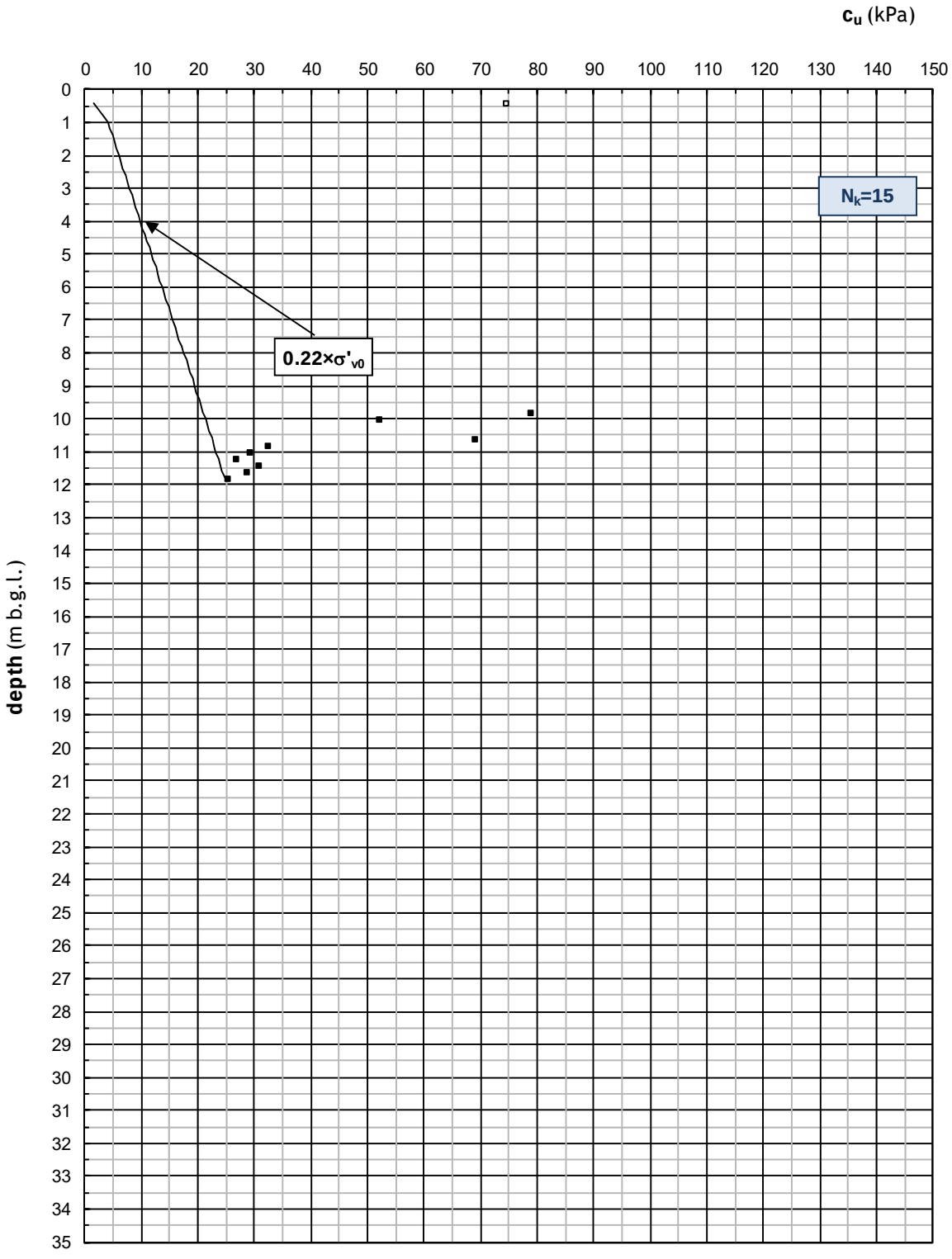
Normalized CPT soil behaviour type chart, as proposed by Robertson (1990)



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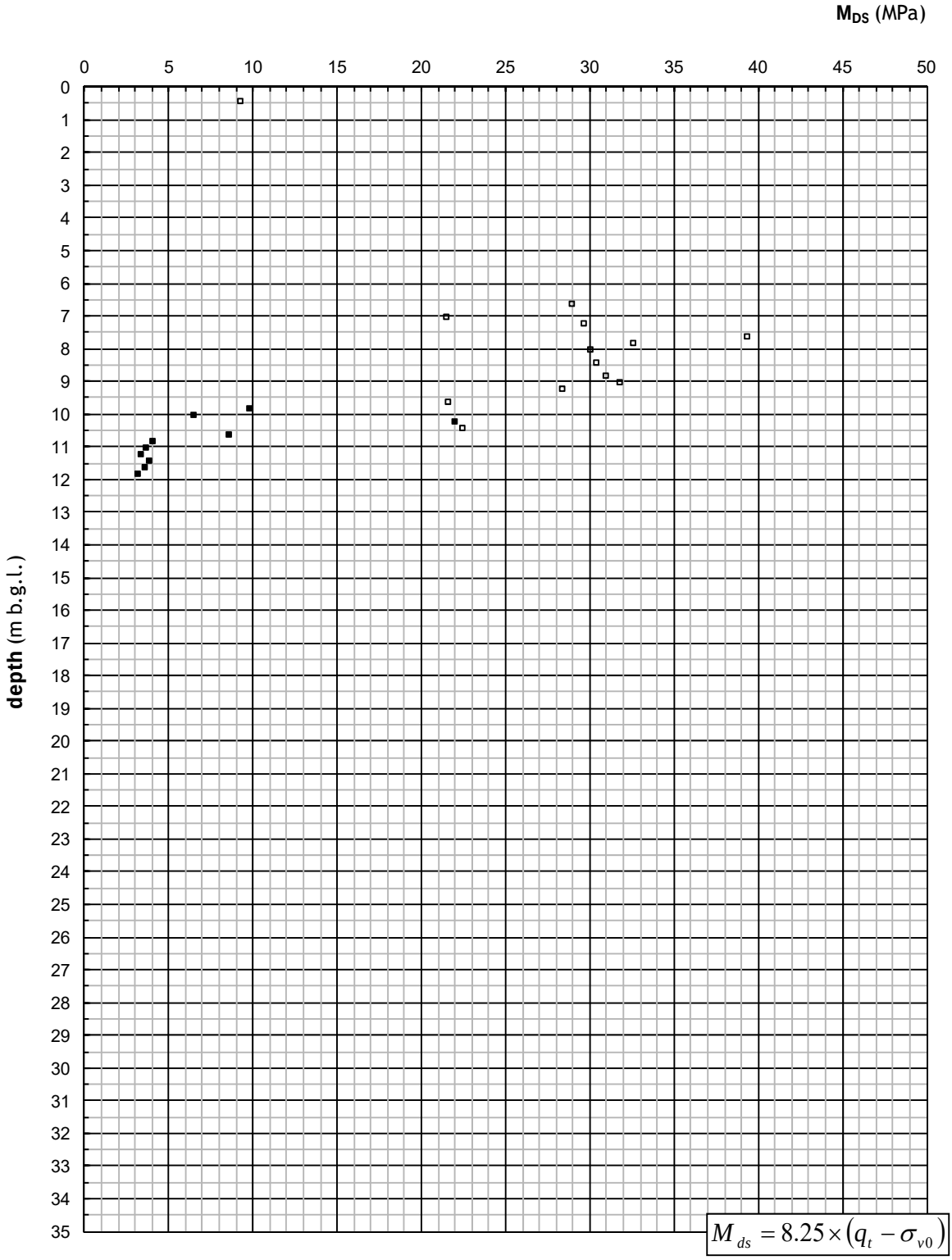
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Undrained shear strength
CPT-2 (2006)



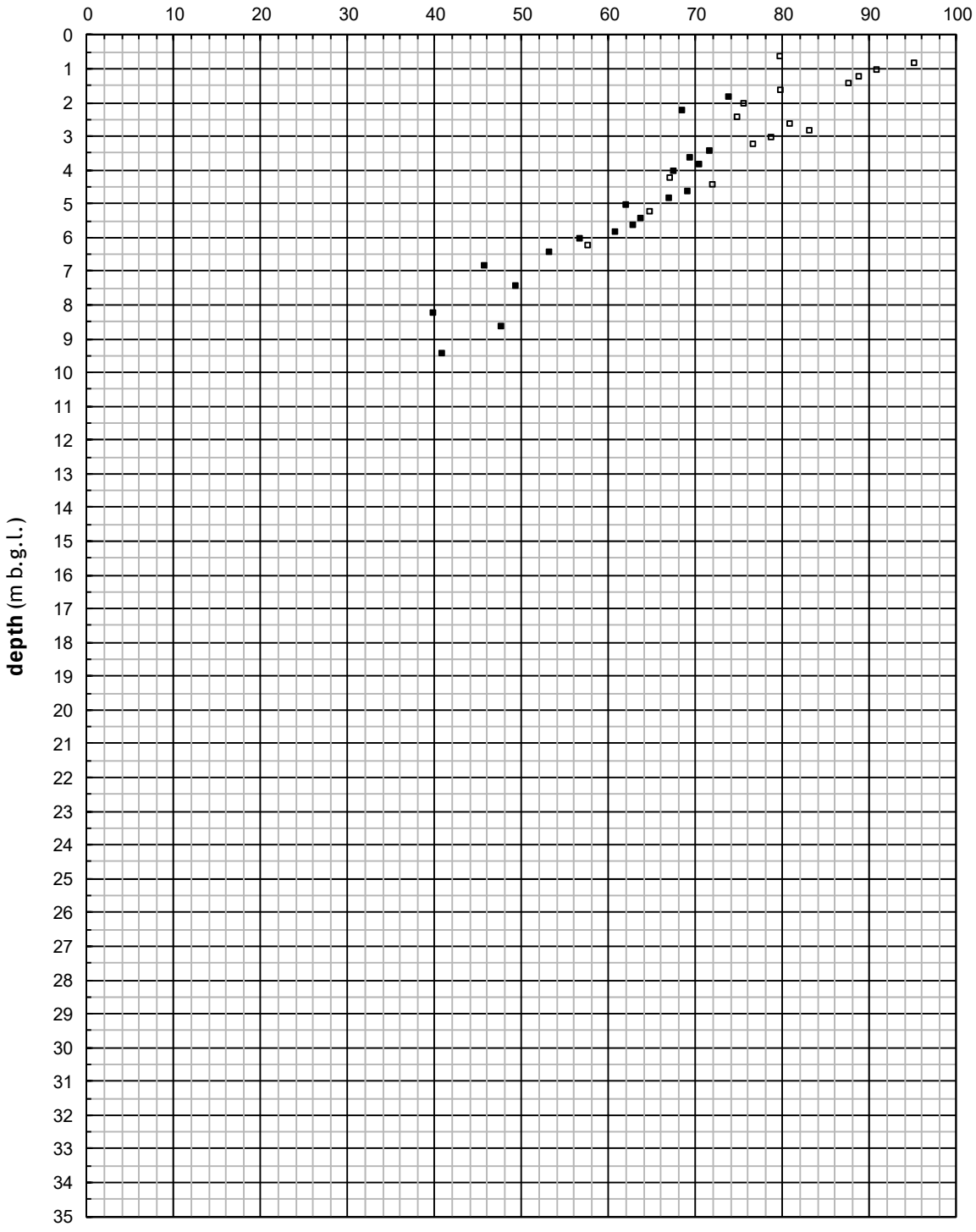
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Oedometric modulus
CPT-2 (2006)



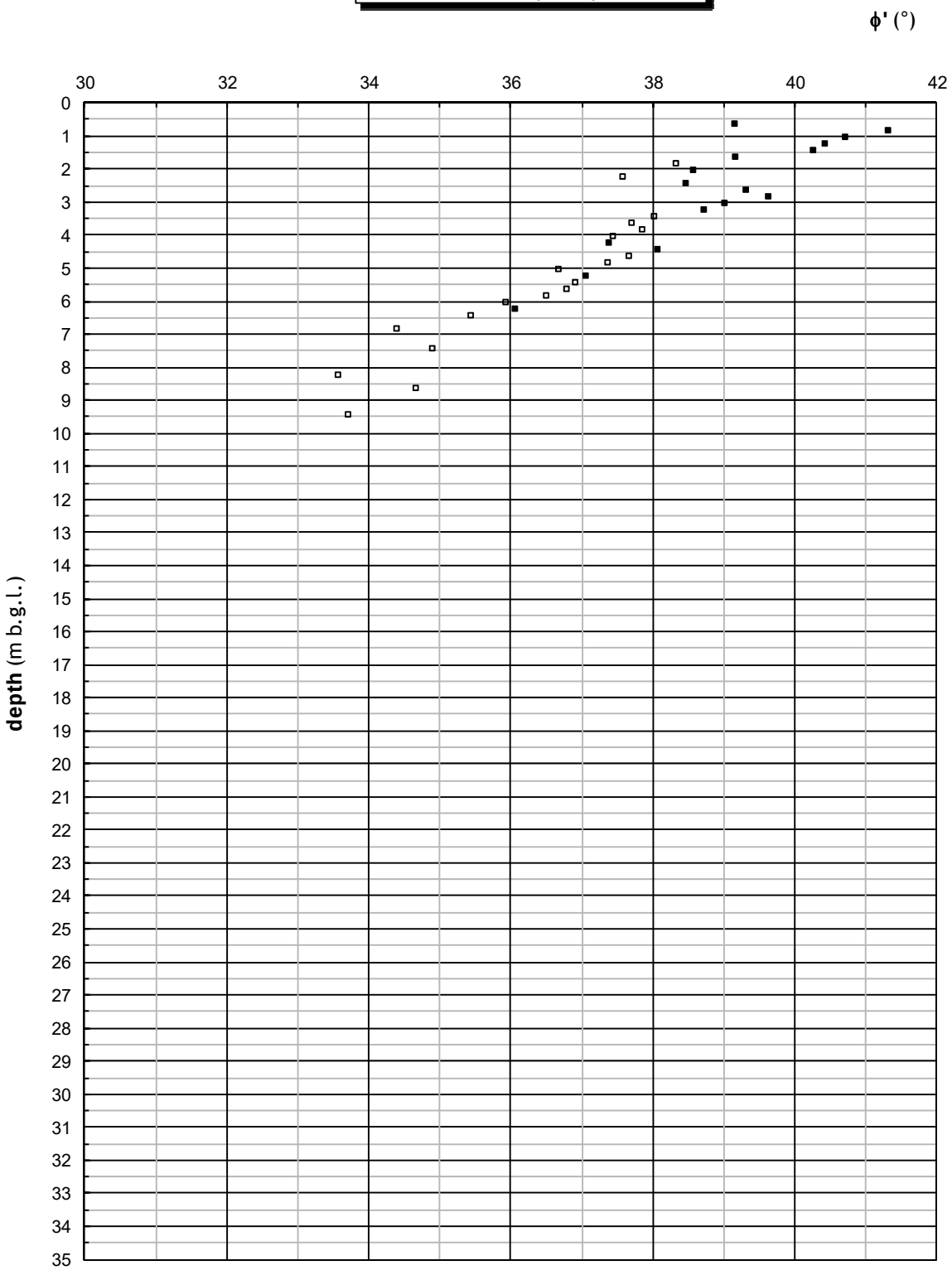
RAVENNA
PiomboniYARD

Relative density
CPT-2 (2006)



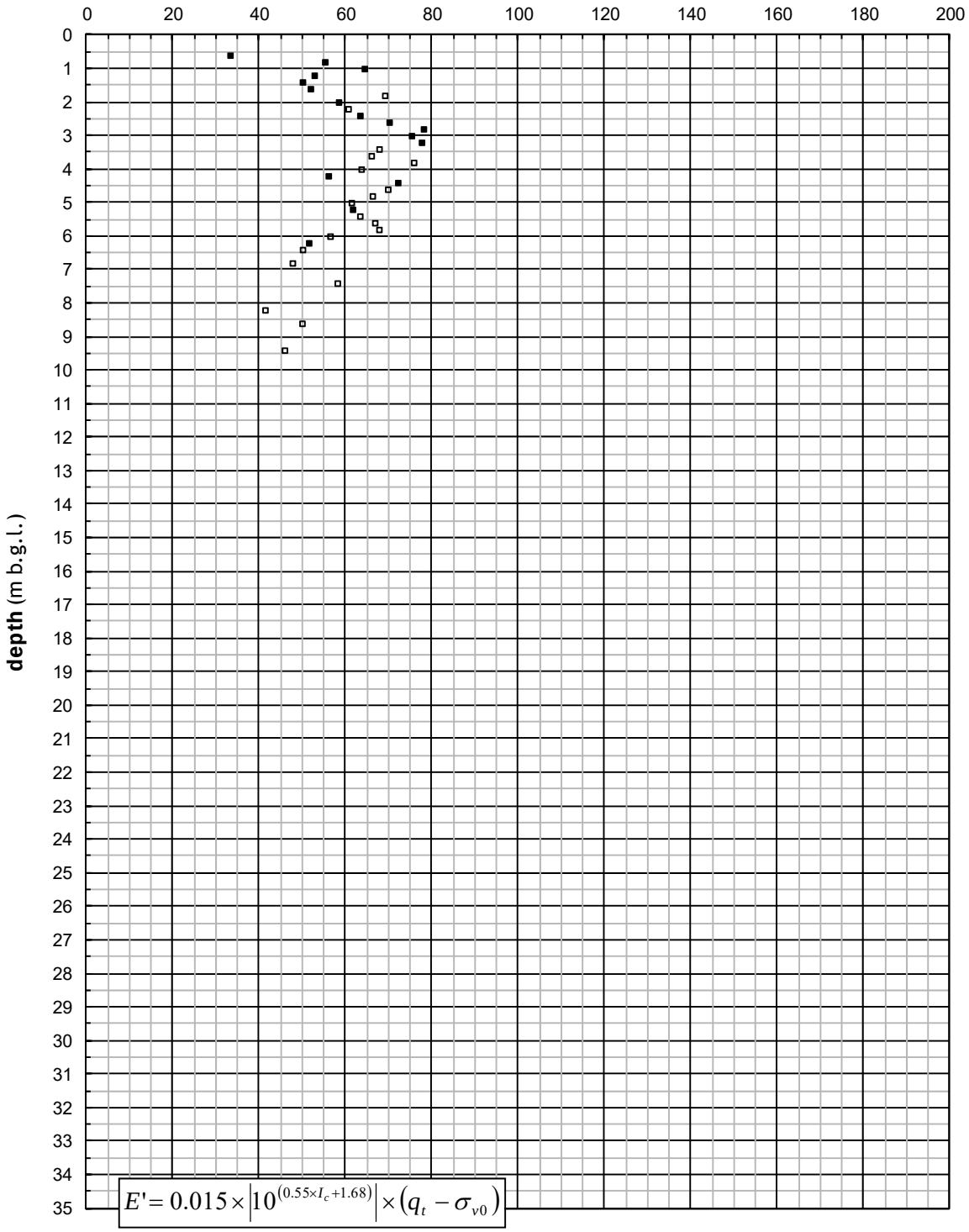
RAVENNA
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Angle of shearing resistance
CPT-2 (2006)



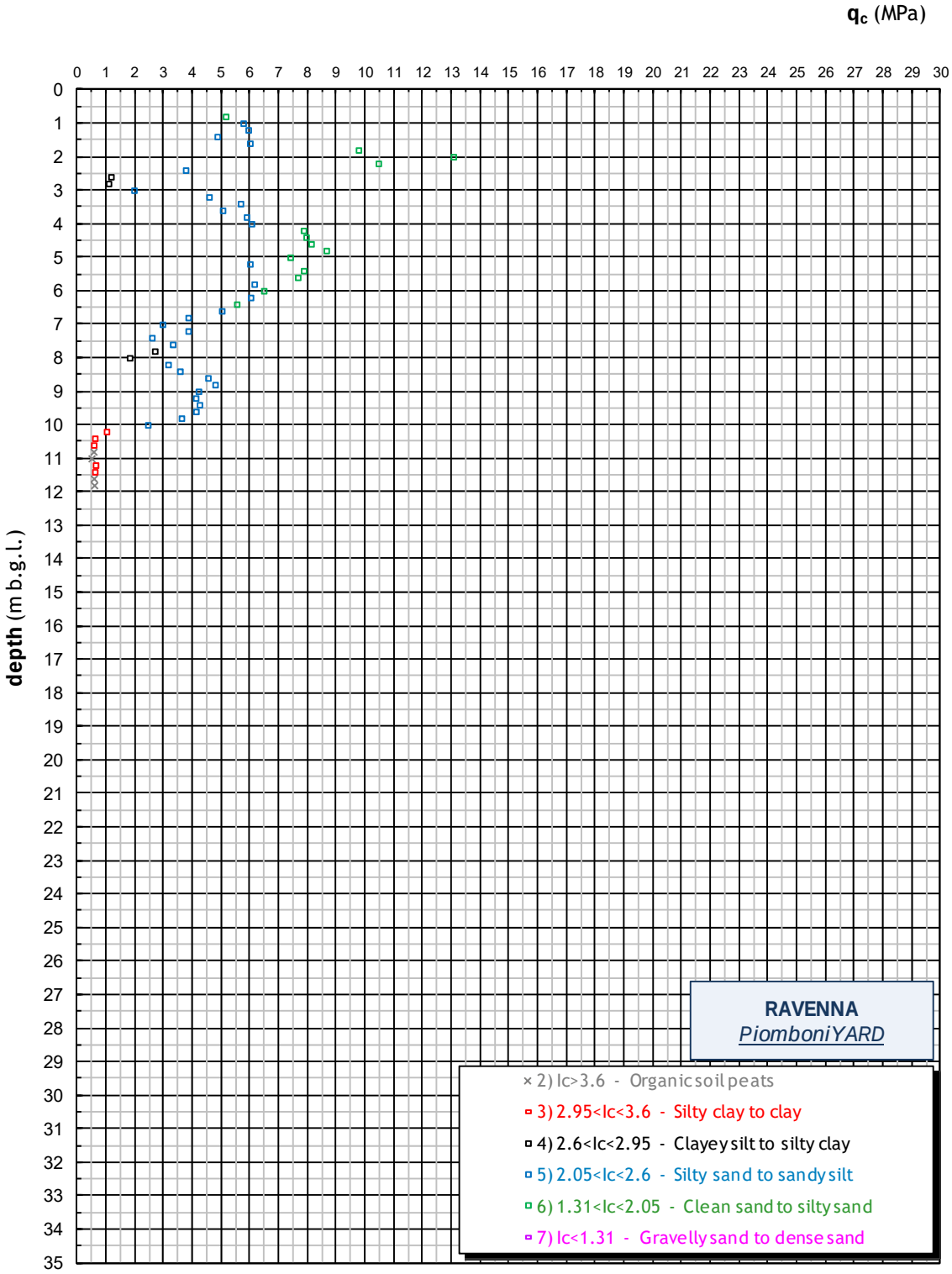
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PiomboniYARD

Young's modulus
CPT-2 (2006)



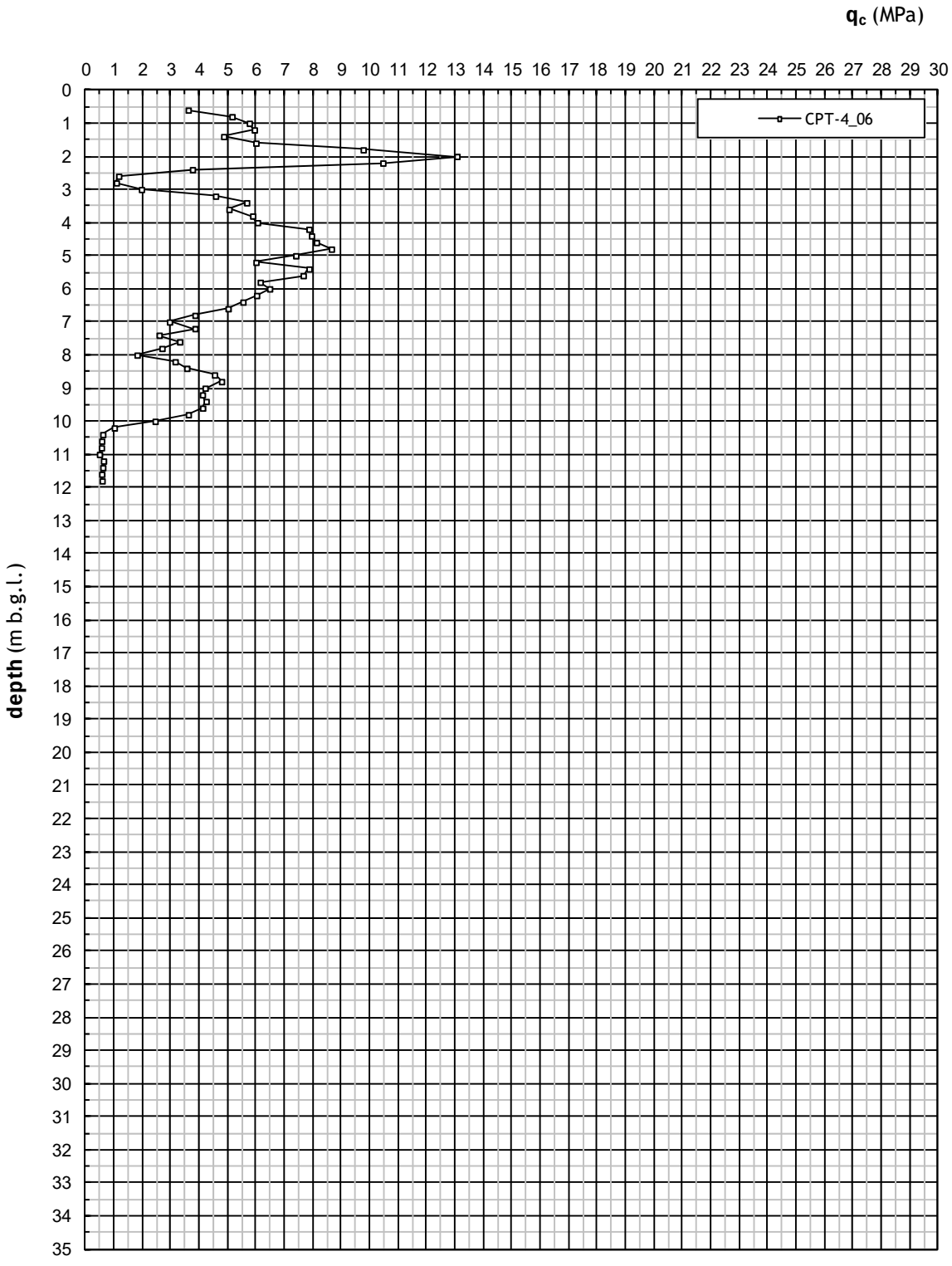
CPT-04 (2006)

Cone point resistance
CPT-4 (2006)



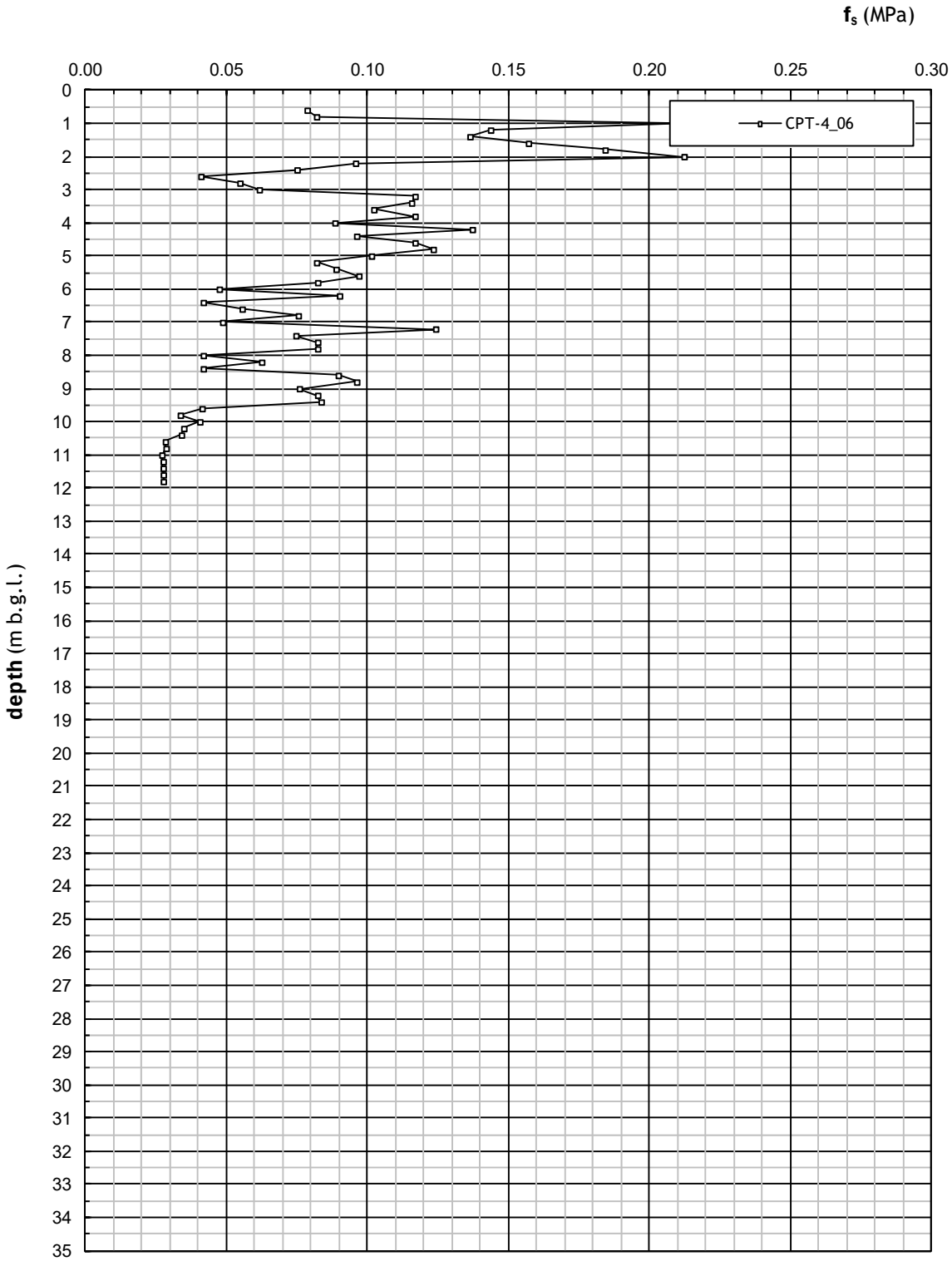
RAVENNA
PiomboniYARD

Cone point resistance



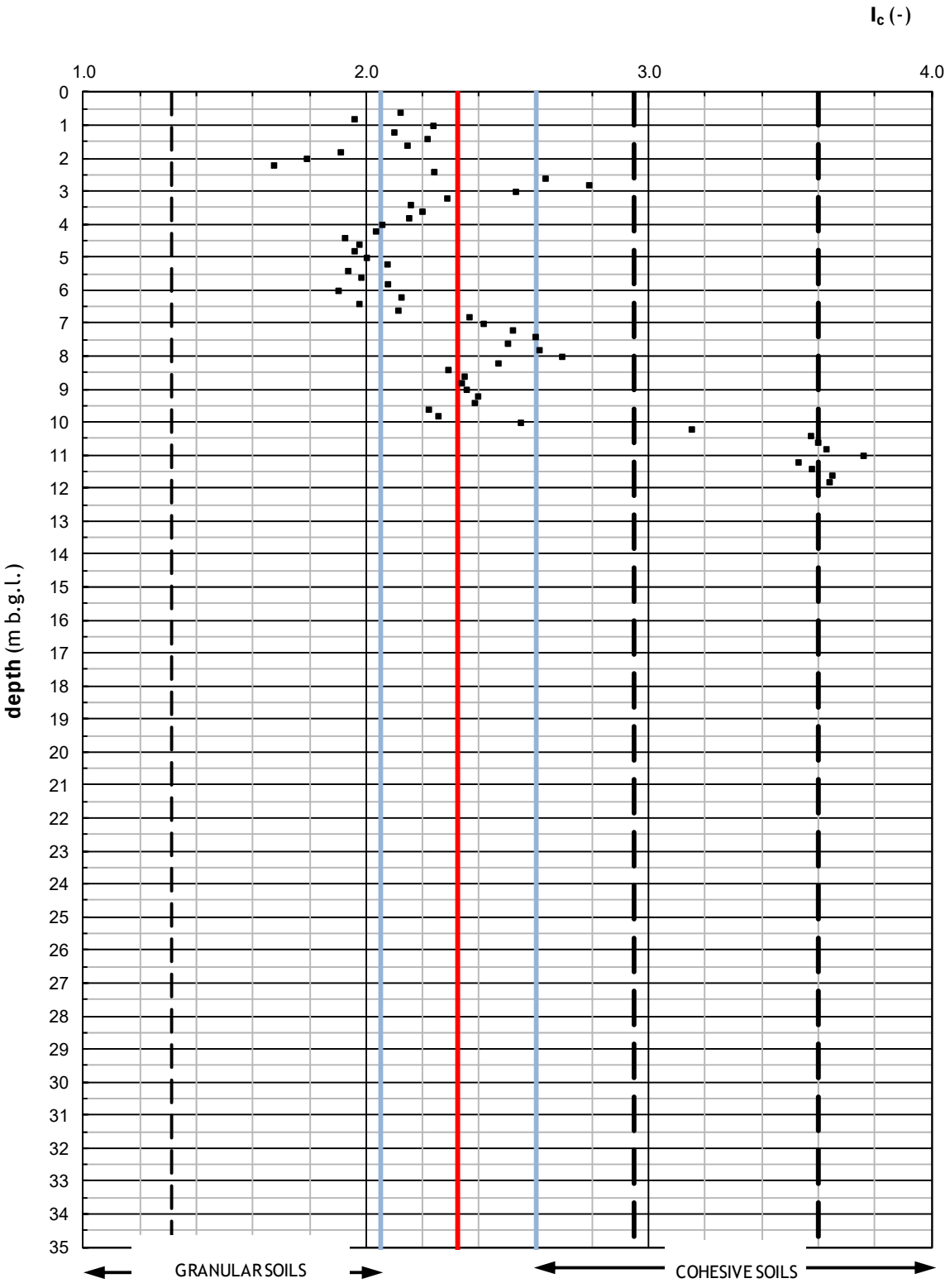
RAVENNA
PiomboniYARD

local friction

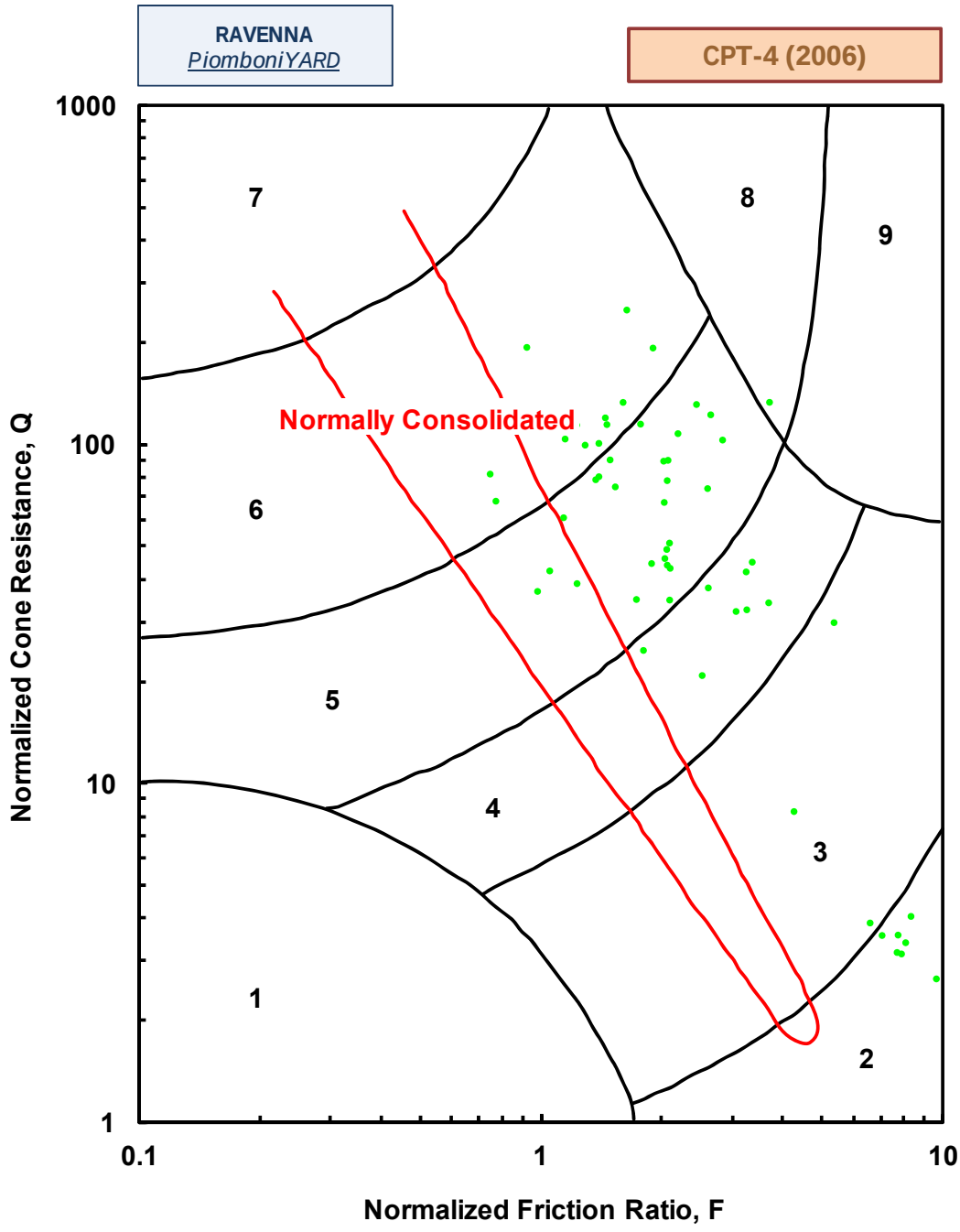


RAVENNA
PiomboniYARD

Robertson's Index: I_c (1998)
CPT-4 (2006)



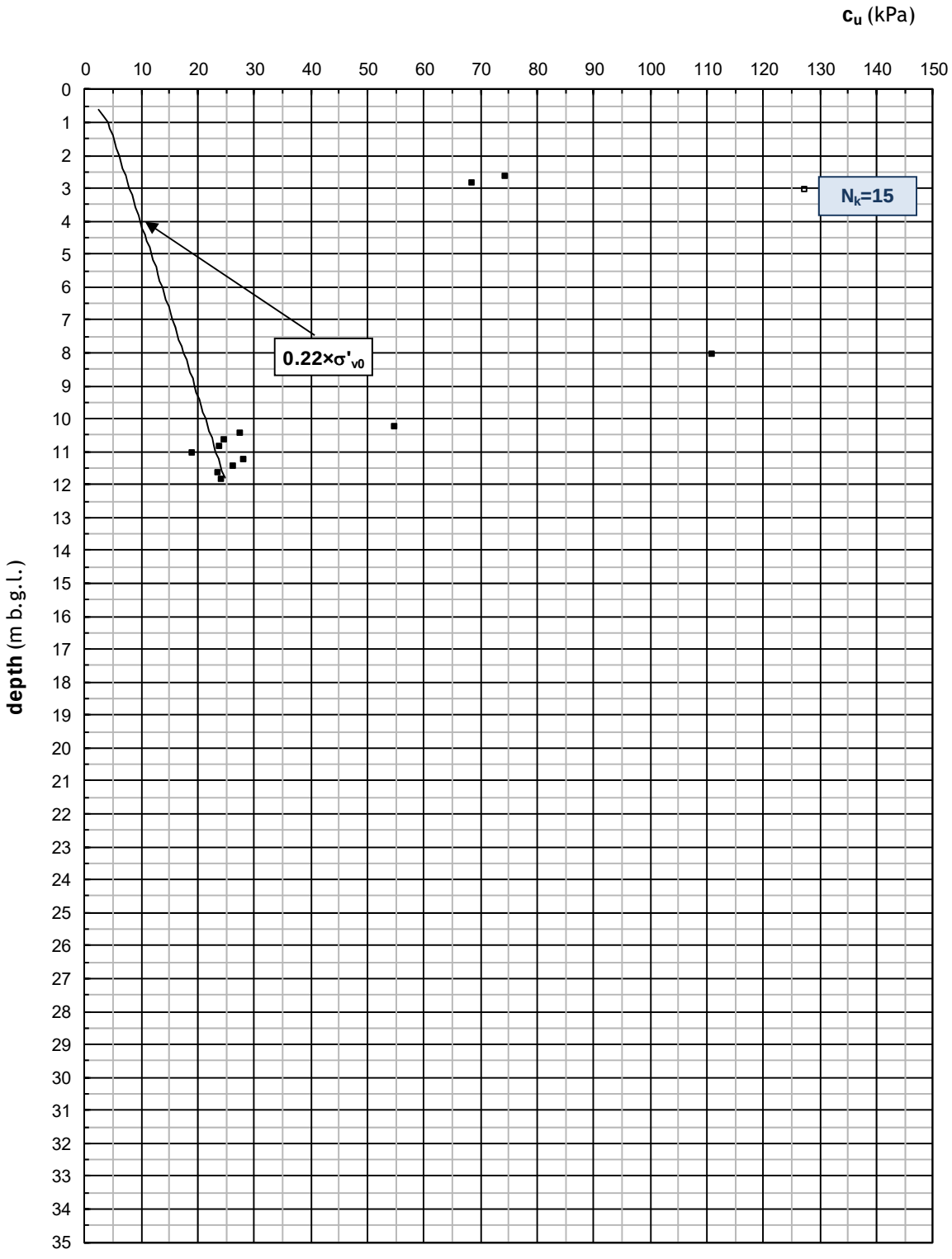
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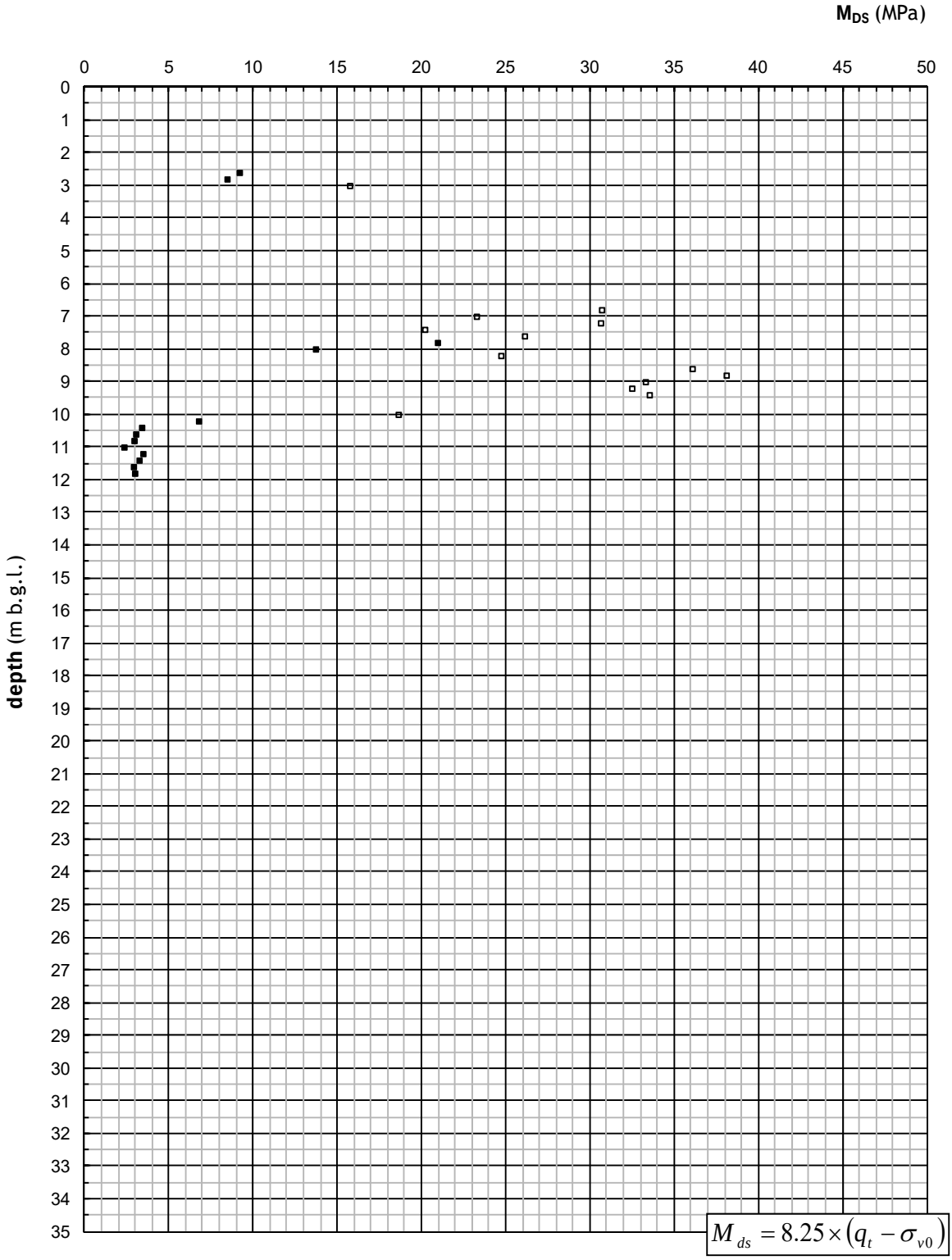
RAVENNA
PiomboniYARD

Undrained shear strength
CPT-4 (2006)



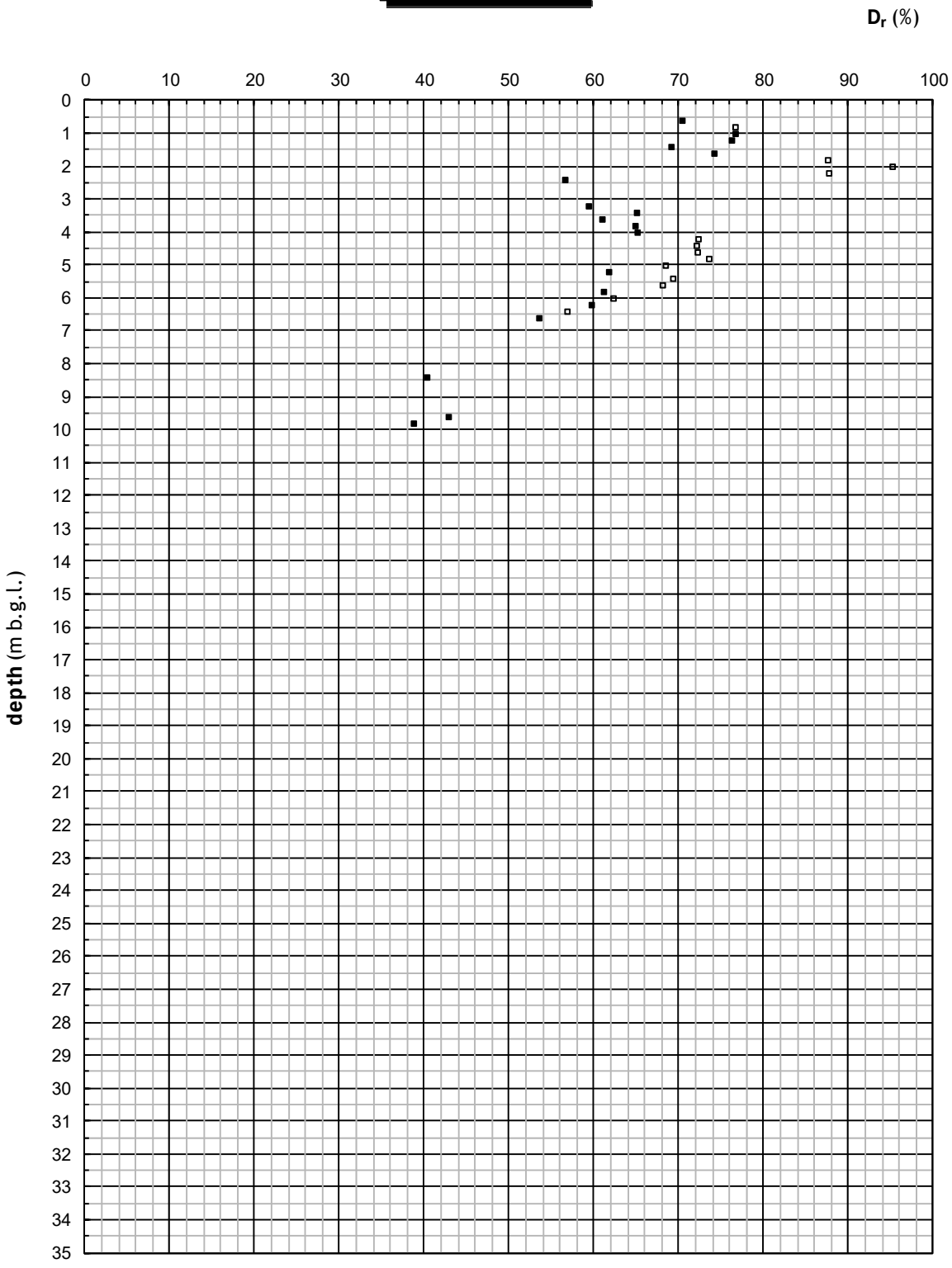
RAVENNA
PiomboniYARD

Oedometric Modulus
CPT-4 (2006)



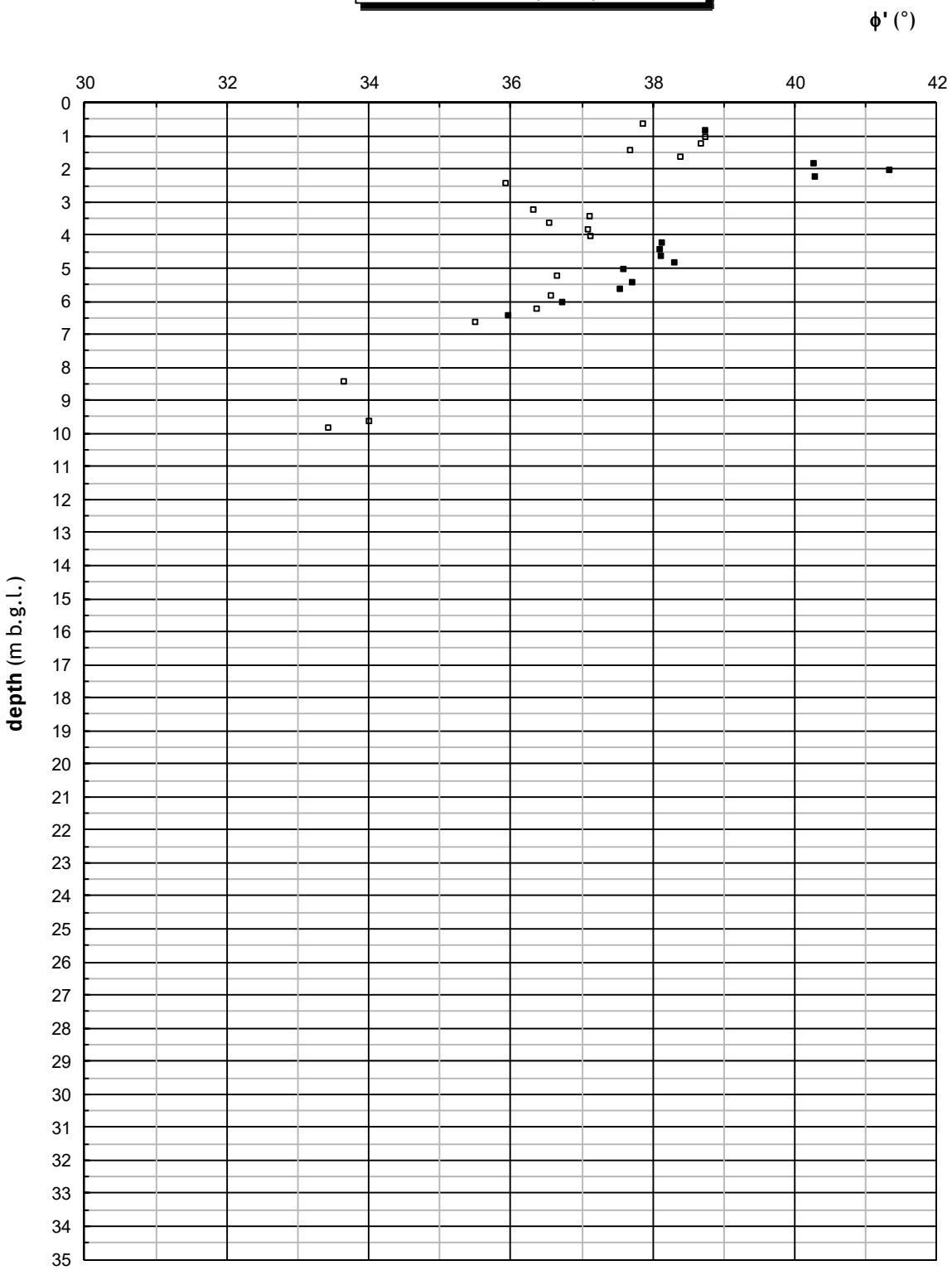
RAVENNA
PiomboniYARD

Relative density
CPT-4 (2006)



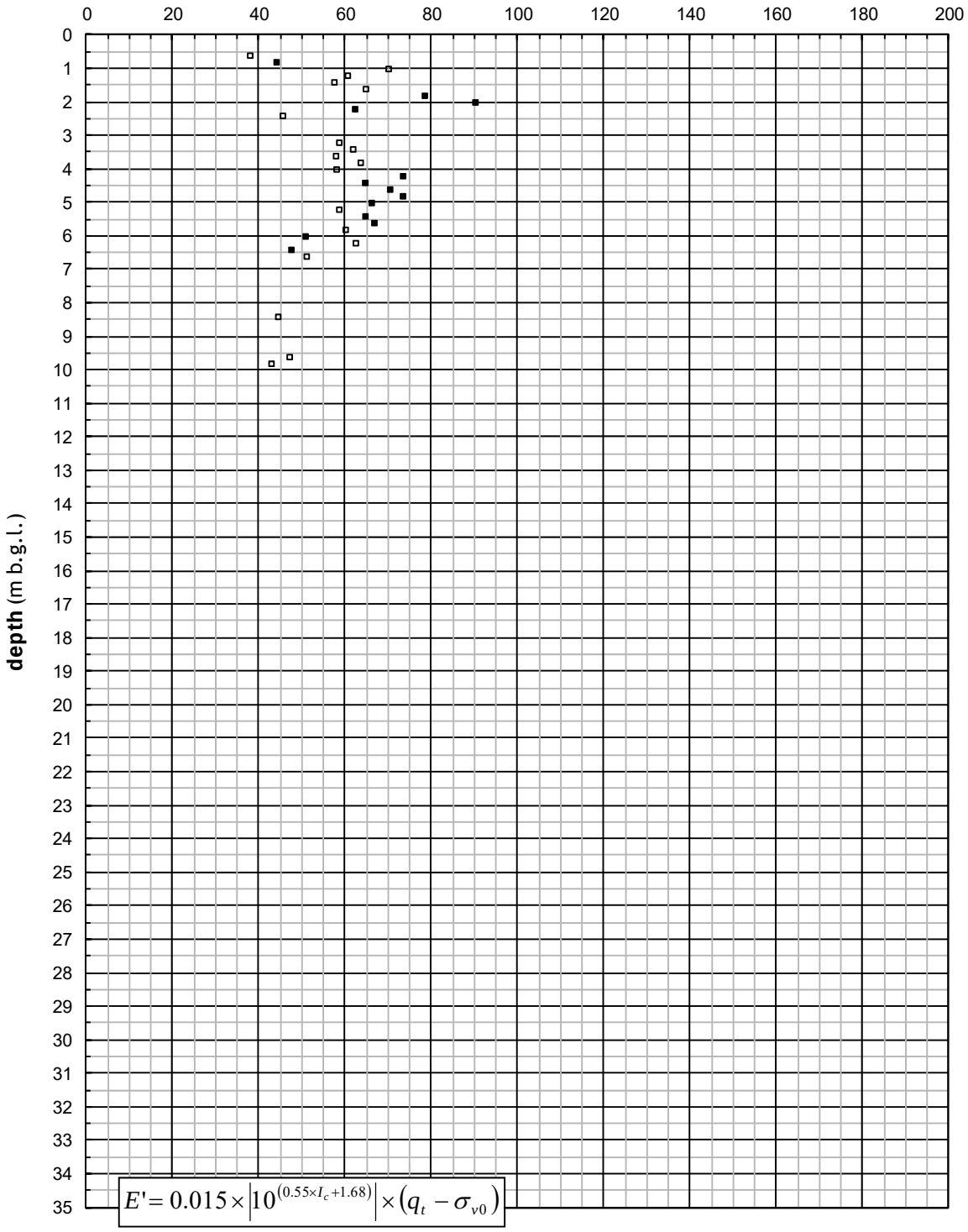
RAVENNA
PiomboniYARD

Angle of shearing resistance
CPT-4 (2006)



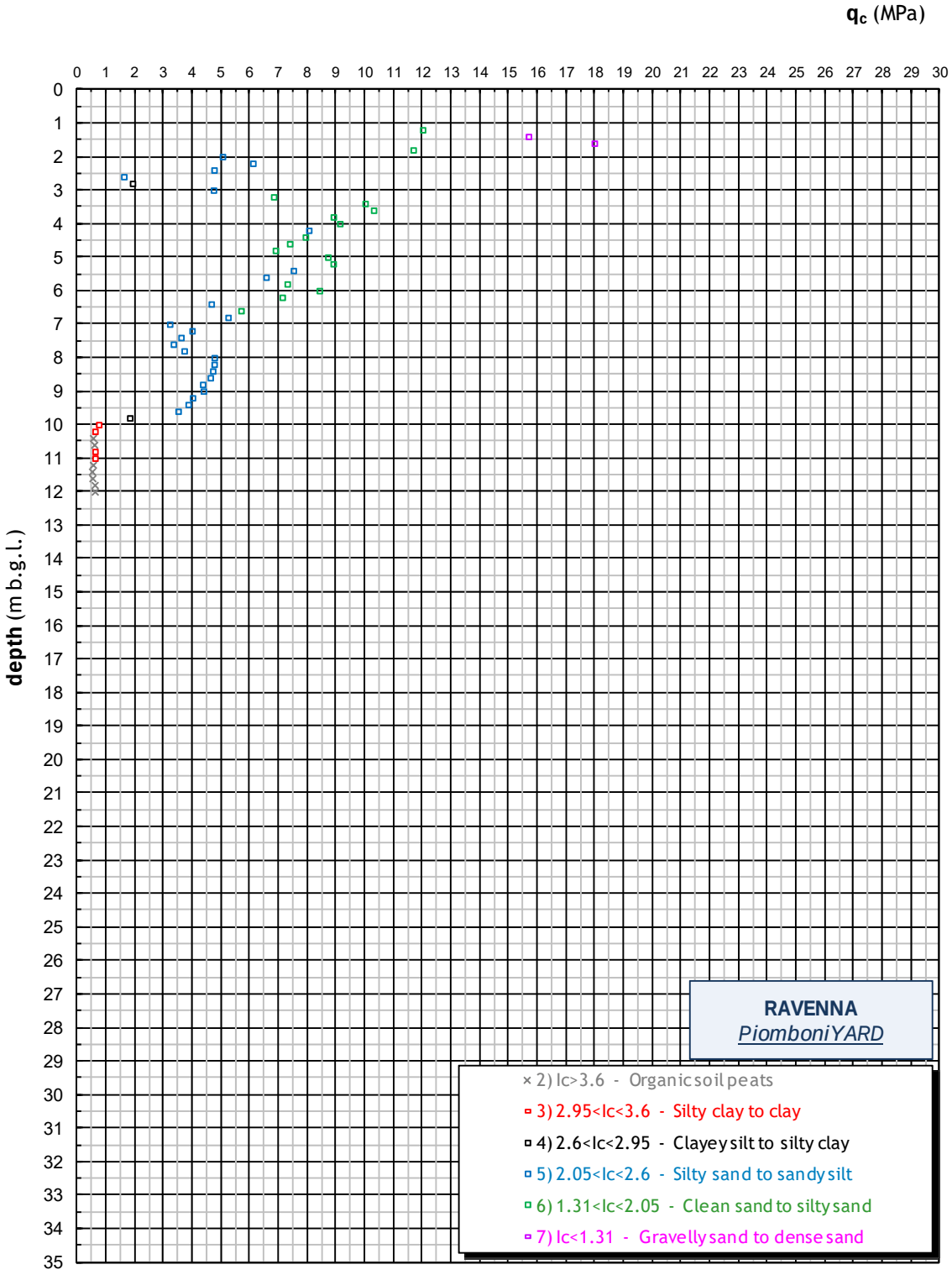
RAVENNA
PiomboniYARD

Young's modulus
CPT-4 (2006)



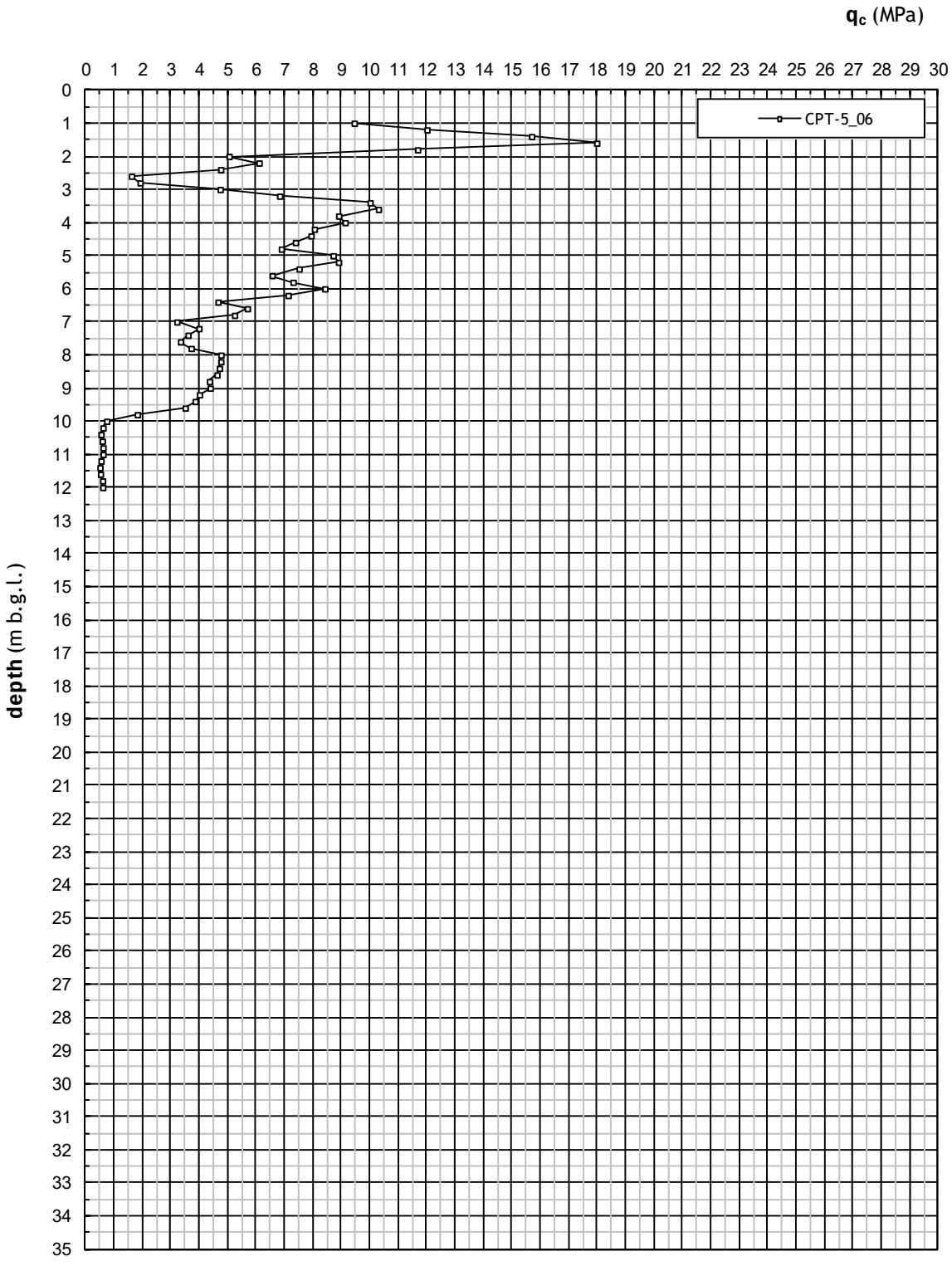
CPT-05 (2006)

Cone point resistance
CPT-5 (2006)



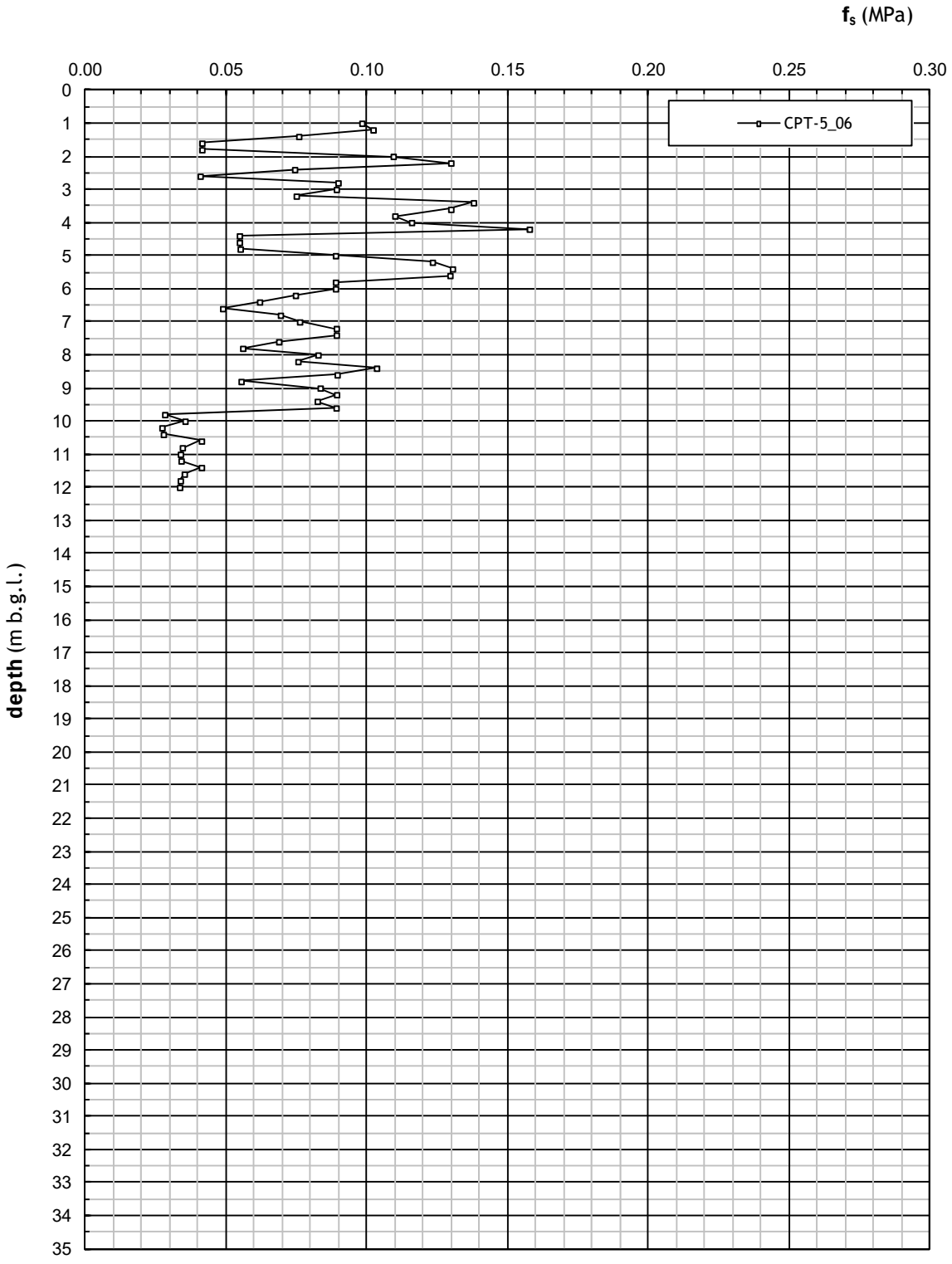
RAVENNA
PiomboniYARD

Cone point resistance



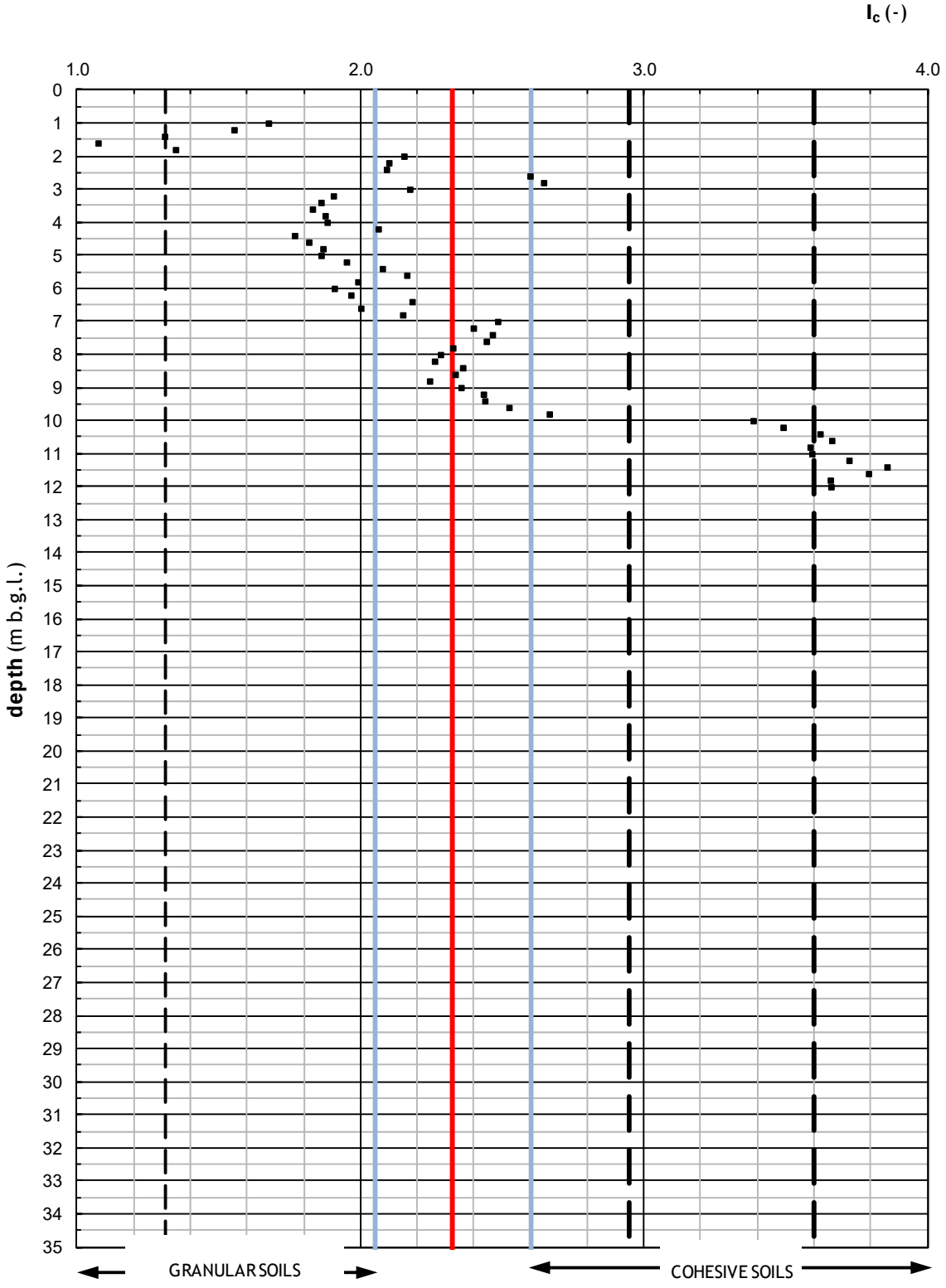
RAVENNA
PiomboniYARD

Local friction

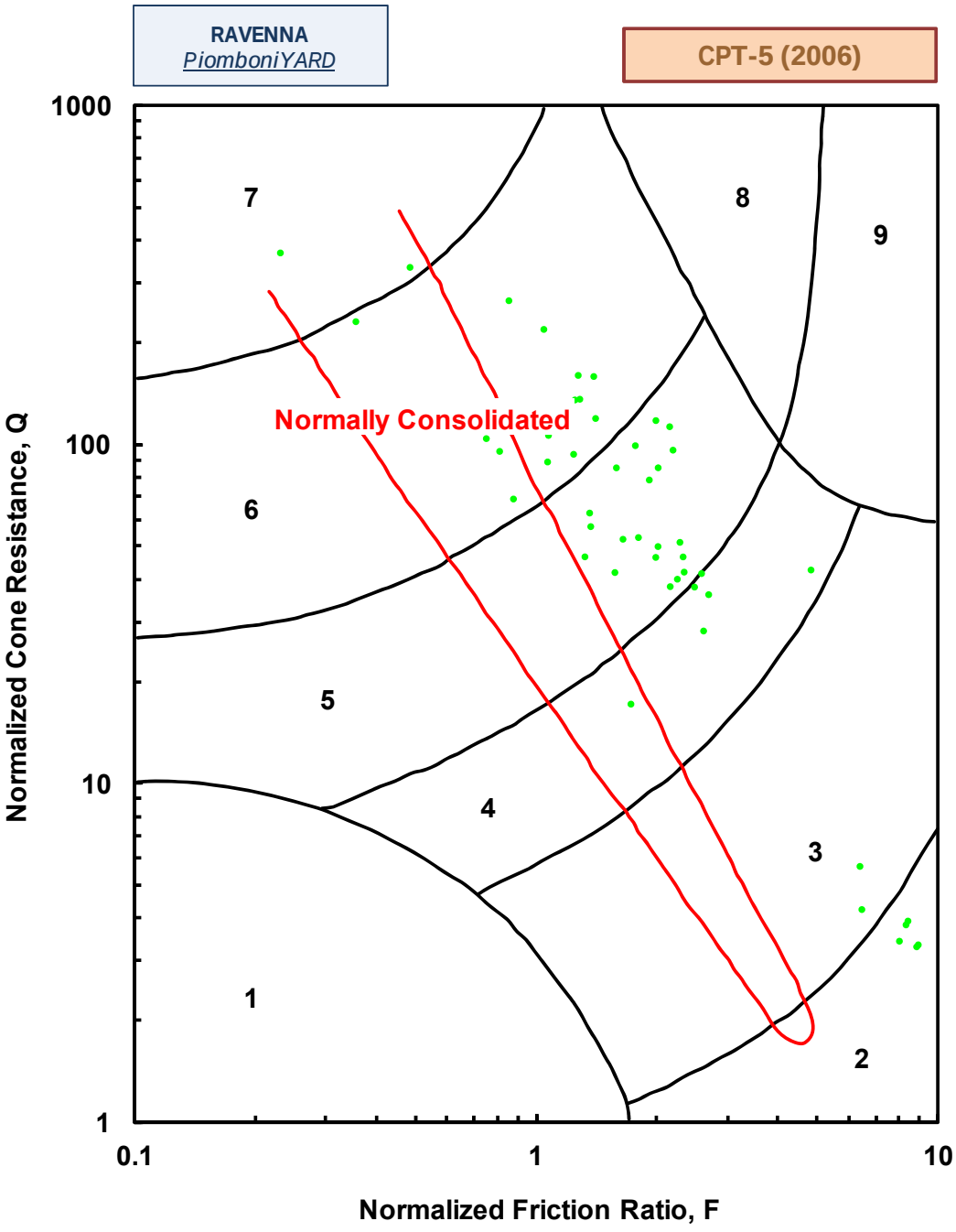


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PiomboniYARD

Robertson's Index: I_c (1998)
CPT-5 (2006)



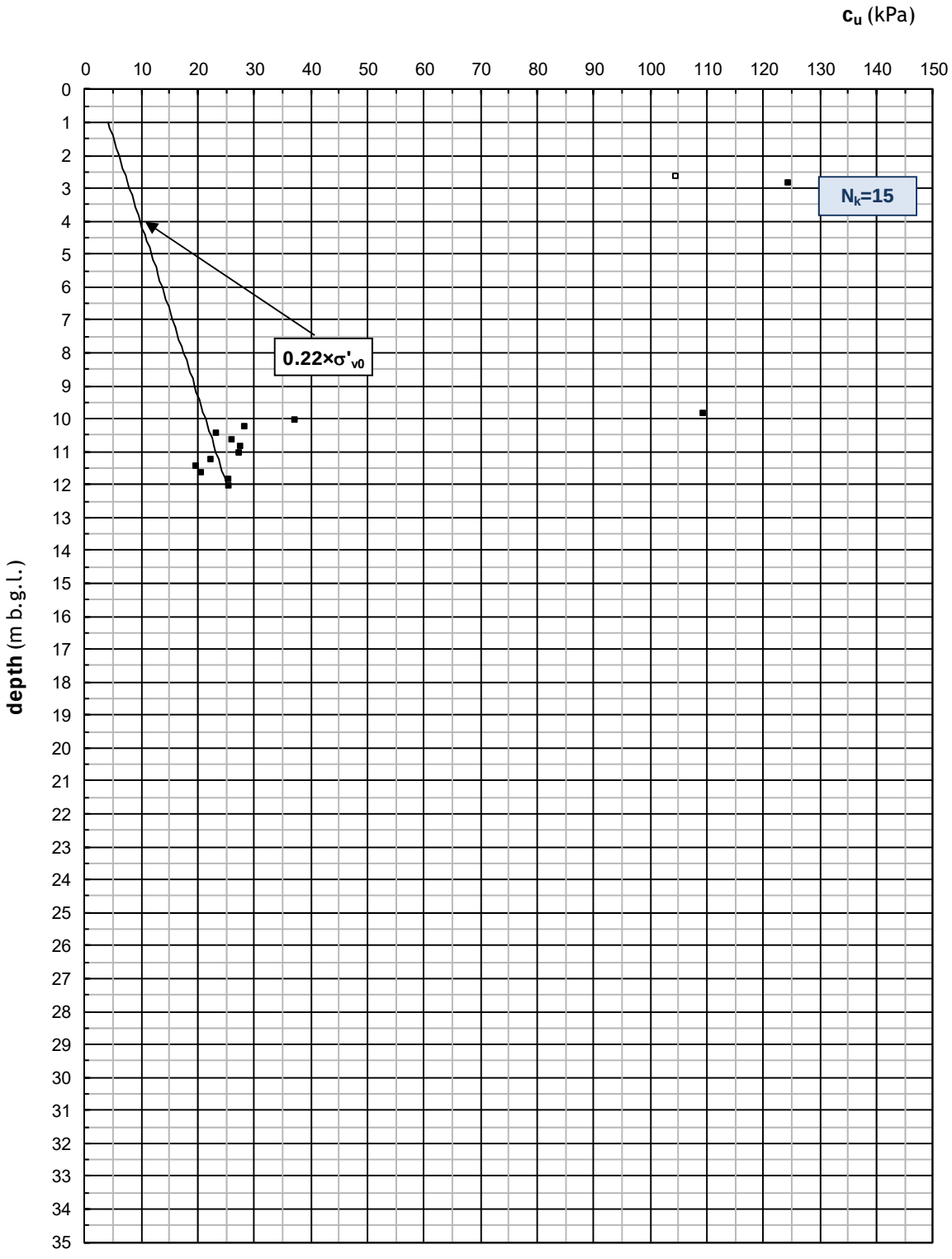
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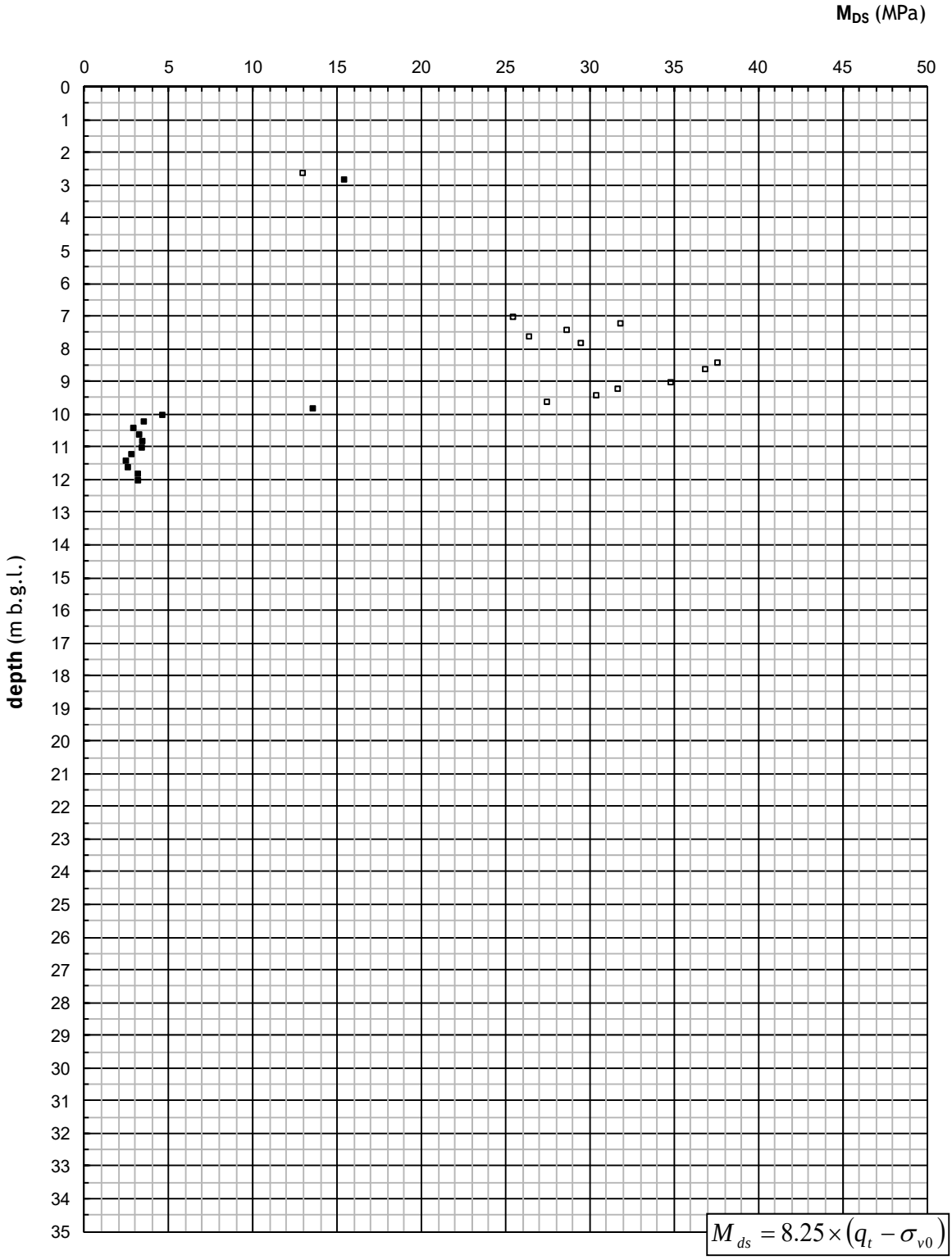
RAVENNA
PiomboniYARD

Undrained shear strength
CPT-5 (2006)



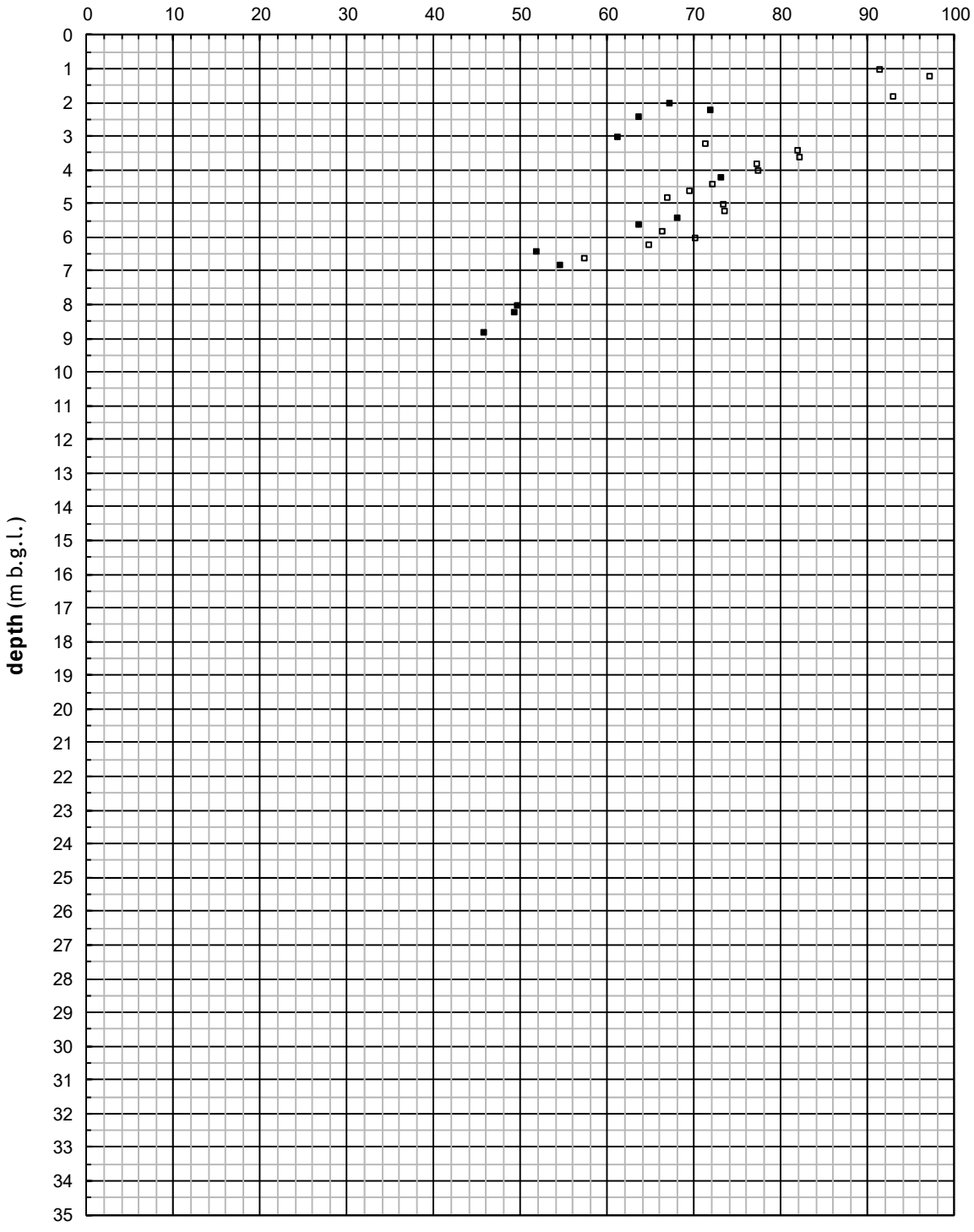
RAVENNA
PiomboniYARD

Oedometric Modulus
CPT-5 (2006)



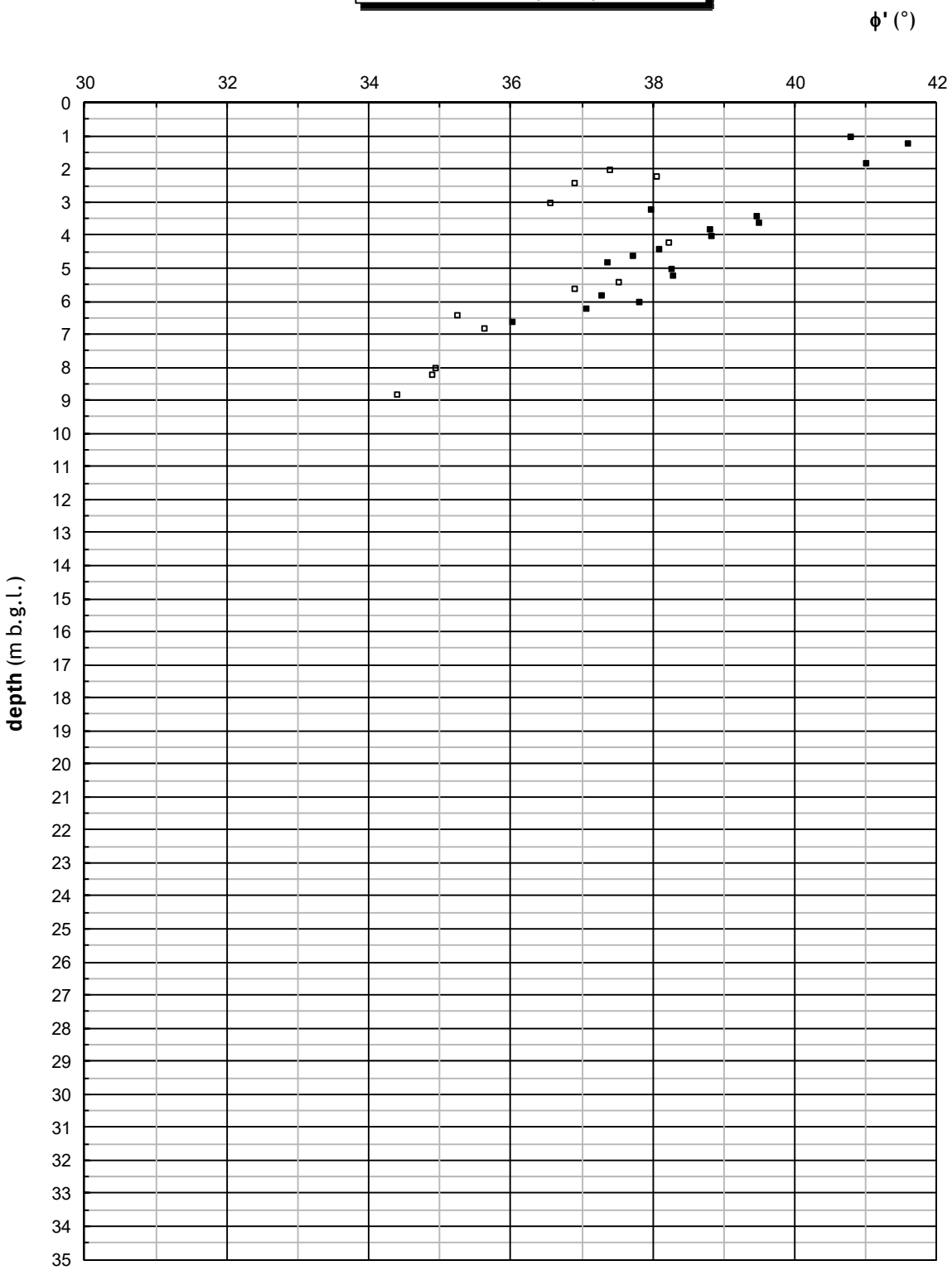
RAVENNA
PiomboniYARD

relative density
CPT-5 (2006)



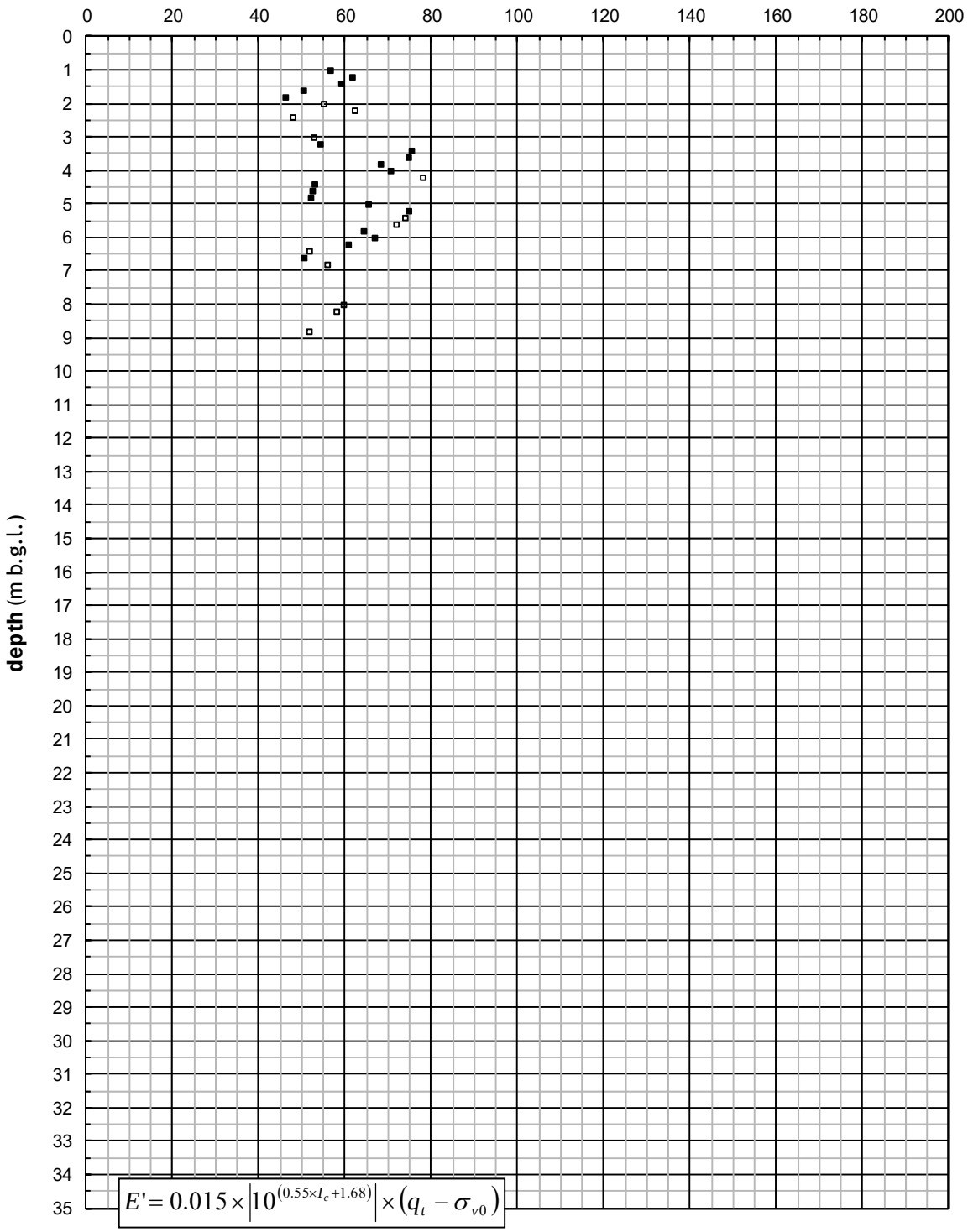
RAVENNA
PiomboniYARD

Angle of shearing resistance
CPT-5 (2006)



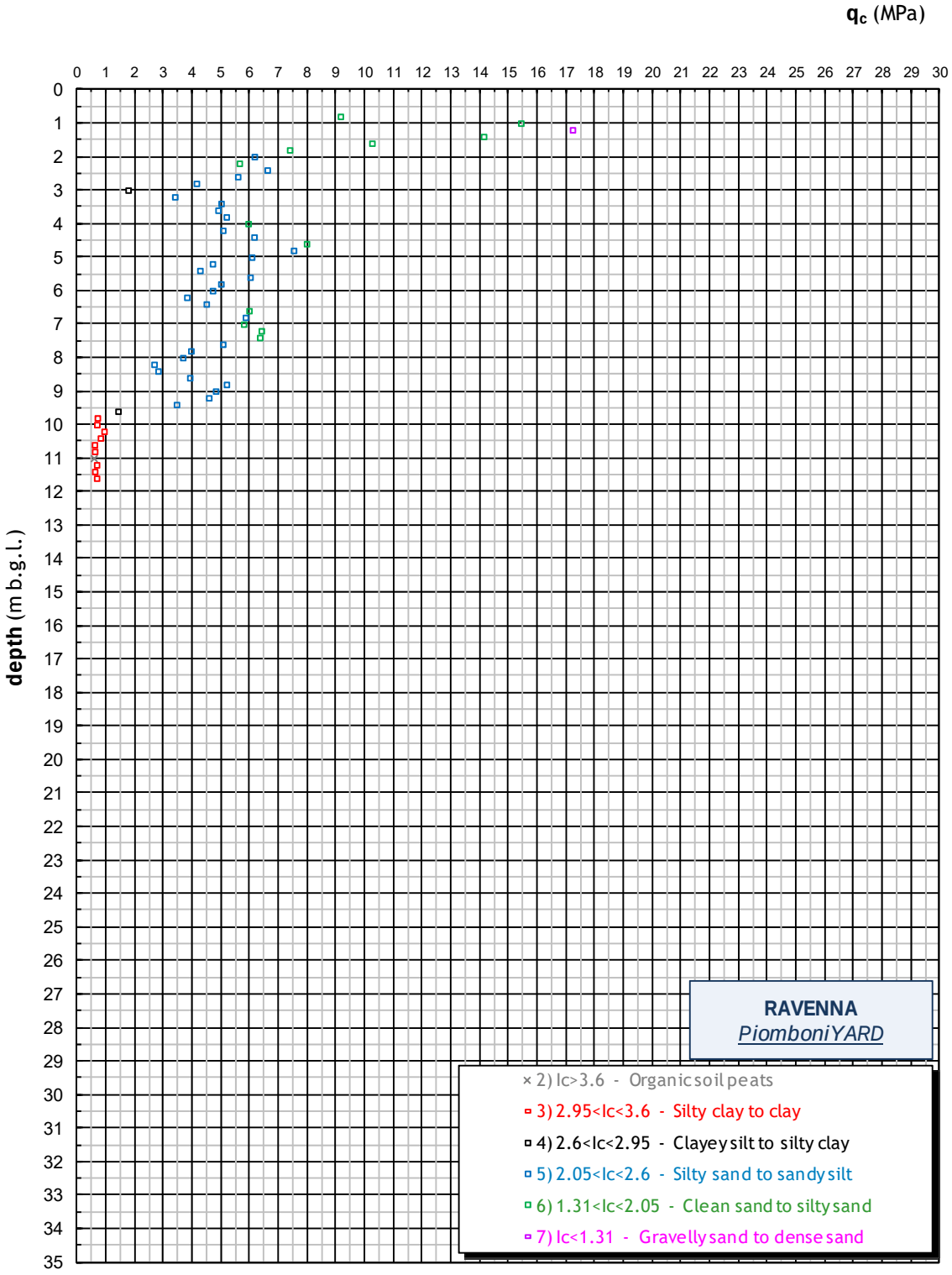
RAVENNA
PiomboniYARD

Young's modulus
CPT-5 (2006)



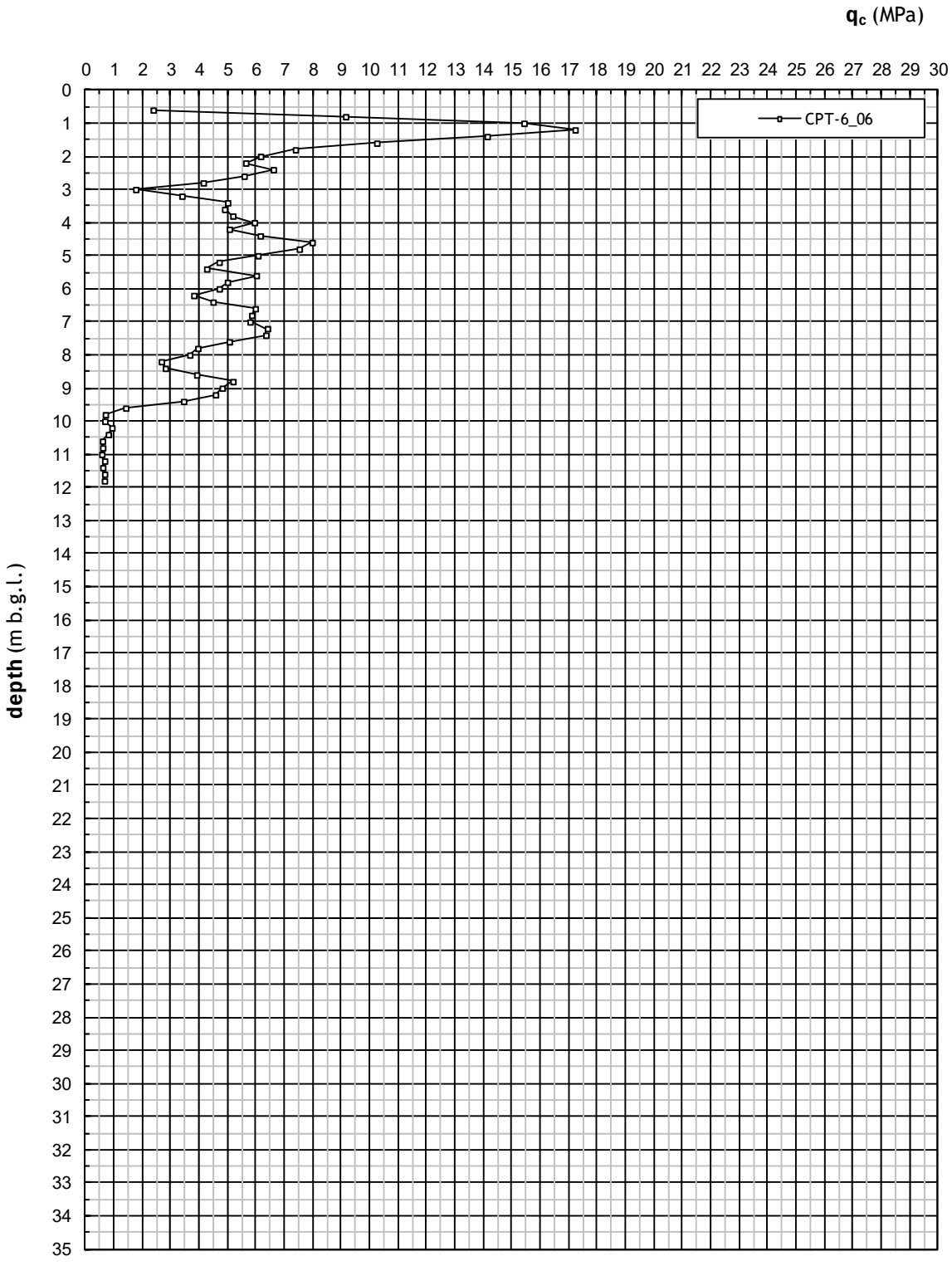
CPT-06 (2006)

Cone point resistance
CPT-6 (2006)



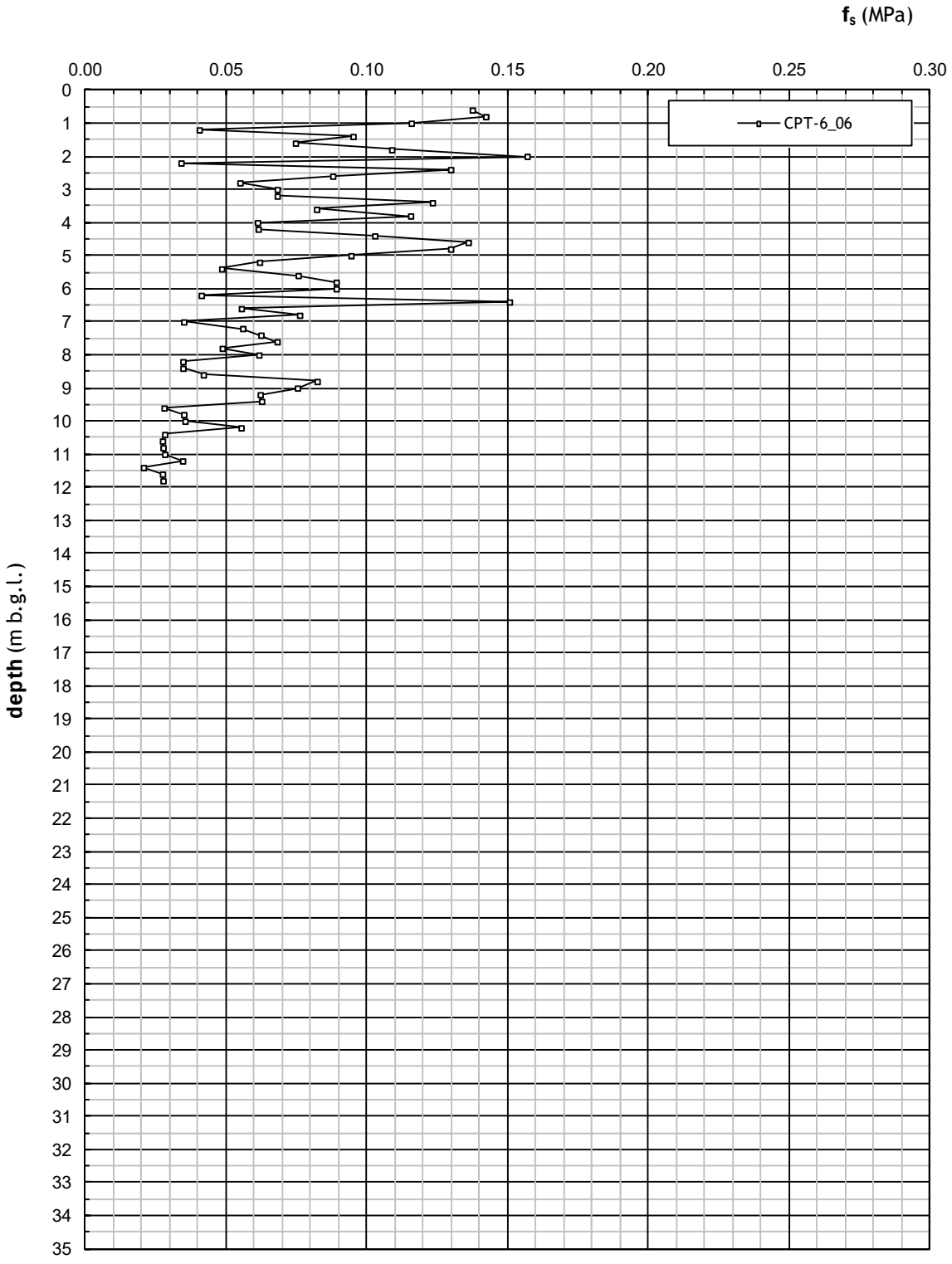
RAVENNA
PiomboniYARD

Cone point resistance



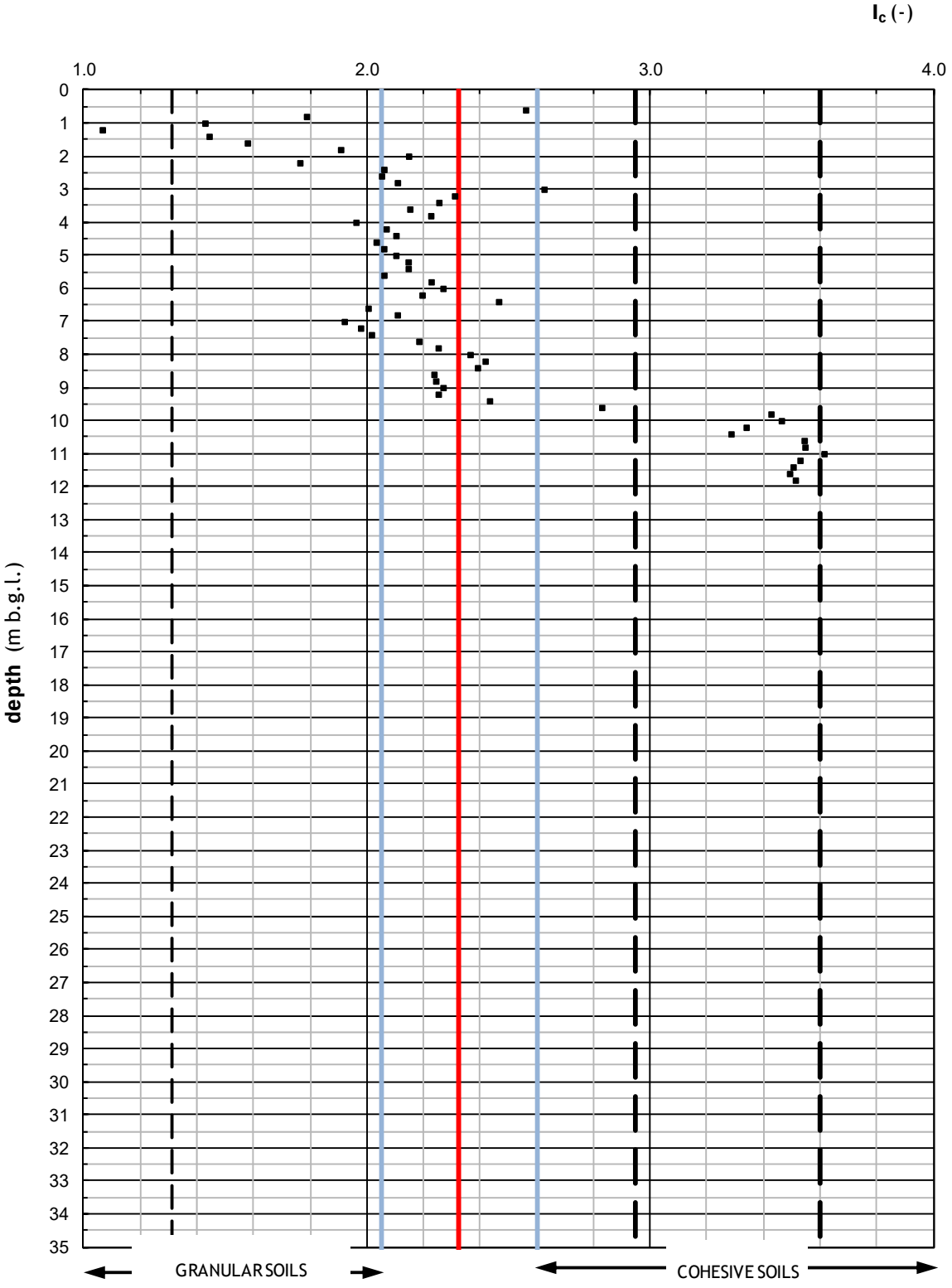
RAVENNA
PiomboniYARD

Local friction

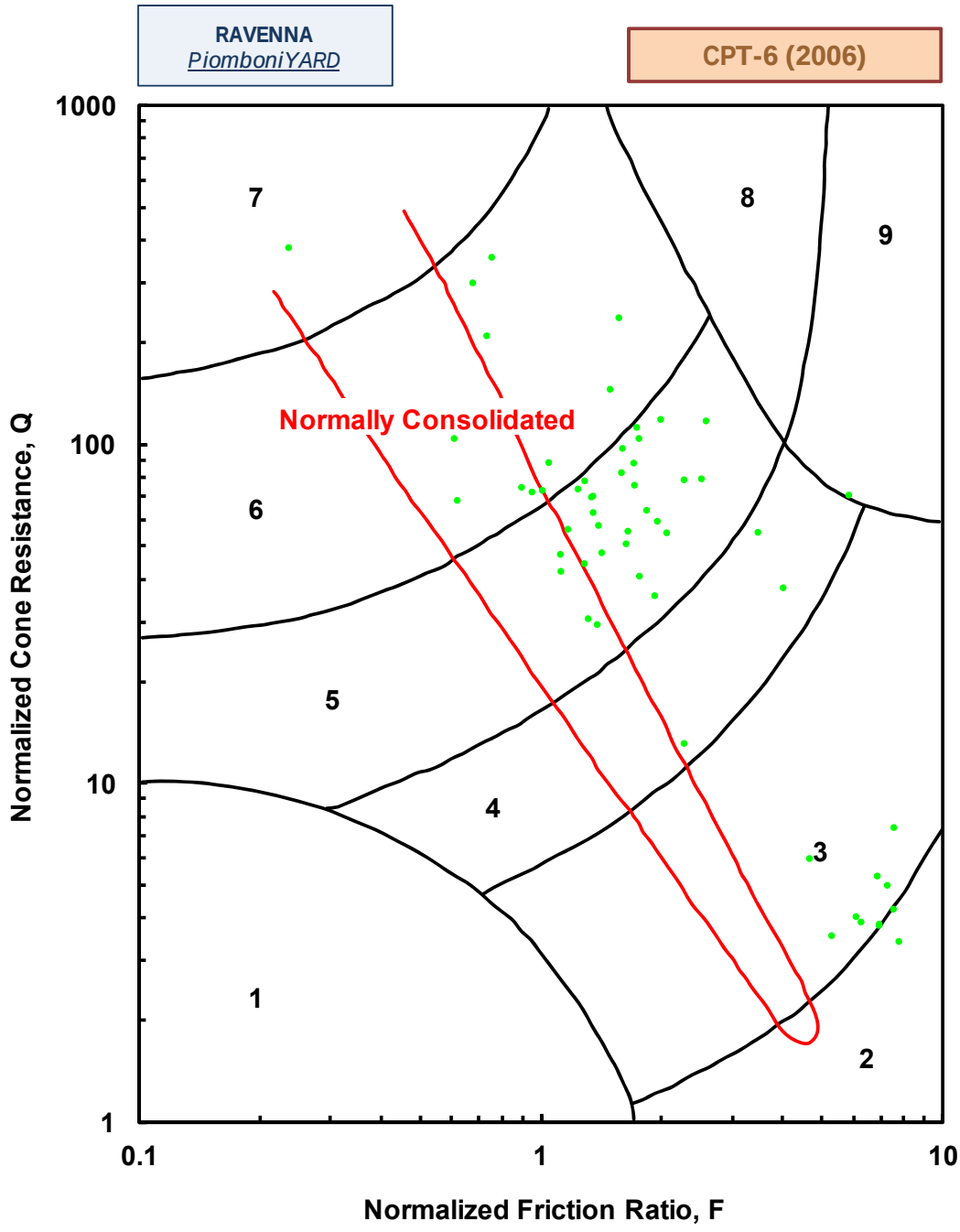


RAVENNA
PiomboniYARD

Robertson's Index: I_c (1998)
CPT-6 (2006)



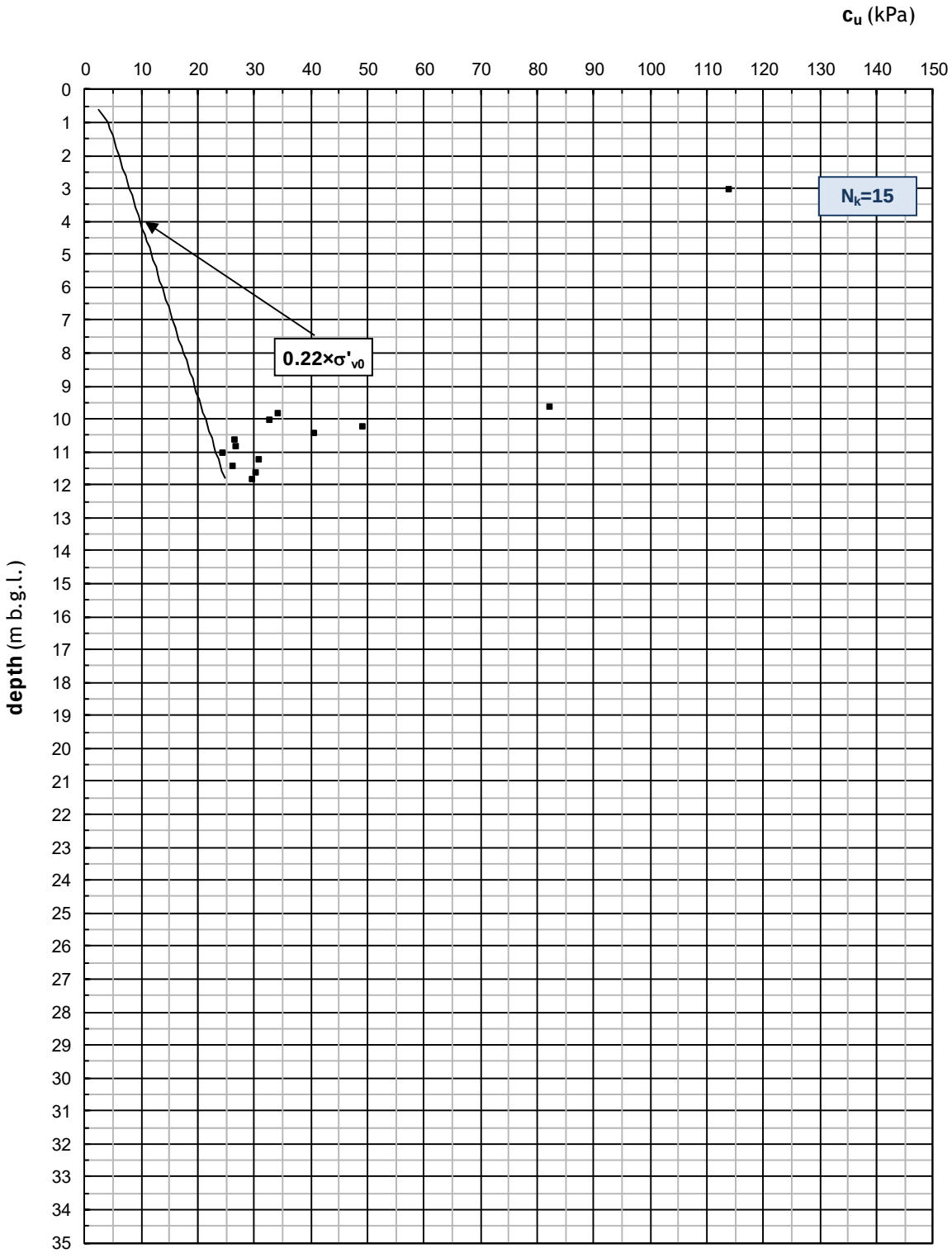
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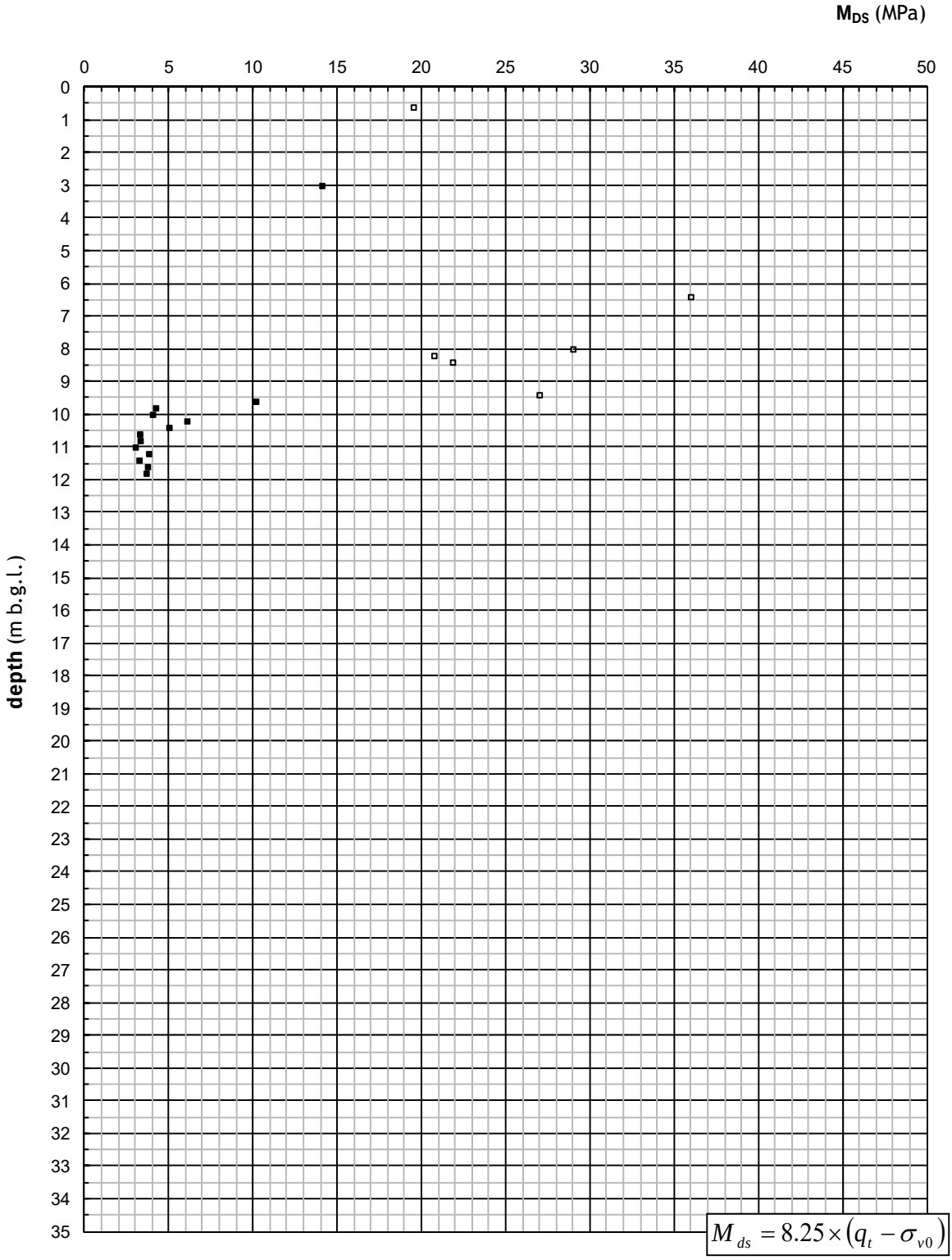
RAVENNA
PiomboniYARD

Undrained shear strength
CPT-6 (2006)



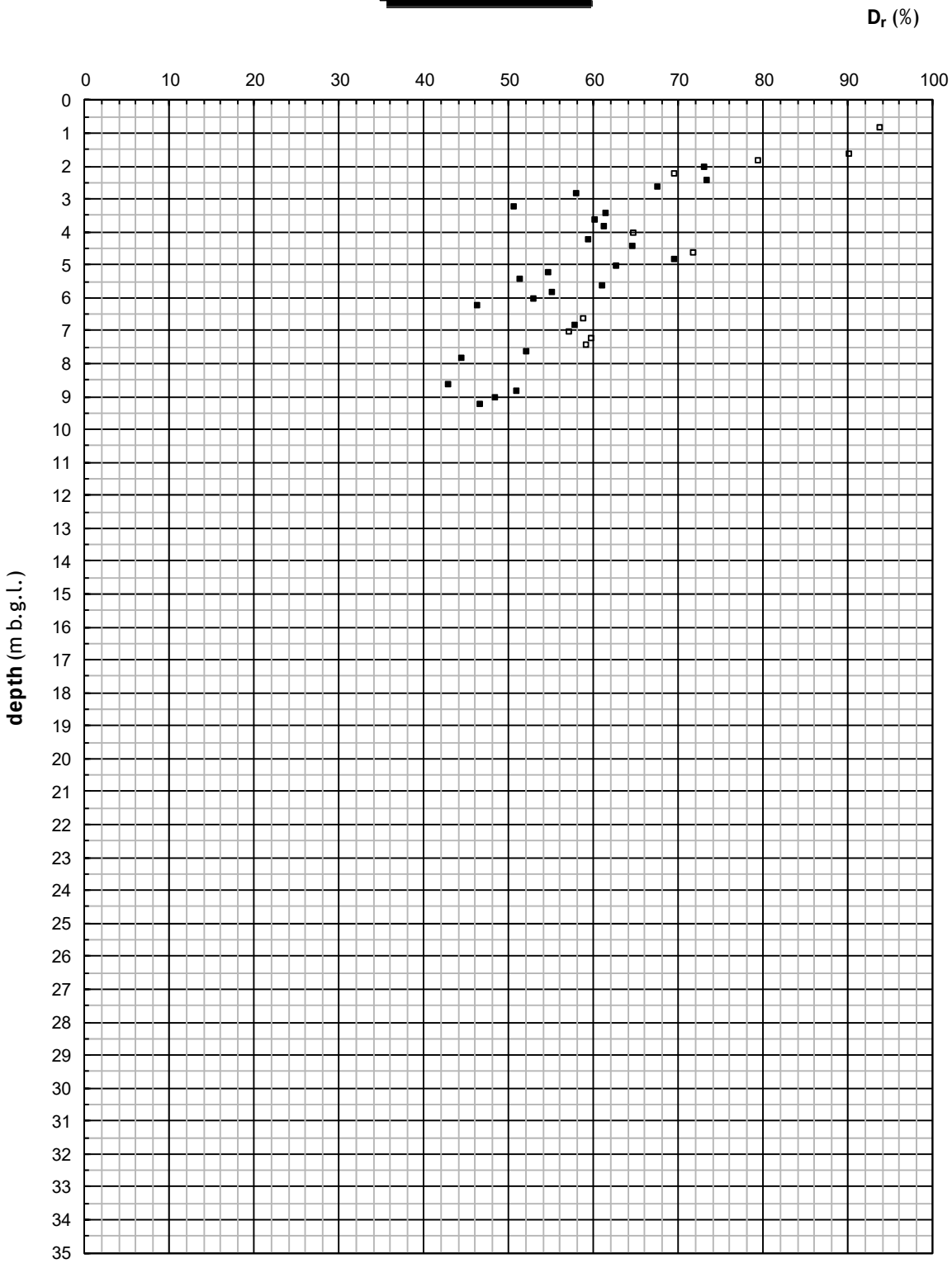
RAVENNA
PiomboniYARD

Oedometric Modululs
CPT-6 (2006)



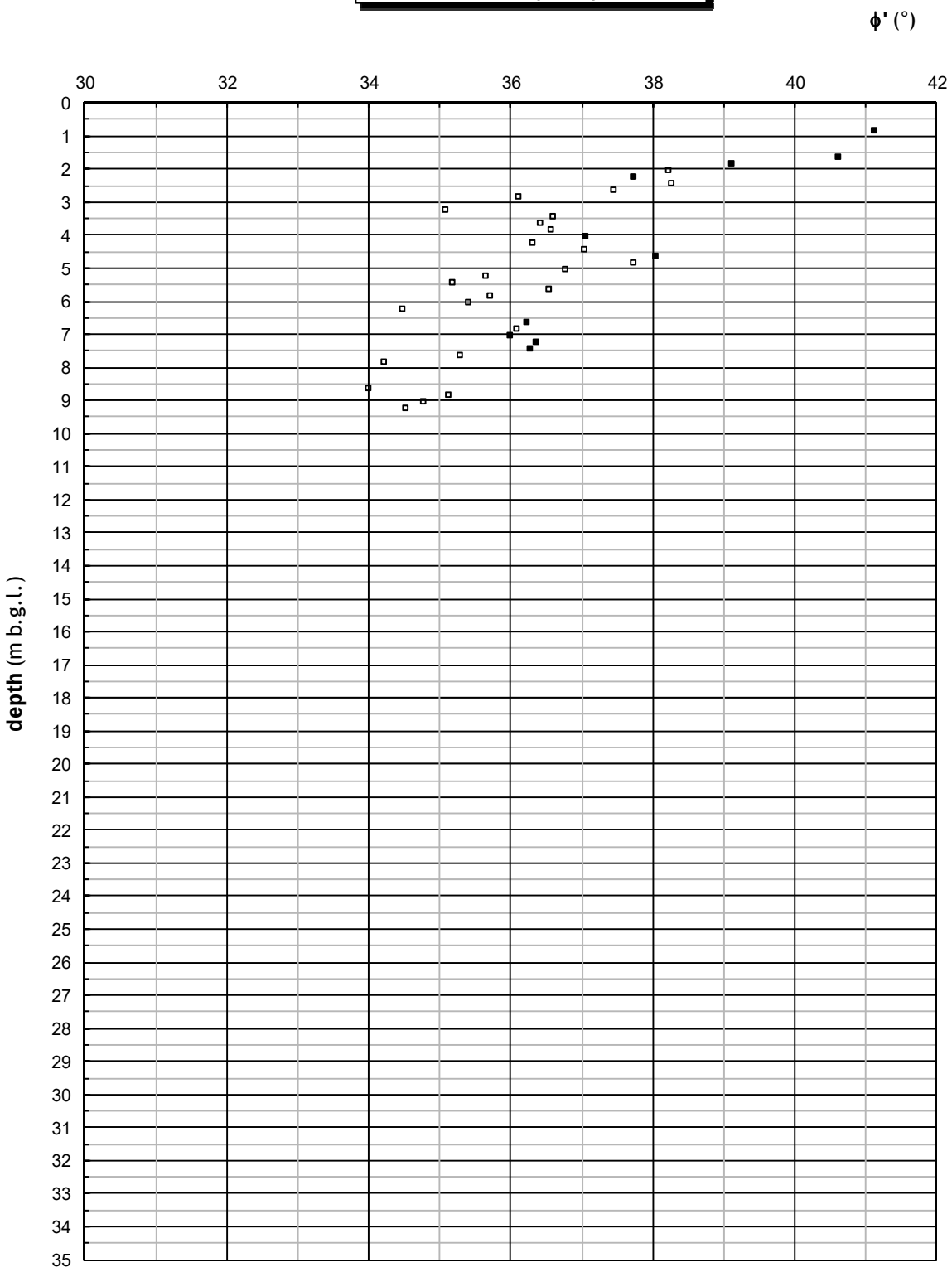
RAVENNA
PiomboniYARD

Relative density
CPT-6 (2006)



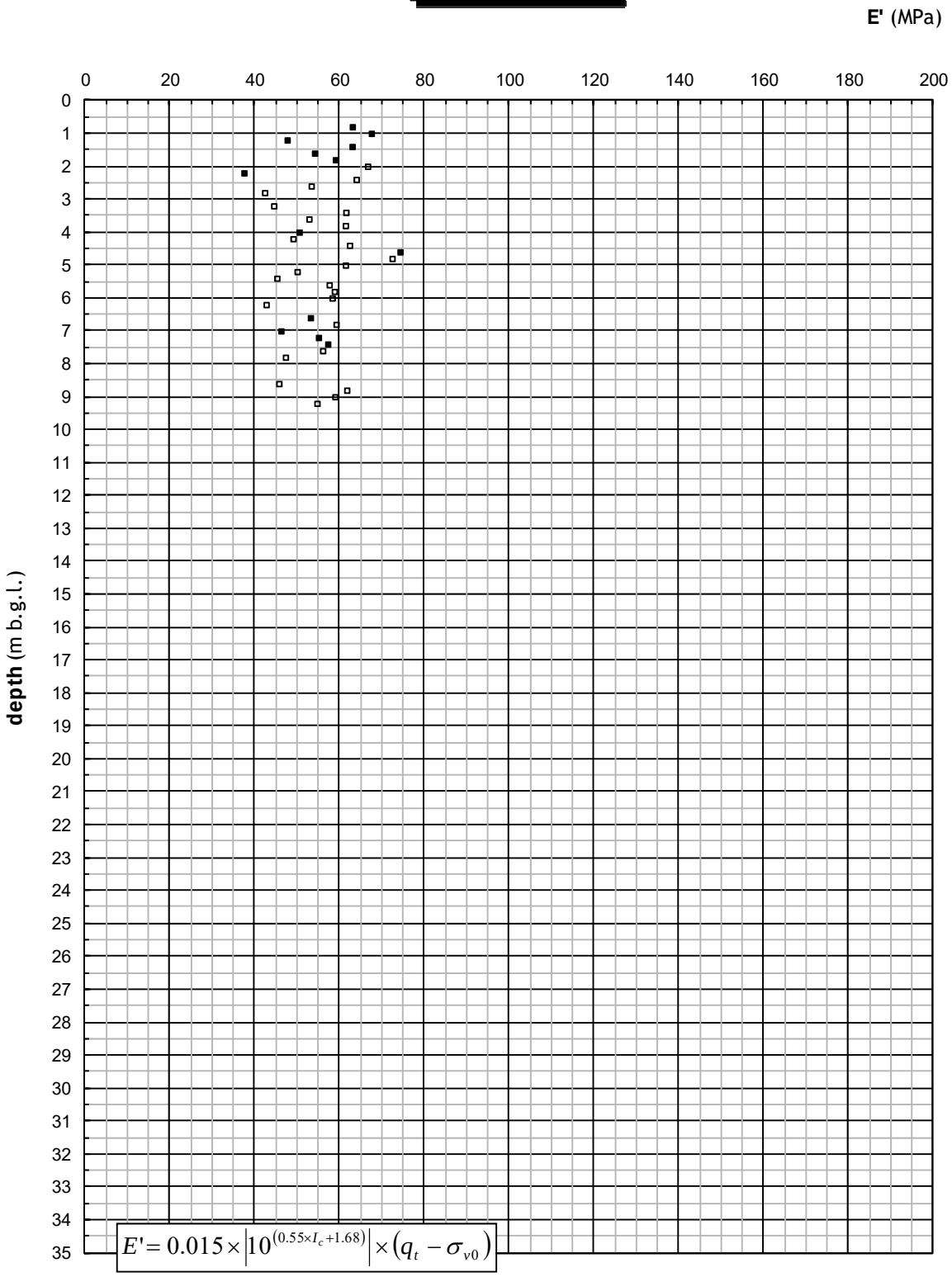
RAVENNA
PiomboniYARD

Angle of shearing resistance
CPT-6 (2006)



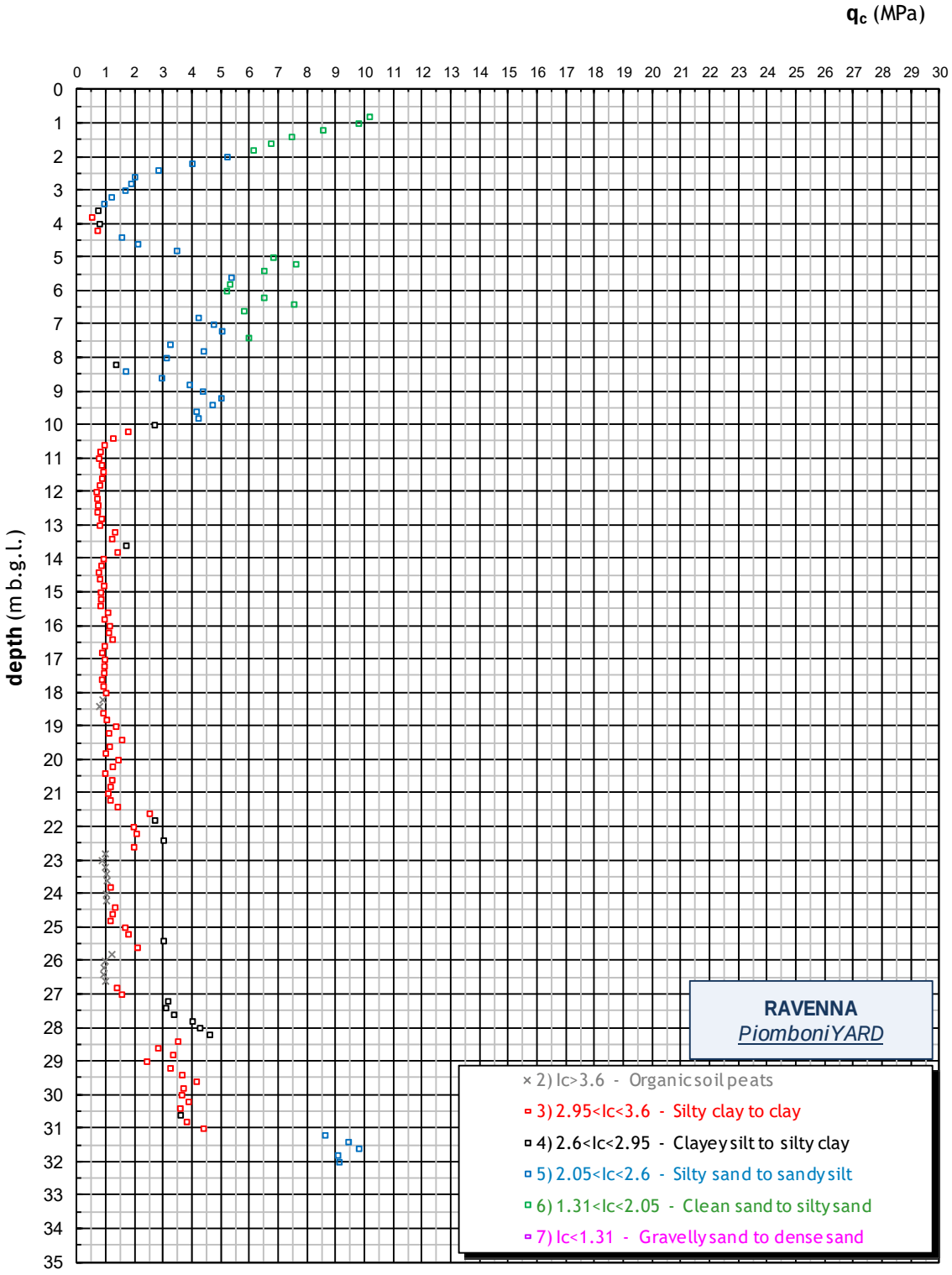
RAVENNA
PiomboniYARD

Young's modulus
CPT-6 (2006)



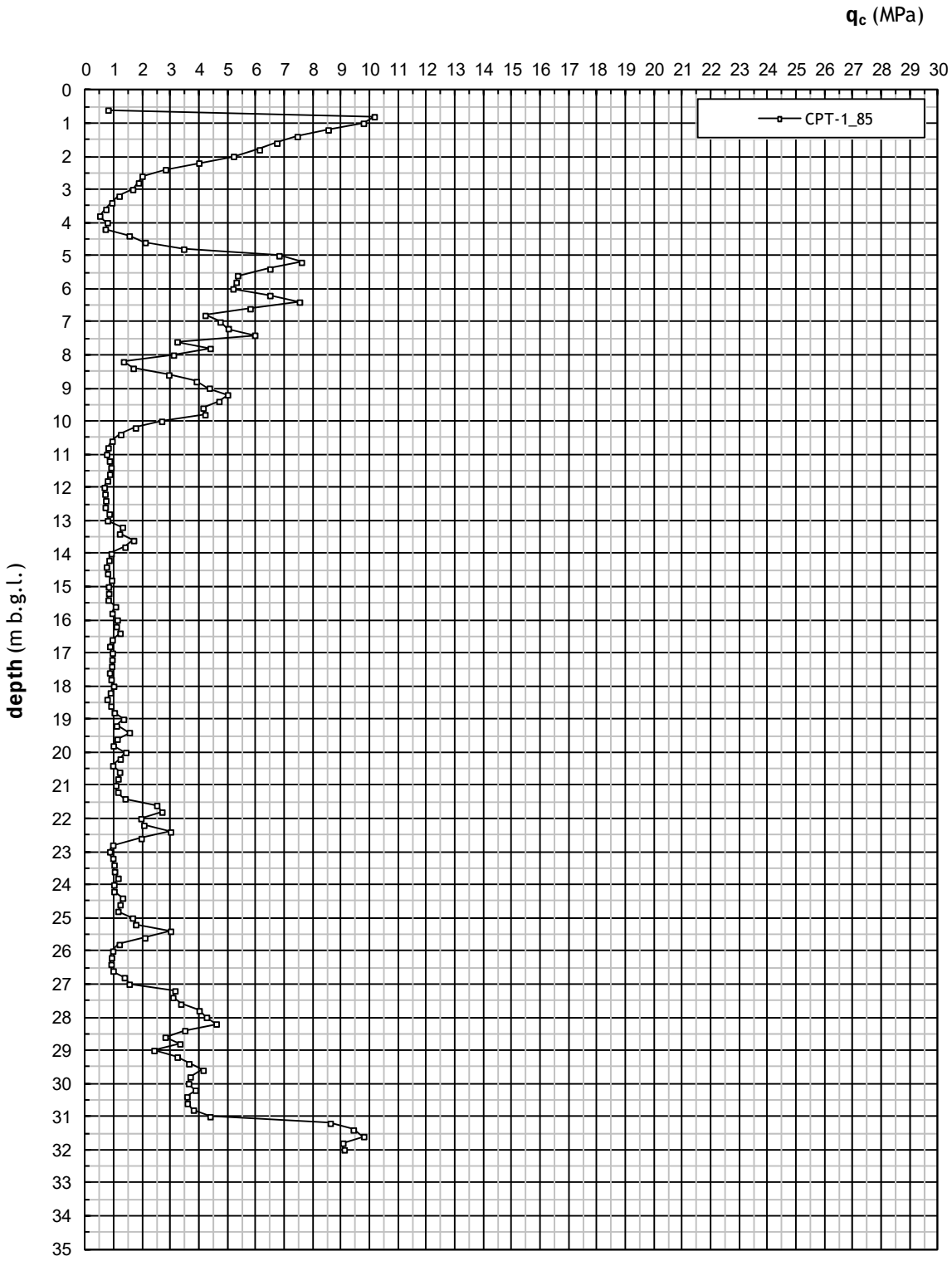
CPT-01 (1985)

Cone point resistance
CPT-1 (1985)



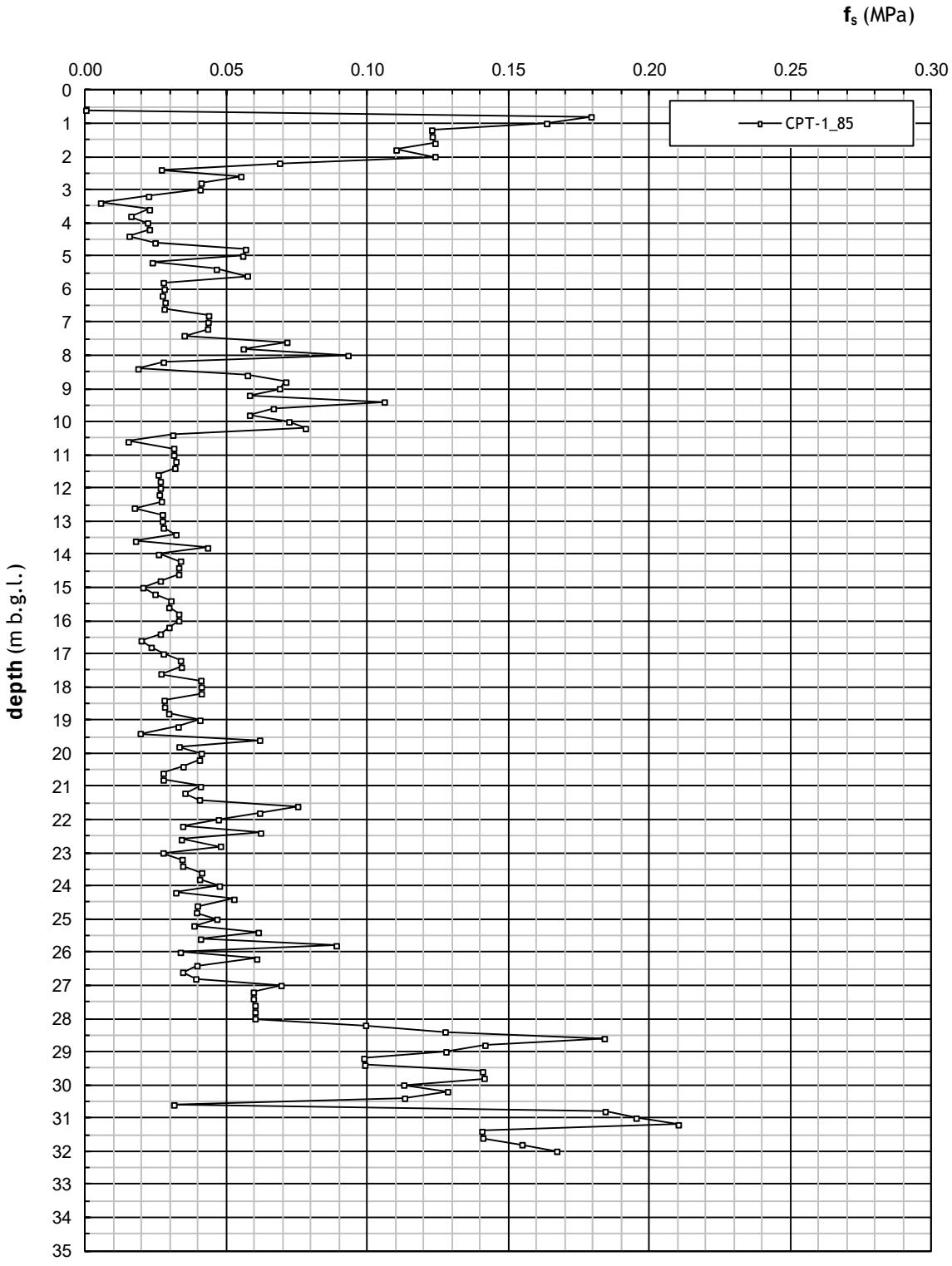
RAVENNA
PiomboniYARD

Cone point resistance



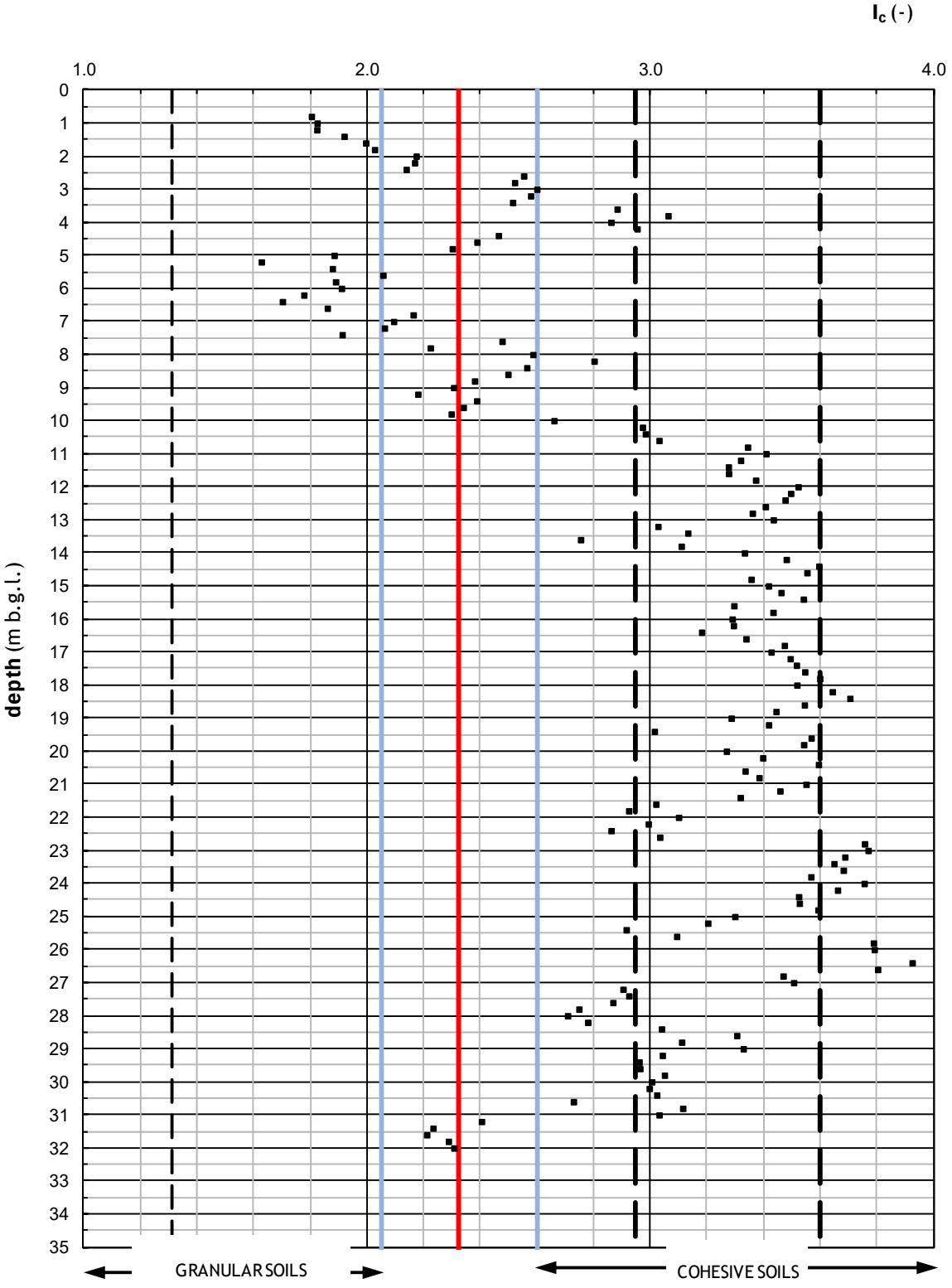
RAVENNA
PiomboniYARD

Local friction

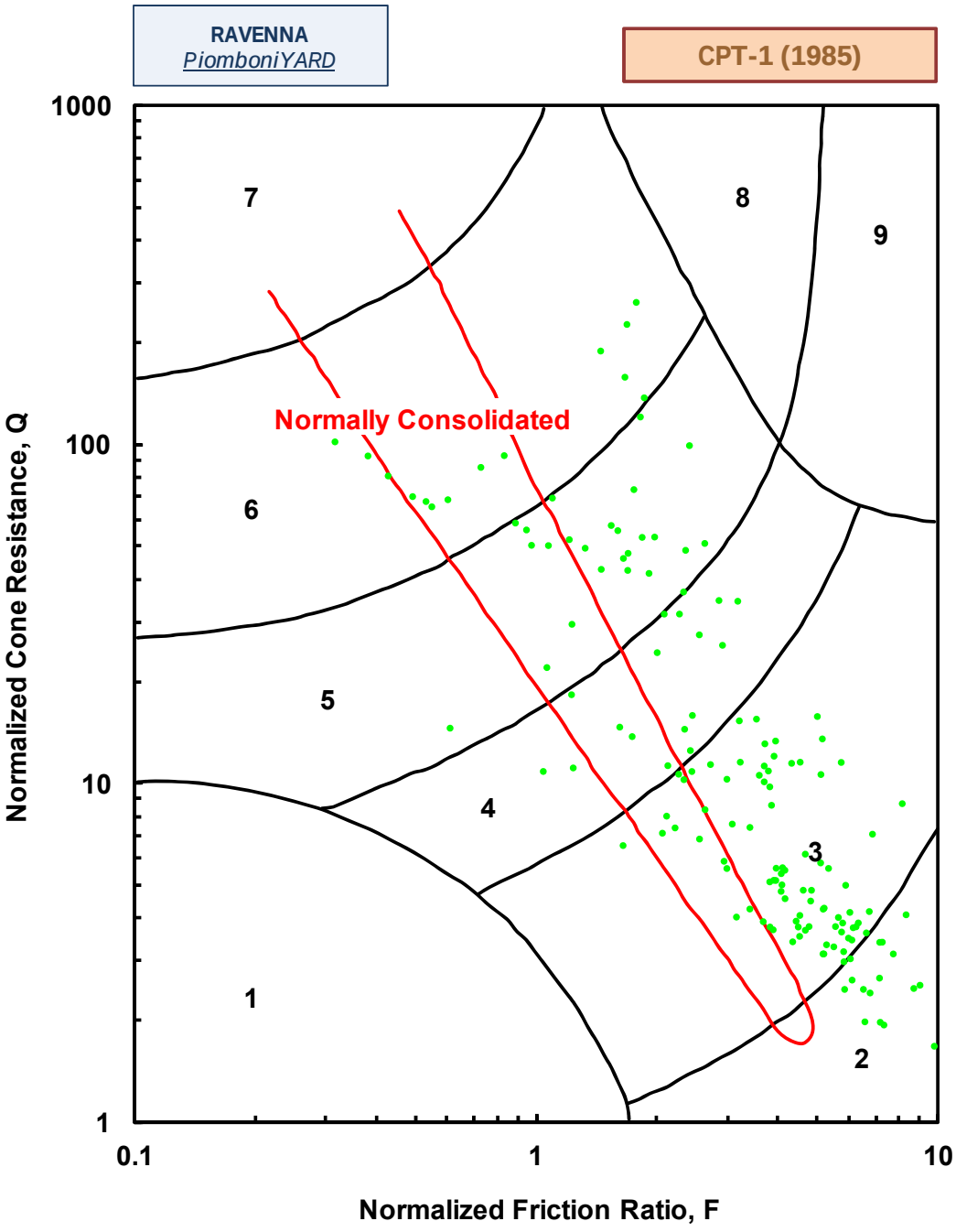


RAVENNA
PiomboniYARD

Robertson's Index: I_c (1998)
CPT-1 (1985)



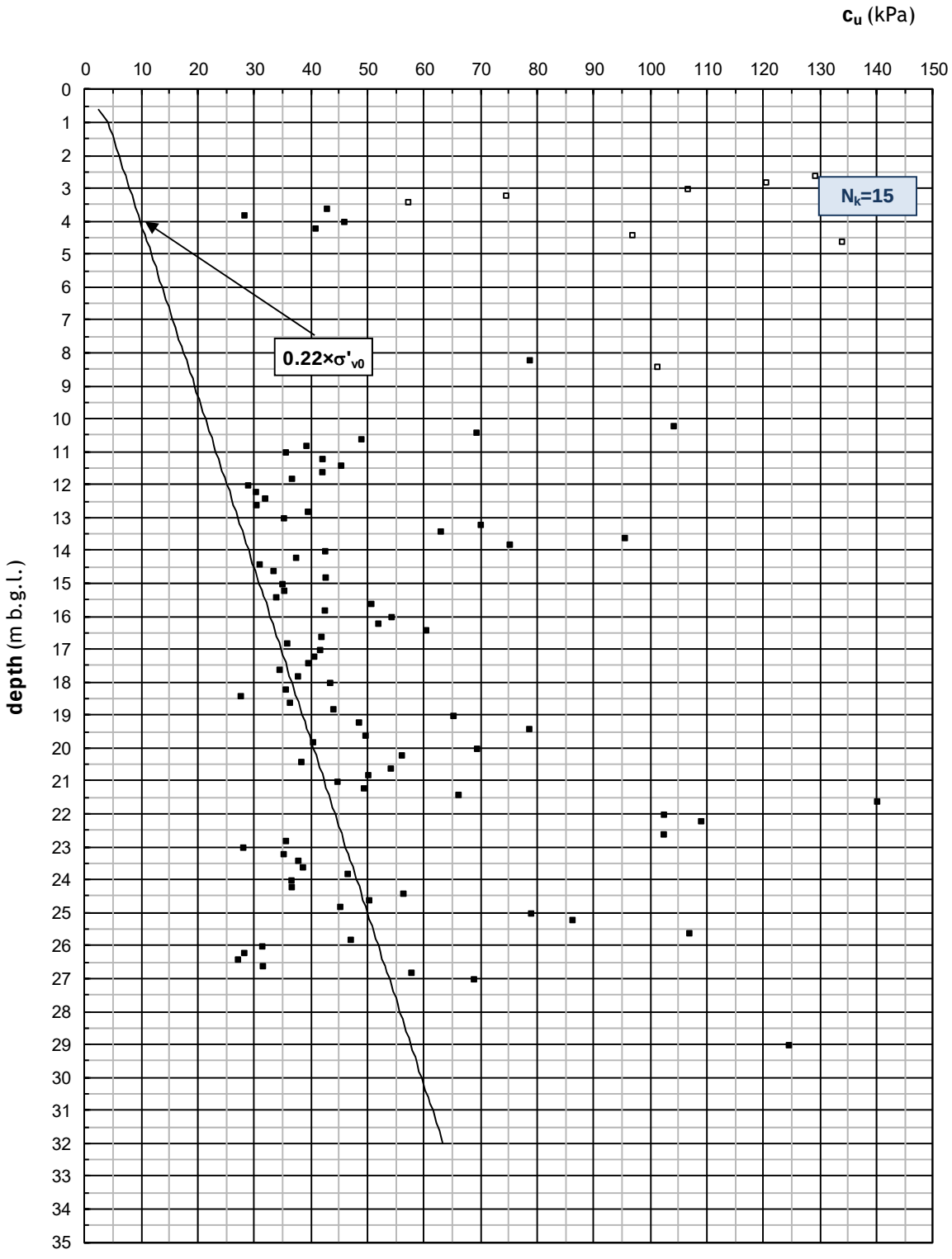
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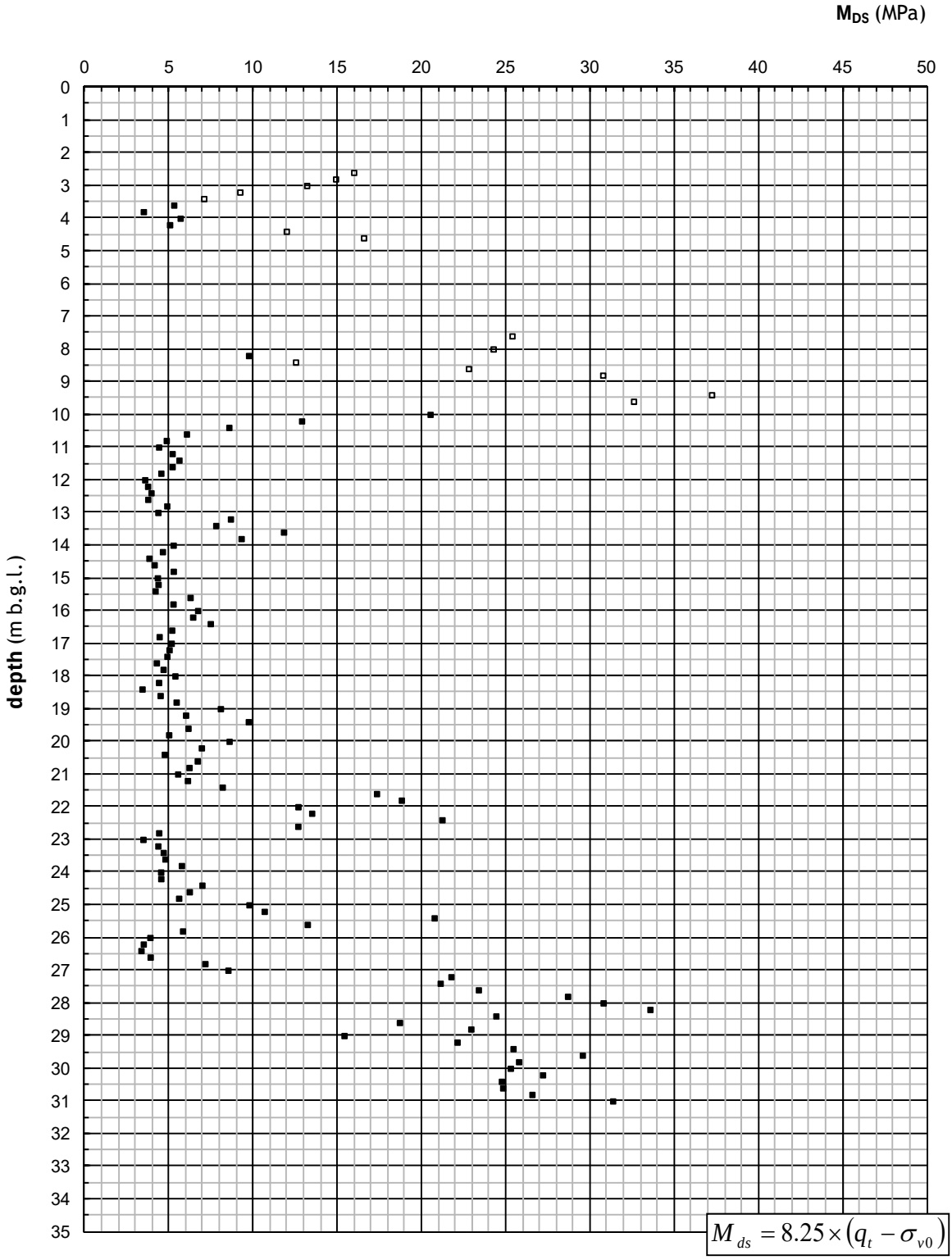
RAVENNA
PiomboniYARD

Undrained shear strength
CPT-1 (1985)



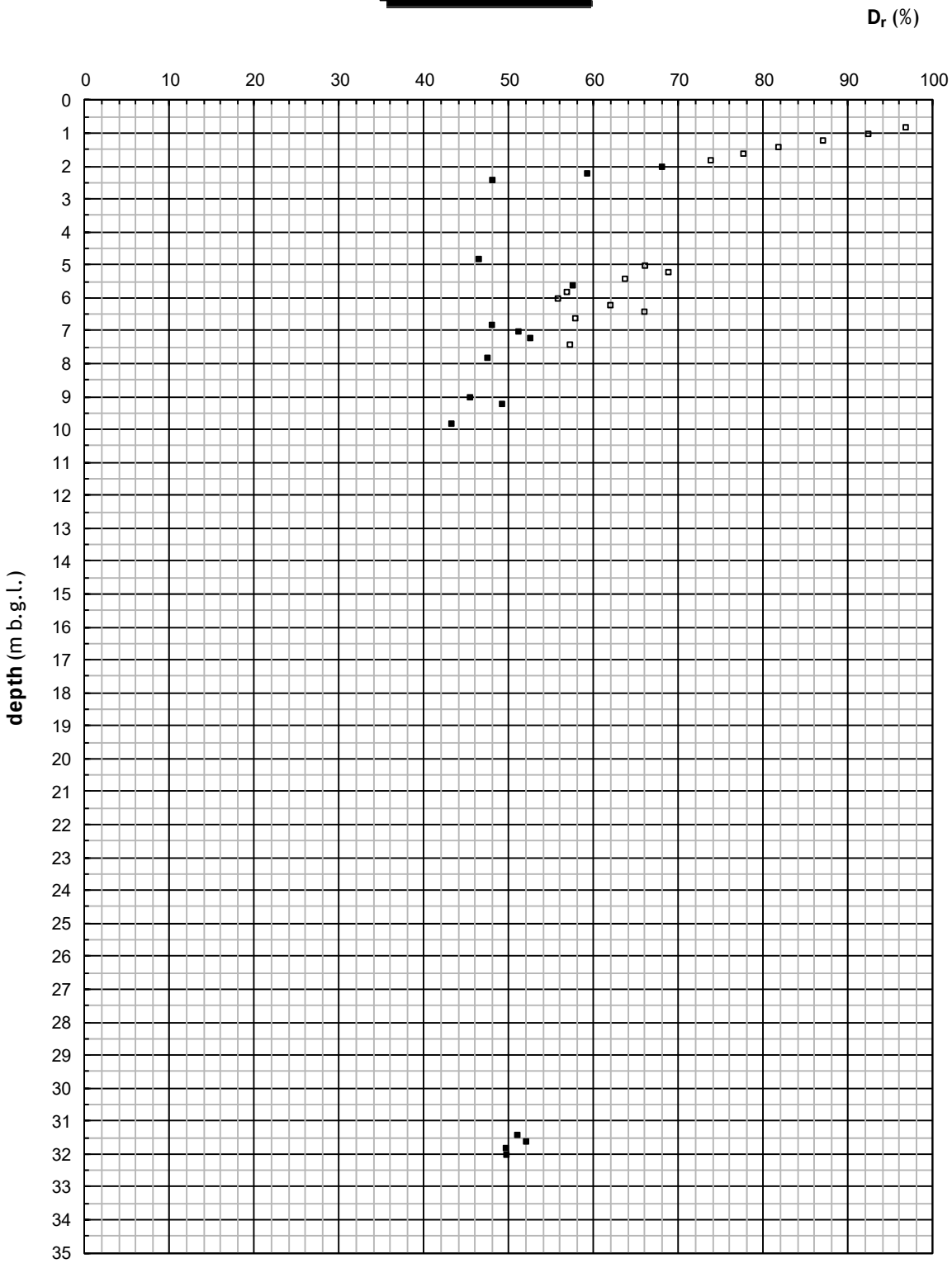
RAVENNA
PiomboniYARD

Oedometric modulus
CPT-1 (1985)



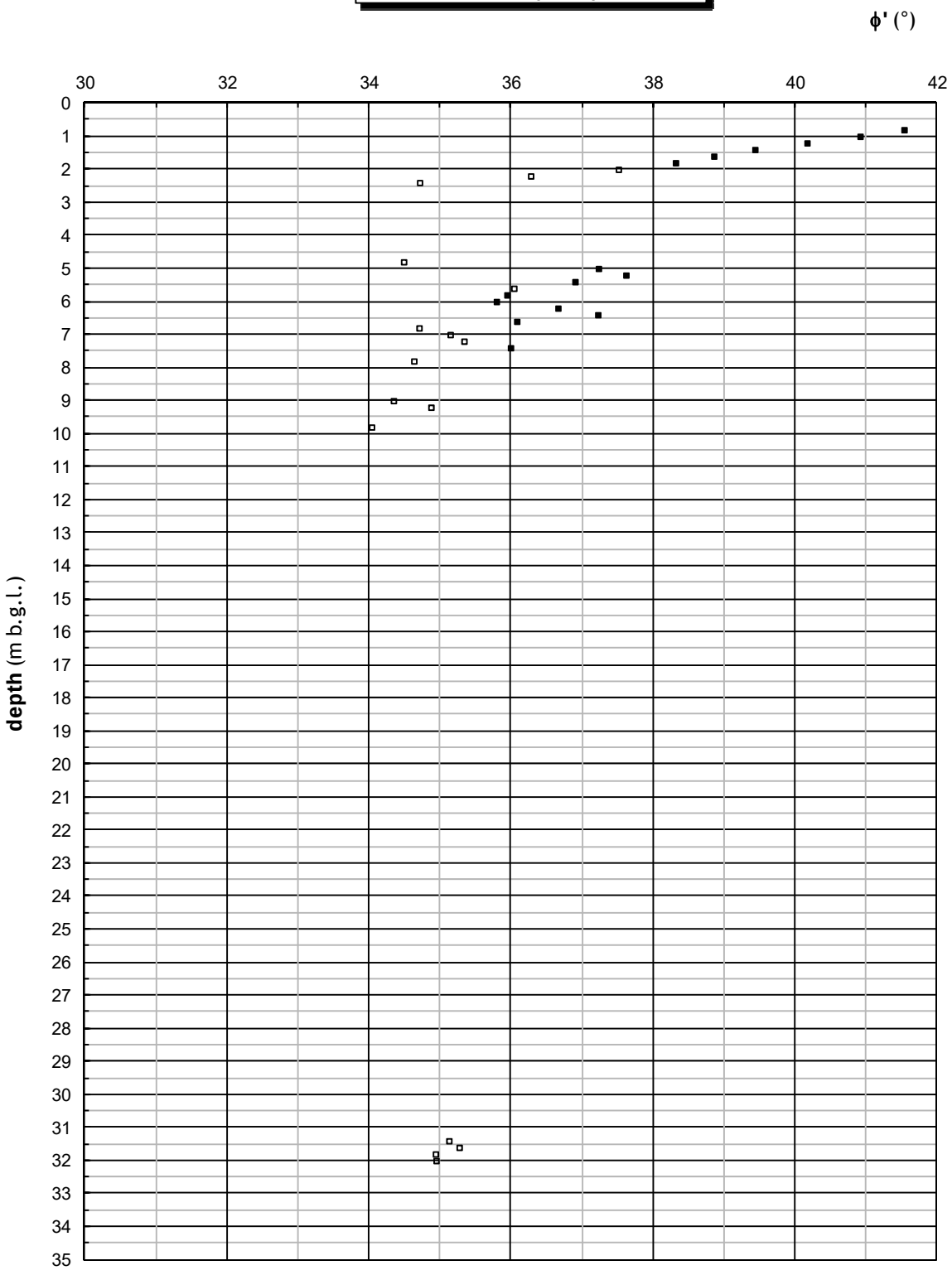
RAVENNA
PiomboniYARD

Relative density
CPT-1 (1985)



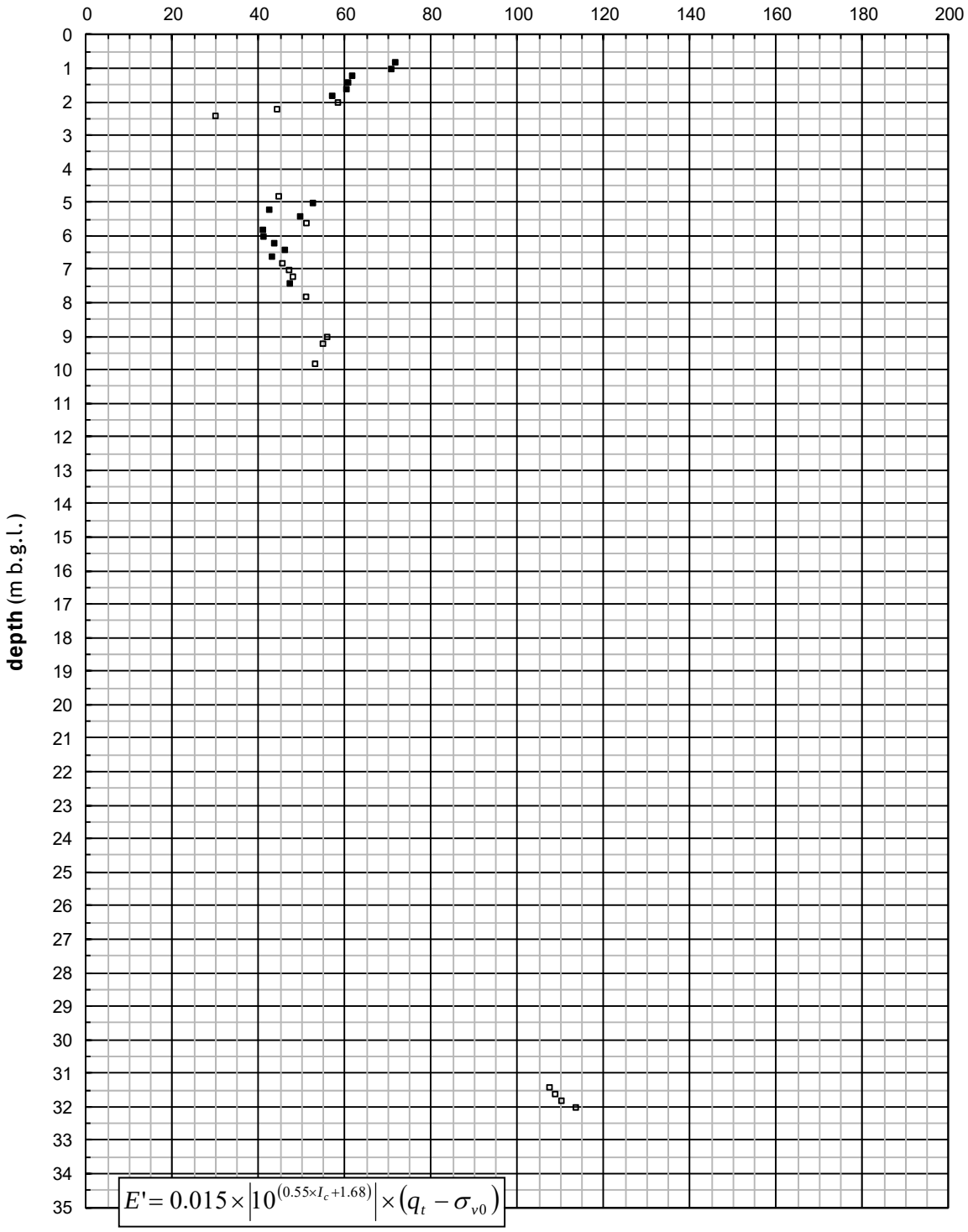
RAVENNA
PiomboniYARD

Angle of shearing resistance
CPT-1 (1985)



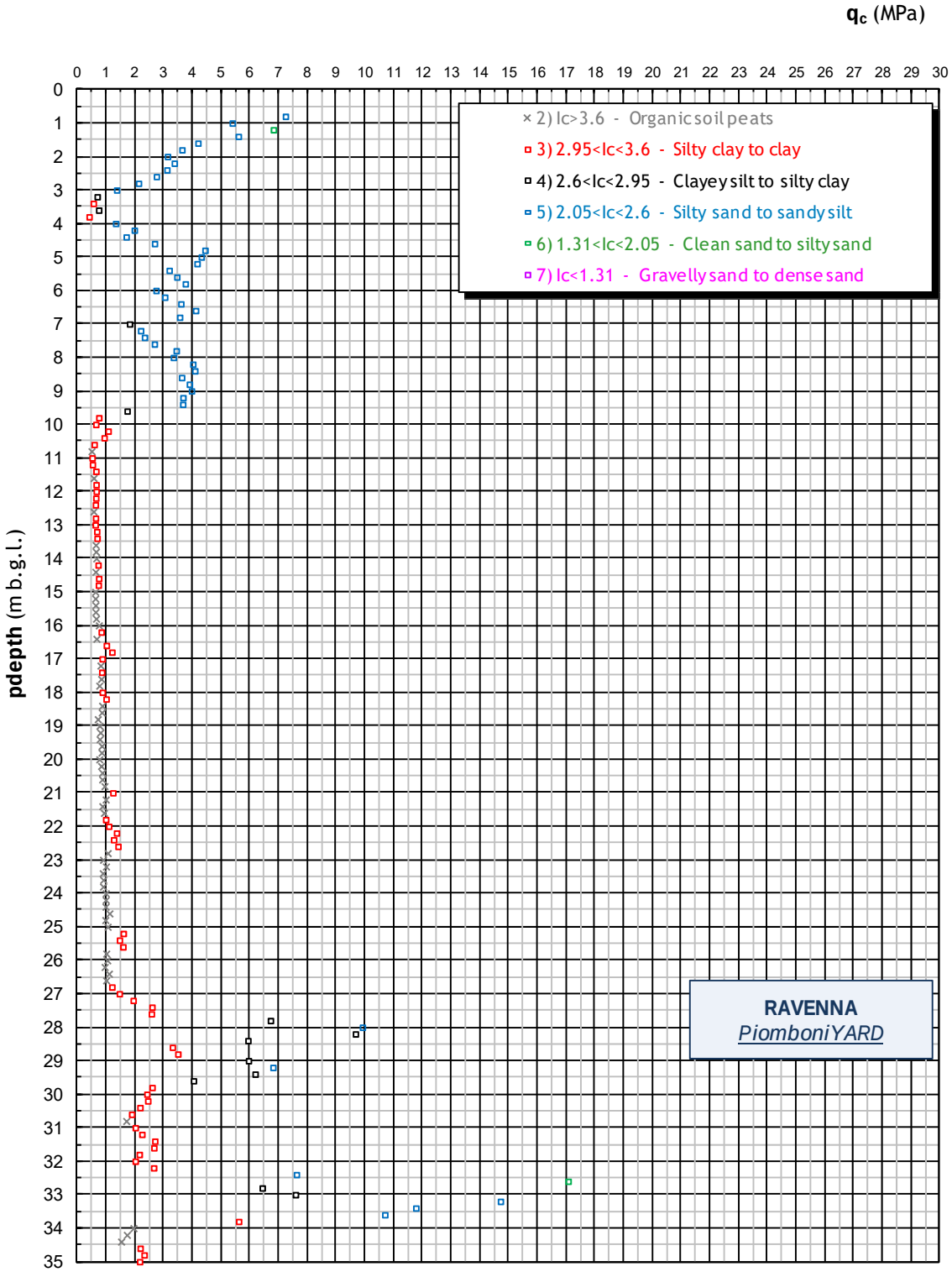
RAVENNA
PiomboniYARD

Young's modulus
CPT-1 (1985)



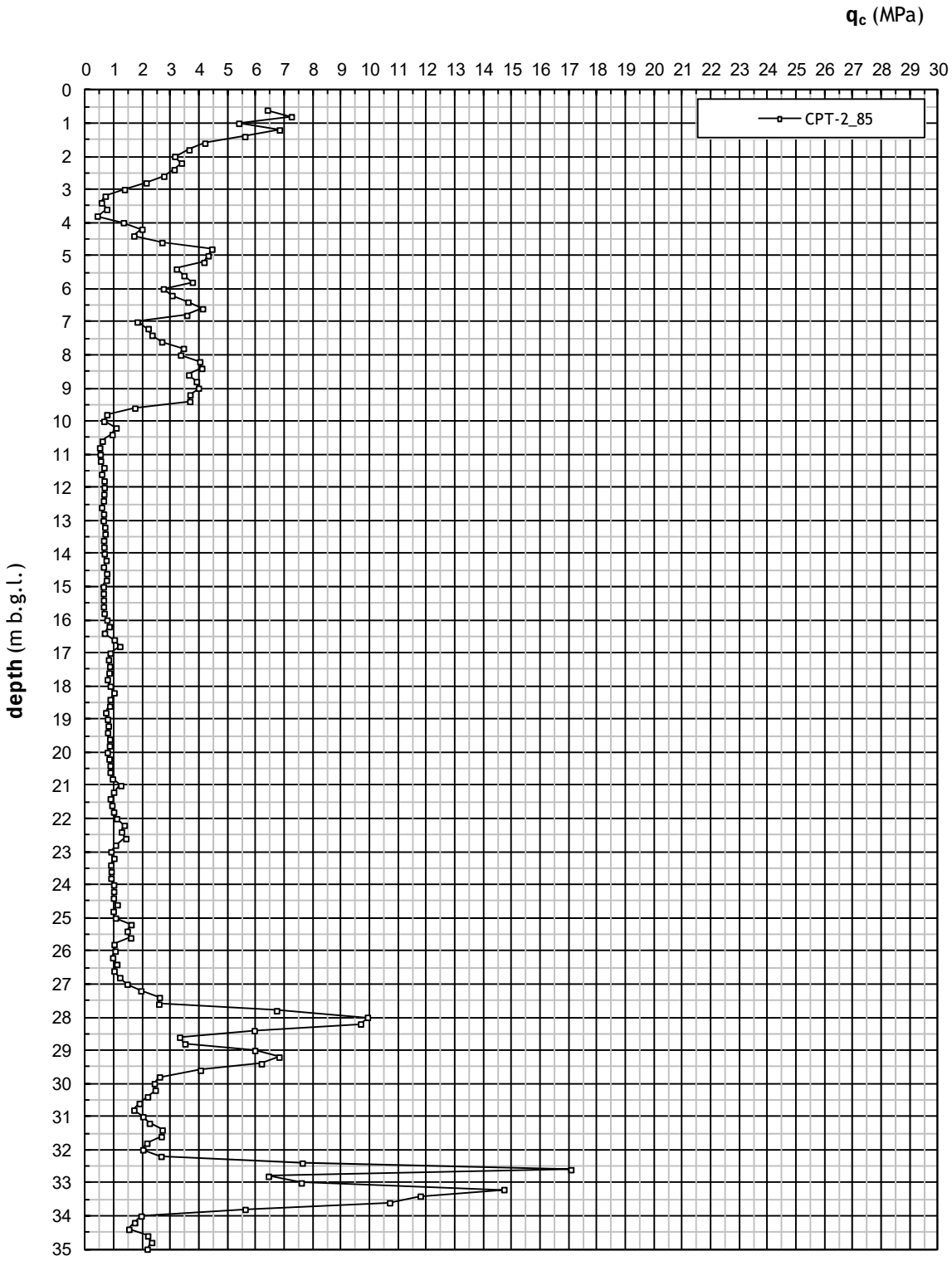
CPT-02 (1985)

Cone point resistance
CPT-2 (1985)



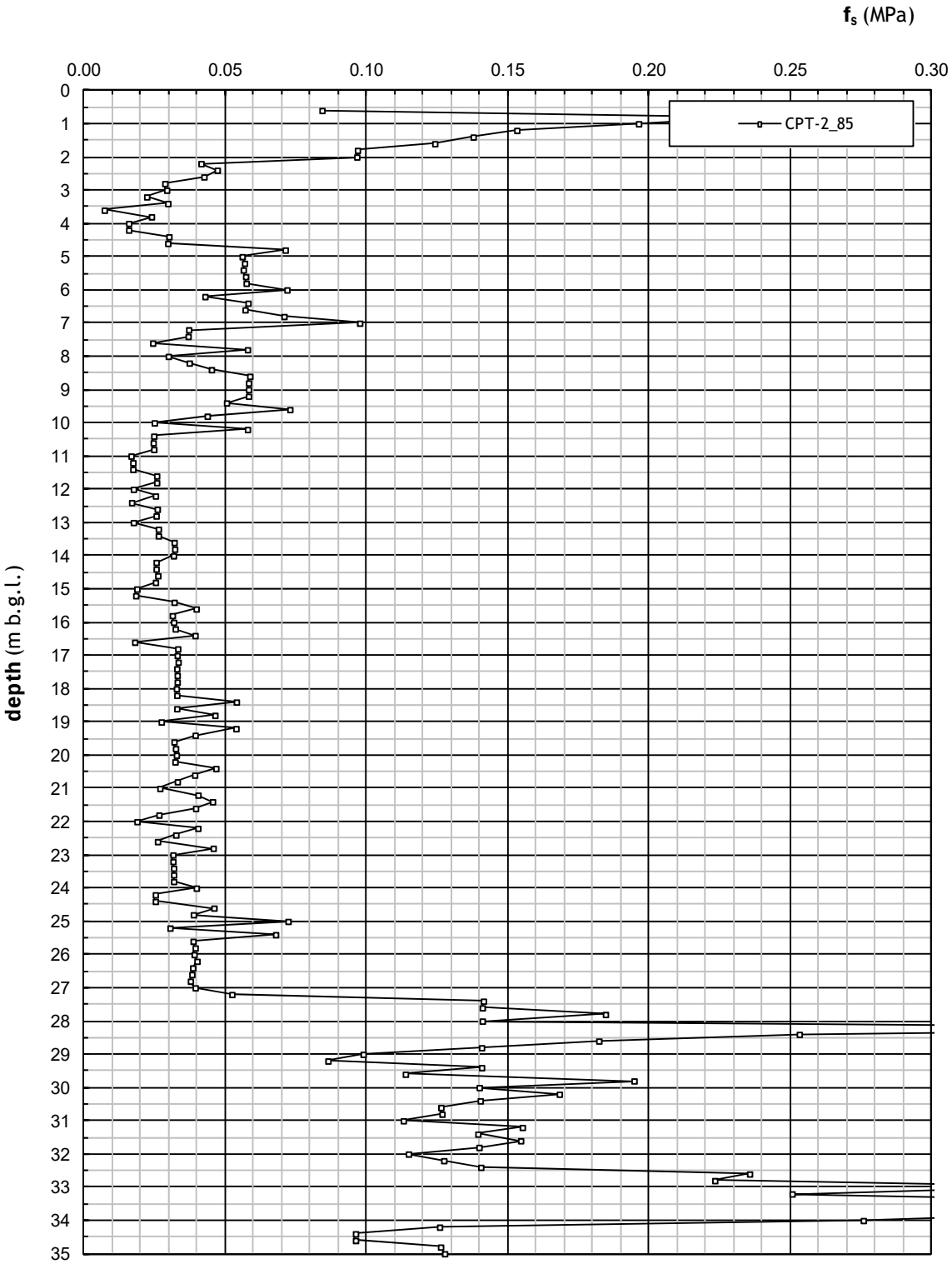
RAVENNA
PiomboniYARD

Cone point resistance



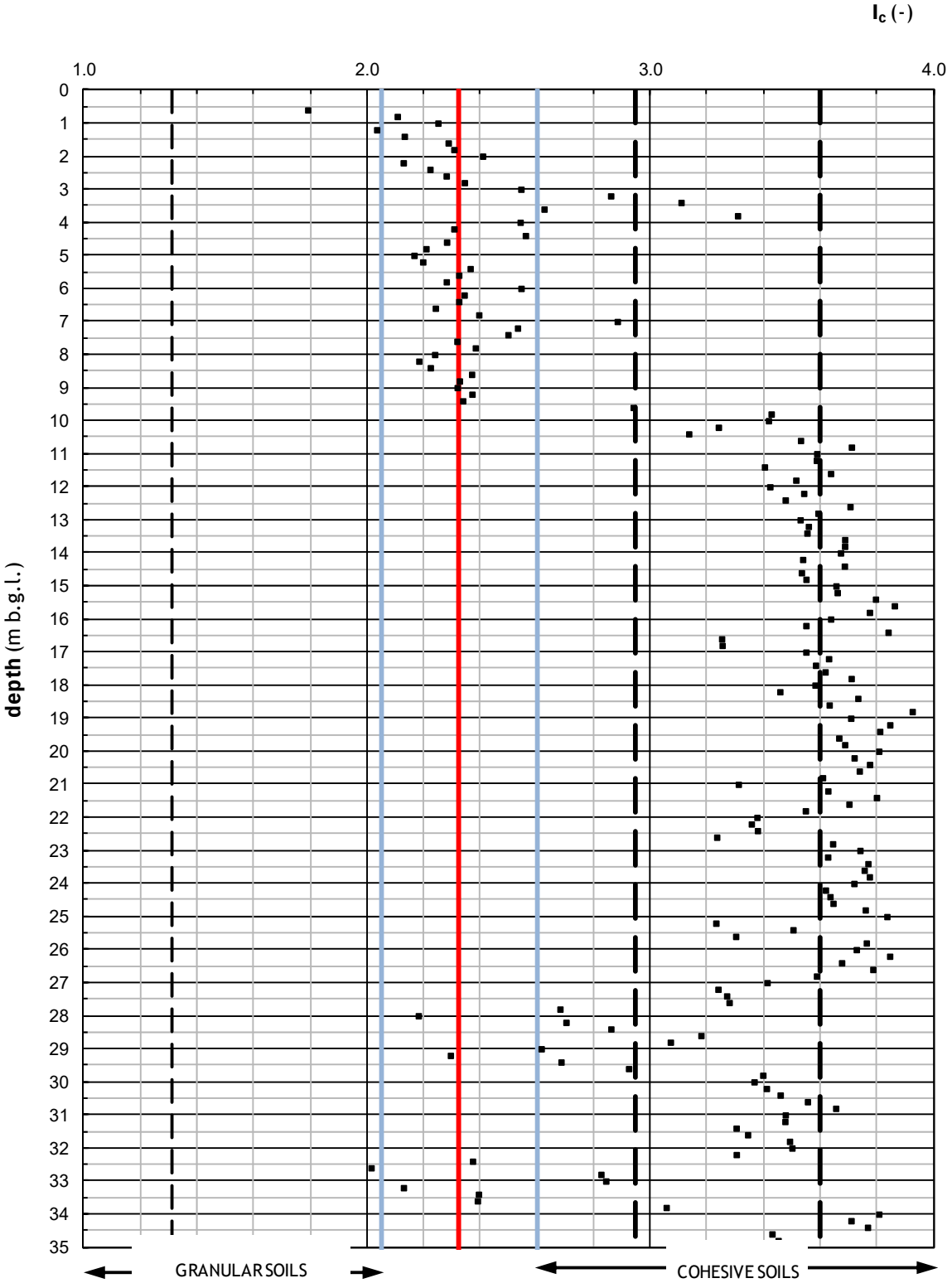
RAVENNA
PiomboniYARD

local friction

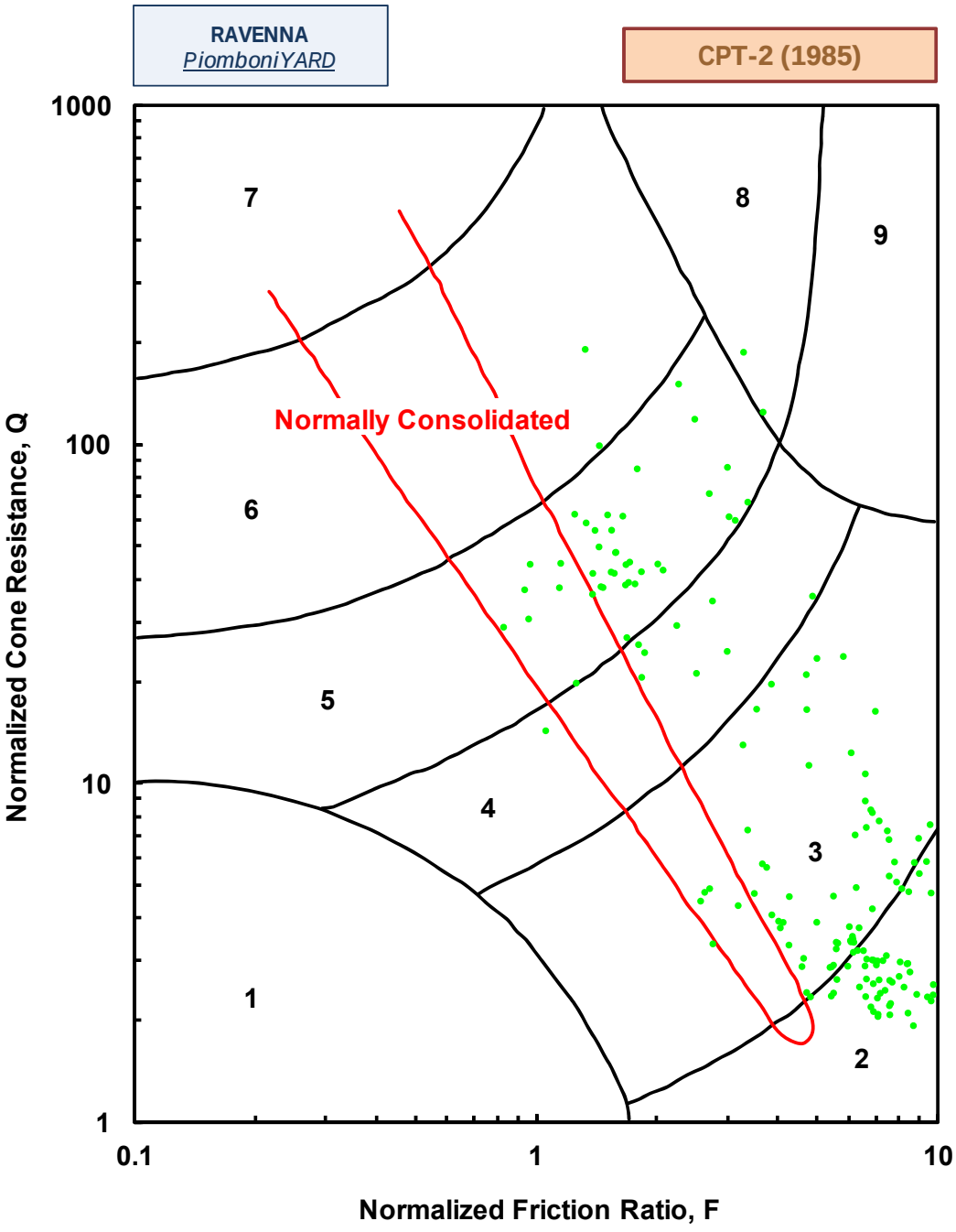


RAVENNA
PiomboniYARD

Robertson's Index: I_c (1998)
CPT-2 (1985)



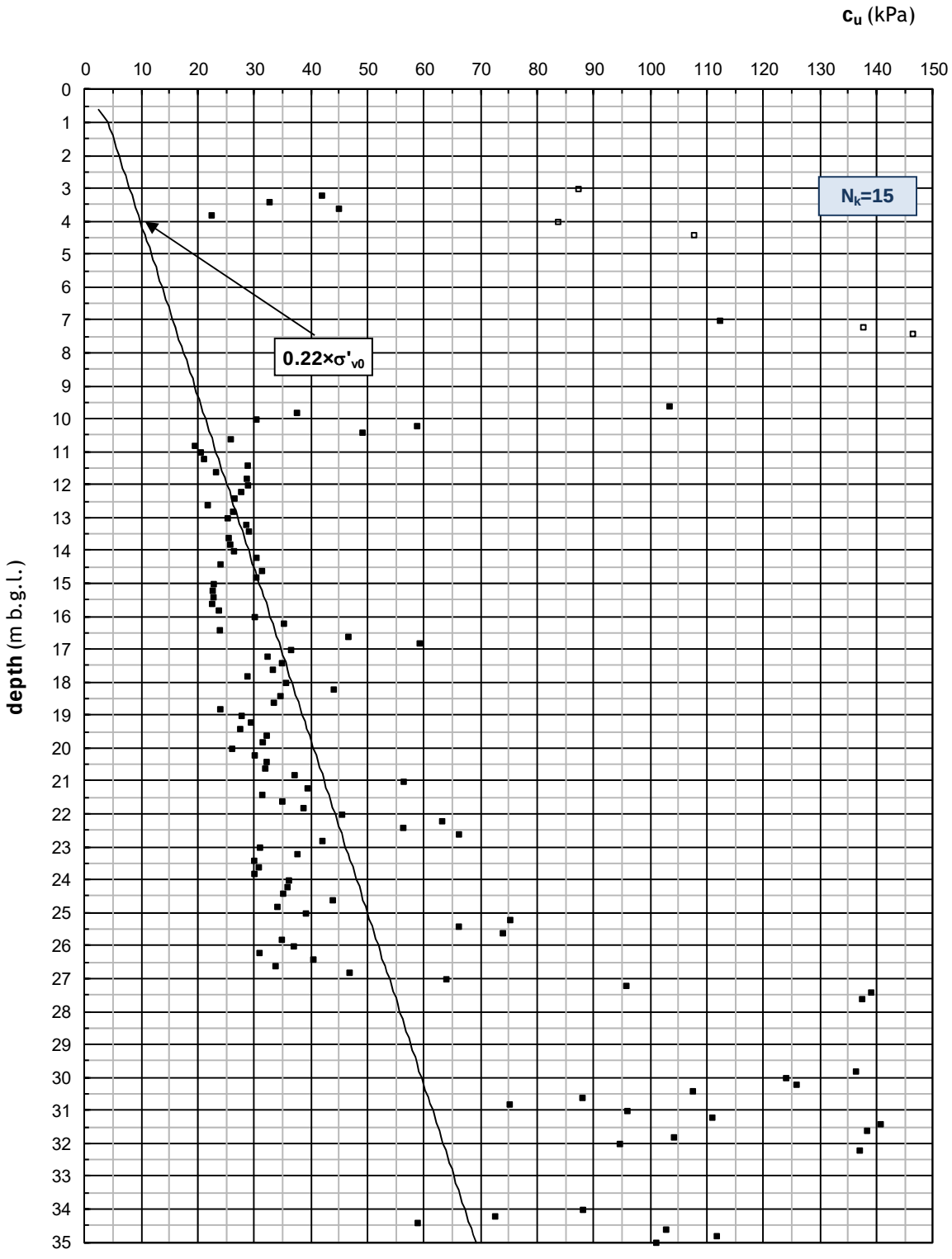
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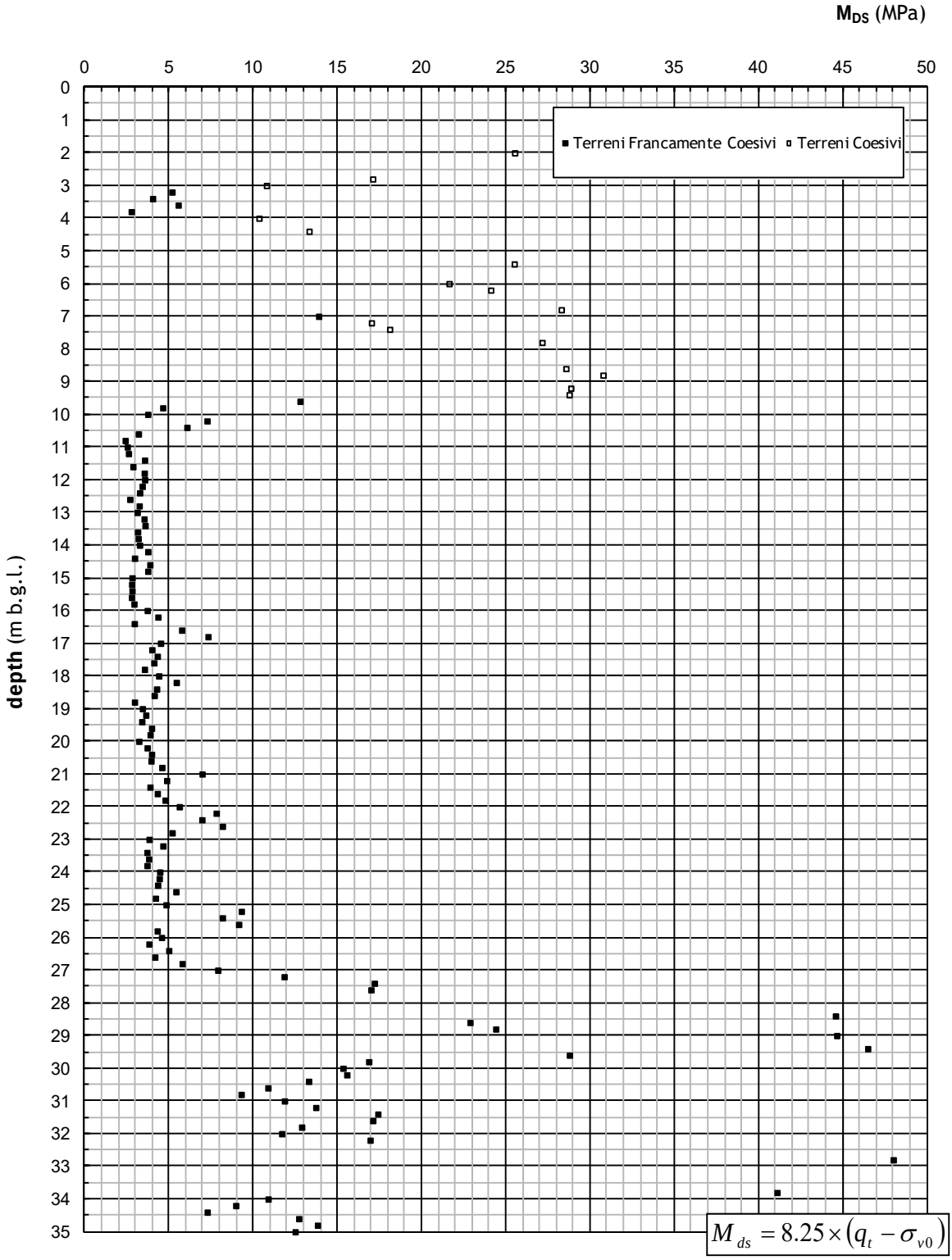
RAVENNA
PiomboniYARD

Undrained shear strength
CPT-2 (1985)



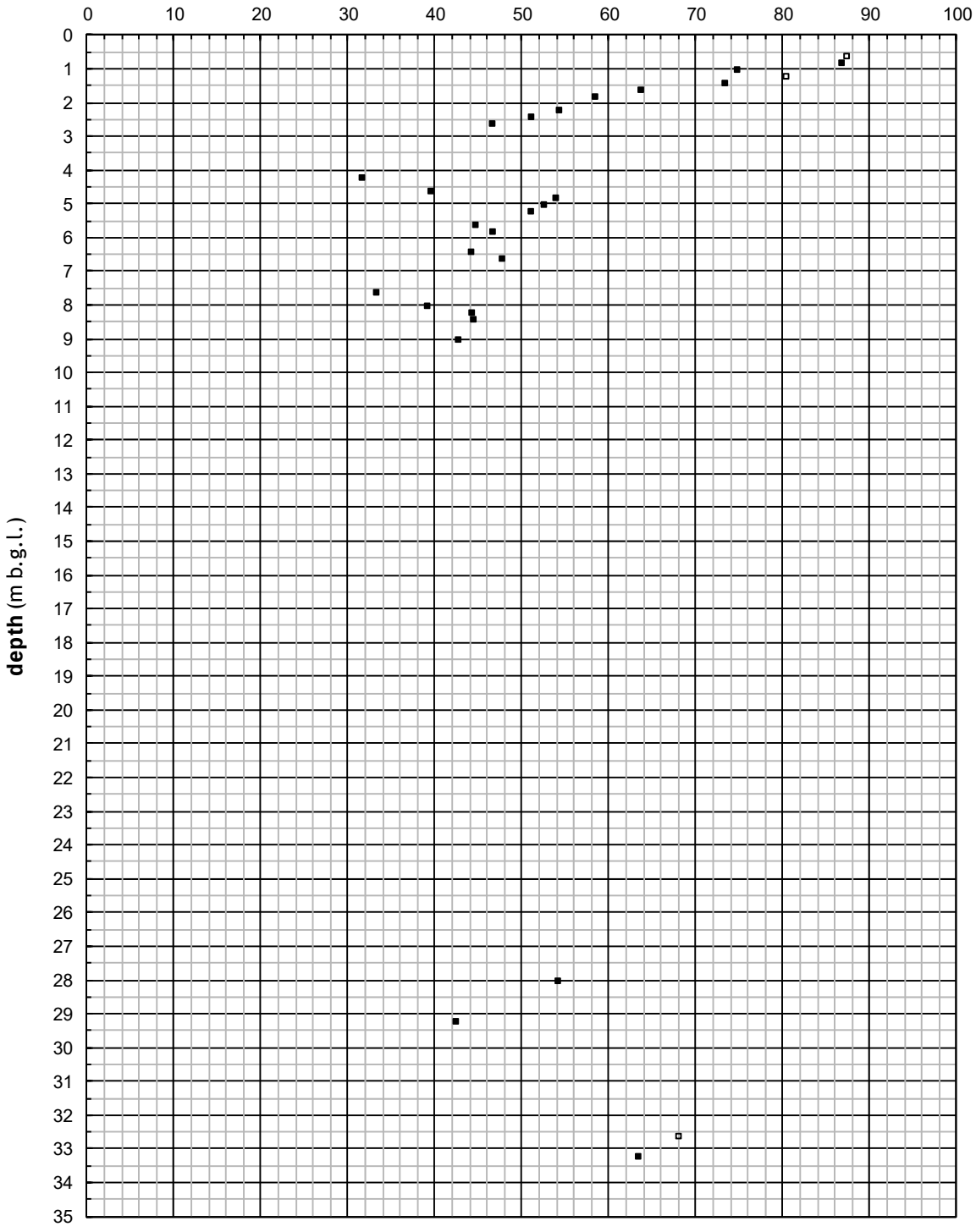
RAVENNA
PiomboniYARD

Oedometric Modulus
CPT-2 (1985)



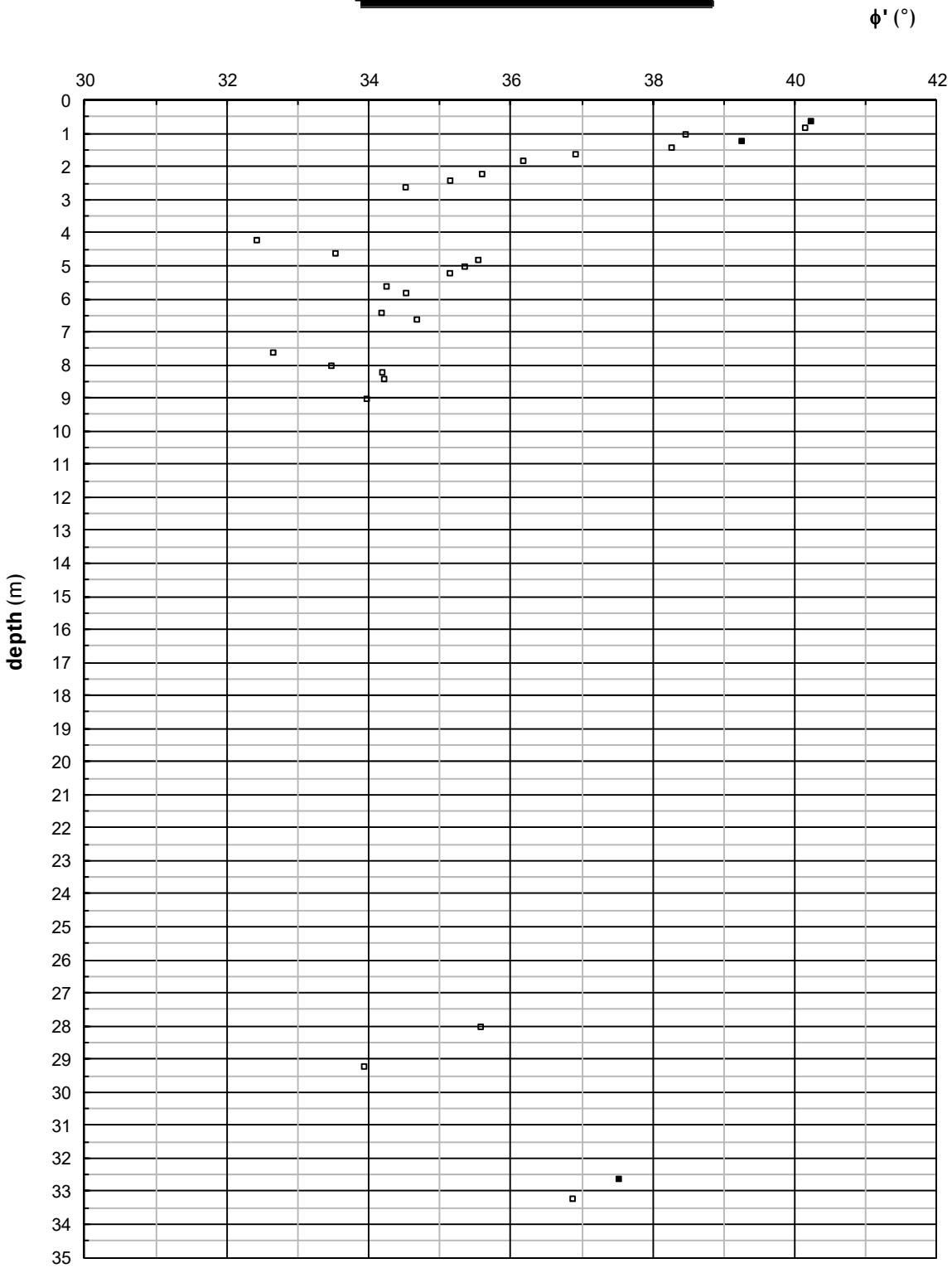
RAVENNA
PiomboniYARD

Relative density
CPT-2 (1985)



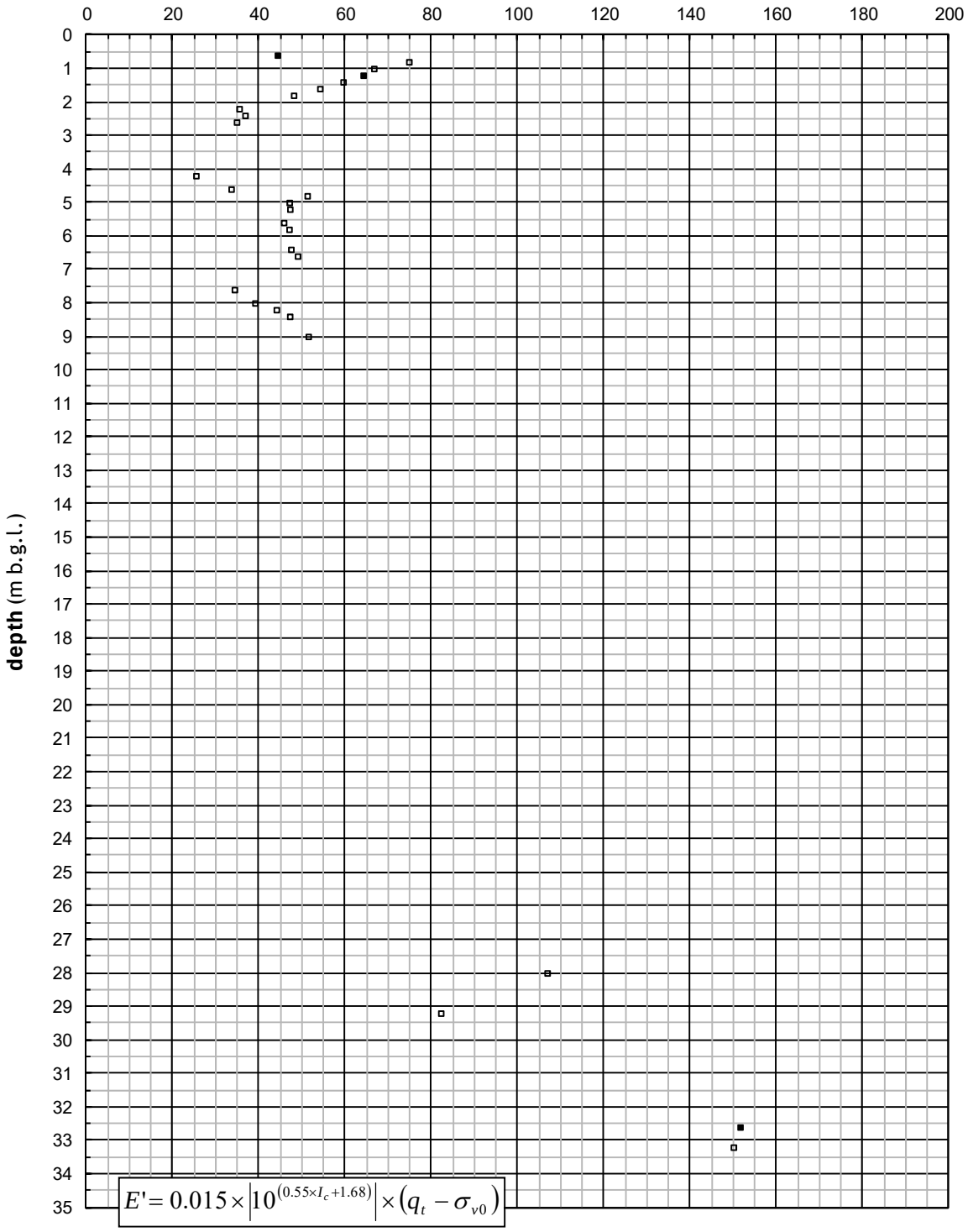
RAVENNA
PiomboniYARD

Angle of shearing resistance
CPT-2 (1985)



RAVENNA
PiomboniYARD

Young's modulus
CPT-2 (1985)



Addendum alla relazione di calcolo della banchina metallica del Cantiere Rosetti – Piomboni

Premessa

Nella presente nota si riporta la valutazione dello stato di sollecitazione nelle bitte di ormeggio della banchina metallica costituente il fronte di approdo principale realizzato lungo il Canale Piombone in destra idraulica all'interno del Cantiere Rosetti di Marina di Ravenna.

La banchina metallica è costituita da profili portanti PSP 808 N (king piles) e da palancole PZ 610 (sheet piles) solidarizzati in testa ad una trave di coronamento di forma quadrata di lato di 1.50 m (J_c = 0.422 m^4). La paratia metallica è vincolata in sommità a tiranti metallici in acciaio Fe52 sub-orizzontali lunghi 26 m, del diametro di 58 mm (A=2640 mm^2) disposti ad interasse di 1.68 m ancorati a piastre di contrasto costituite da coppie di palancole Larsenn 61. La trave di coronamento alloggia bitte in acciaio API 5L Gr. X52, di sezione cava del diametro di 508 mm e 15.09 mm di spessore riempite di calcestruzzo. L'altezza utile della bitta è di 500 mm mentre la parte immersa nella trave di coronamento è si 1500 mm. Le bitte sono soggette ad un tiro di progetto ortogonale alla banchina di intensità pari a P=500 kN. Nel seguito si riportano le verifiche di resistenza delle bitte e dei tiranti della banchina facendo riferimento alla normativa vigente all'epoca della costruzione dell'opera portuale (1987-1988) ed in particolare al metodo delle tensioni ammissibili allora adottato.

Verifica di resistenza della bitta

La resistenza della bitta è determinata dal modulo resistente della sezione, per la quale si considera lo spessore ridotto al valore minimo di 10 mm previsto alla fine della vita utile, dalla tensione ammissibile dell'acciaio attraverso le relazioni seguenti (De= 497.82 mm Di=477.82 mm; s_{min}= 10 mm; σ_{amm} = 240 N/mm^2):

$W = \pi[D_e^4 - D_i^4]/[32D_e] = 1832 \cdot 10^3\ mm^3$

$\sigma_{amm} = 240\ N/mm^2$

$M_{rd} = \sigma_{amm}\ W = 439.7\ kNm$

Lo sforzo massimo trasferibile alla bitta, considerando un braccio dell'azione orizzontale pari a h= 0.37 m, risulta a sua volta valere:

$M_{sd} = \eta\ F\ h$

essendo η = 1.35 il coefficiente di amplificazione dinamica dei carichi valutati in condizioni statiche. Eguagliando il momento resistente (capacità) al momento di progetto (domanda) si ricava l'azione massima che può agire sulle bitte ottenendo:

$F = M_{rd} / \eta\ h \approx 880\ kN$

Ferma restando la prescrizione di non superare i 500 kN di componente di sforzo ortogonale alla banchina. il tiro di ormeggio consentito può crescere da un valore minimo di 500 kN per tiro ortogonale alla banchina sino al valore di 850 kN quando l'angolo di tiro supera 54° di inclinazione nel piano orizzontale, angolo oltre il quale il tiro massimo ammissibile è costante essendo determinato dalla resistenza della bitta (850 kN) e non più da quella dei tiranti.

Verifica dei tiranti di ancoraggio

Nel seguito si riporta la valutazione dell'incremento di tiro nei tiranti di ancoraggio della banchina indotto dal tiro di ormeggio P = 500 kN in direzione ortogonale alla banchina verso mare. Il modello di riferimento è costituito da una trave si suolo elastico sollecitata nel piano orizzontale costituita dalla trave di coronamento vincolata ai tiranti di ancoraggio la cui rigidezza alla traslazione si può supporre, in virtù del ridoto interasse tra i tiranti, diffusa al continuo. In questo schema statico le grandezze di riferimento sono le seguenti:

Rigidezza specifica del tiranti

$K = E_s A_s \cos^2\alpha/(pL) = 210.000.000 \times 26 \times 10^{-4} \times 1.00 / (1.68 \times 26) = 12500$ kPa/m

Lunghezza caratteristica di interazione

$L_c = [\, 4E_c J_t / K \,]^{1/4} = [\, 4 \times 30.000.000 \times 0.4219 / 12500]^{1/4} = 7.98$ m

In base a tali grandezze si possono determinare lo spostamento della trave di coronamento e l'incremento di sforzo nel tirante in corrispondenza della bitta, rispettivamente pari a:

$w = P L_c^3 / 8E_c J_t = 500 \times 7.98^3 / (8 \times 30.000.000 \times 0.4219) = 2.5$ mm

$\Delta T = p\, kw = 1.68 \times 12500 \times 0.0025 = 52.7$ kN

corrispondente ad un incremento di tensione normale nella sezione d'acciaio dei tiranti pari a:

$\Delta\sigma = \Delta T / A_s = 20$ N/mm^2

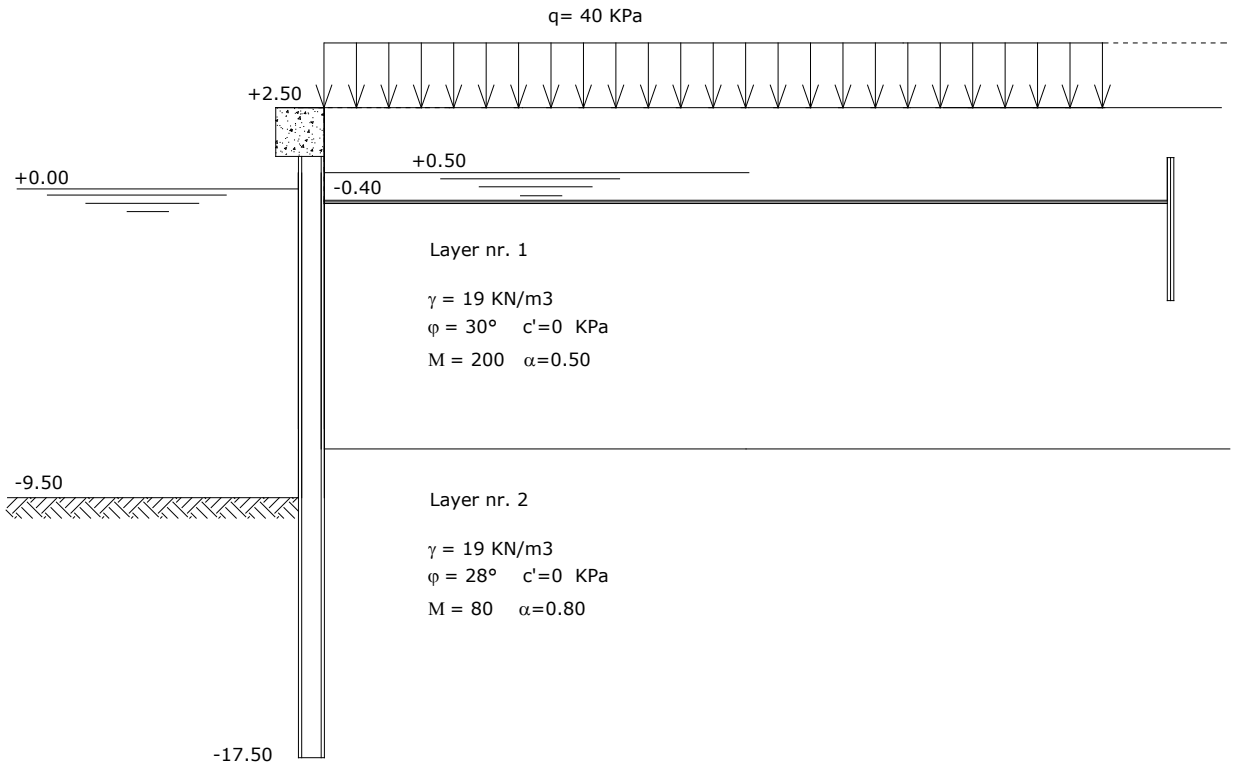
che rappresenta un ridotto incremento (9%) rispetto allo sforzo nel tirante agente in condizione di esercizio con sovraccarico di 40 kPa, pari a 583.9 kN. Lo sforzo massimo attinge così il valore:

$T_{max} = 583.9 + 52.7 = 636.6$ kN

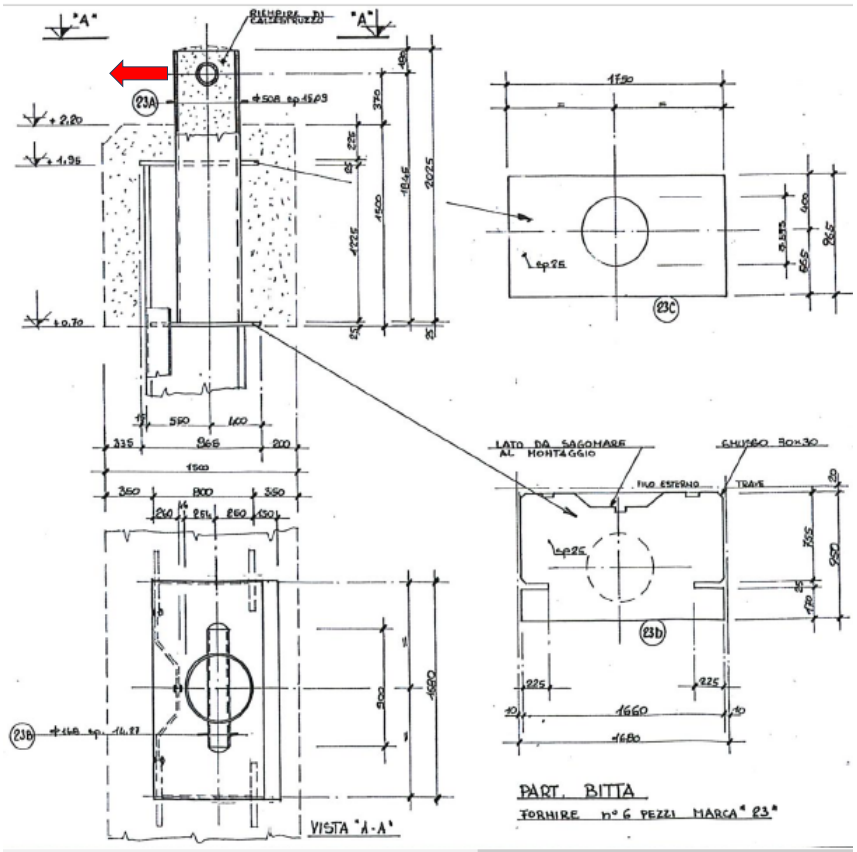
$\sigma_{max} = T_{max} / A_s = 221 + 20 = 241$ N/mm^2 < $\sigma_{amm} = 260$ N/mm^2

che rientra entro i limiti ammissibili di progetto.

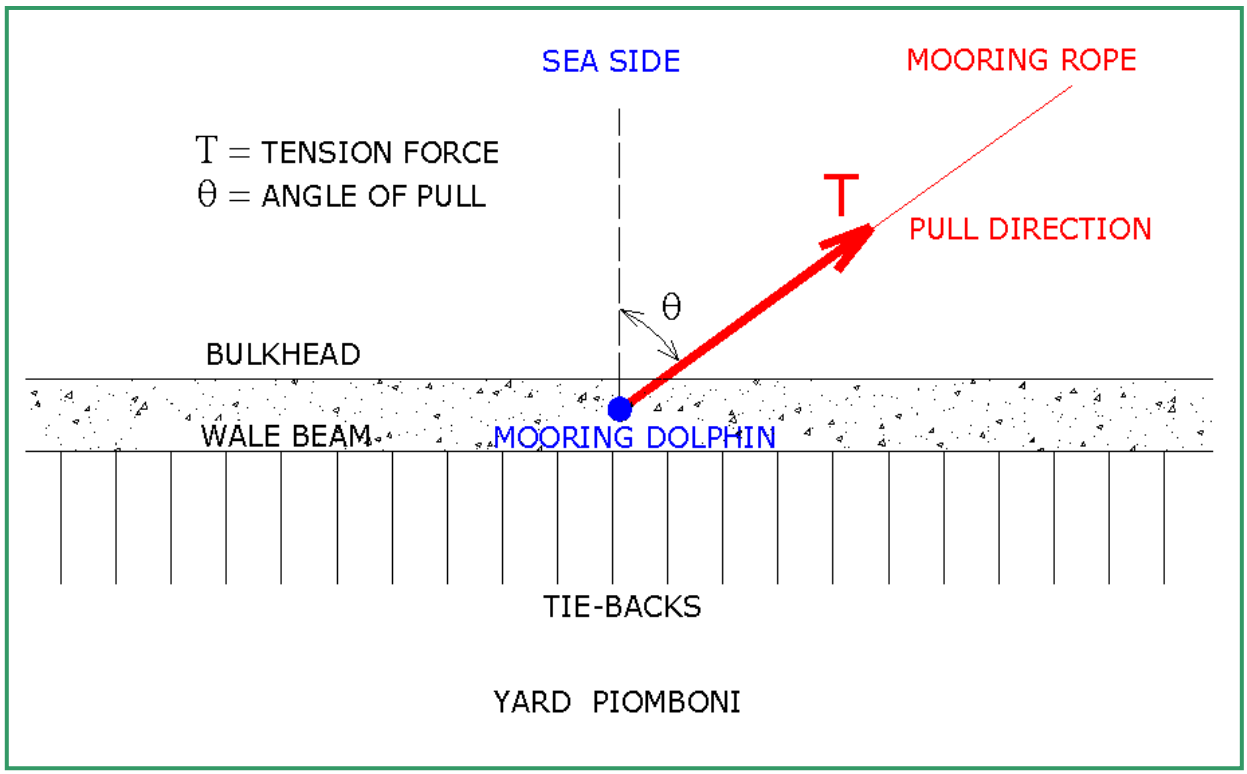
Plane Strain Model
Design Load

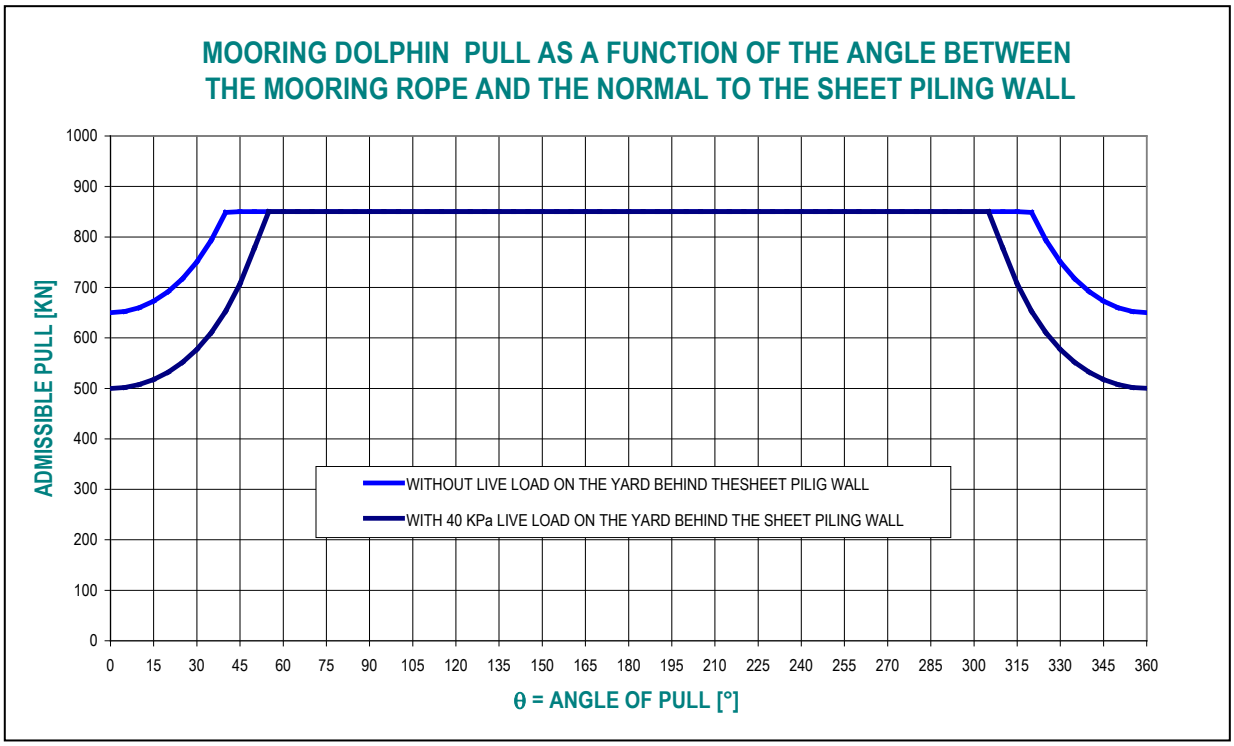


Configurazione di progetto della banchina



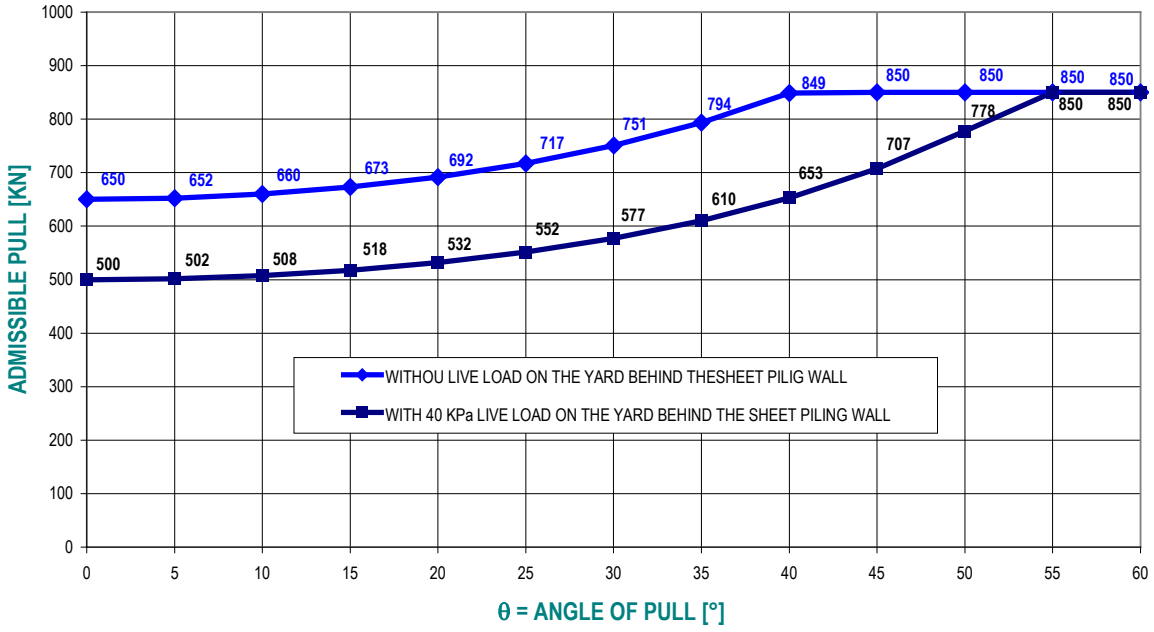
RMI YPB BOLLARD FROM No 13 TO No 23





Configurazione dei tiri di ormeggio ammissibili per le bitte

MOORING DOLPHIN PULL AS A FUNCTION OF THE ANGLE BETWEEN THE MOORING ROPE AND THE NORMAL TO THE SHEET PILING WALL



PULL ON THE BOLLARDS
STEEL SHEET PILING WALL

θ	T	T*
(°)	(KN)	(KN)
0	500	650
5	502	652
10	508	660
15	518	673
20	532	692
25	552	717
30	577	751
35	610	794
40	653	849
45	707	850
50	778	850
55	850	850
60	850	850
65	850	850
70	850	850
75	850	850
80	850	850
90	850	850

T = tiro nella bitta con sovraccarico di 40 kPa

T^* = tiro nella bitta senza sovraccarico nel piazzale

Verifica delle bitte della banchina in cemento armato

All'interno del cantiere Rosetti, sempre in continuità a monte della banchina metallica è presente un'altra banchina , di costruzione antecedente (anni 1970) realizzata con diaframmi cemento armato, sulla cui trave di coronamento sono state installate bitte metalliche delle medesime caratteristiche geometriche (De=508 mm) e meccaniche (acciaio API 5L Gr. X52). Il tiro massimo di progetto è in questo caso di 400 kN

Come in precedenza la resistenza della bitta è determinata dal modulo resistente della sezione, per la quale si considera lo spessore ridotto al valore minimo corroso di 5 mm (limite inferiore), dalla tensione ammissibile dell'acciaio attraverso le relazioni seguenti (D_e= 487.82 mm D_i=477.82 mm; σ_{amm} = 240 N/mm^2):

$W = \pi[D_e^4 - D_i^4]/[32D_e] = 888 \cdot 10^3$ mm^3

σ_{amm} = 240 N/mm^2

$M_{rd} = \sigma_{amm} W$ = 213.2 kNm

Lo sforzo massimo trasferibile alla bitta, considerando un braccio dell'azione orizzontale pari a h= 0.37 m, risulta a sua volta valere:

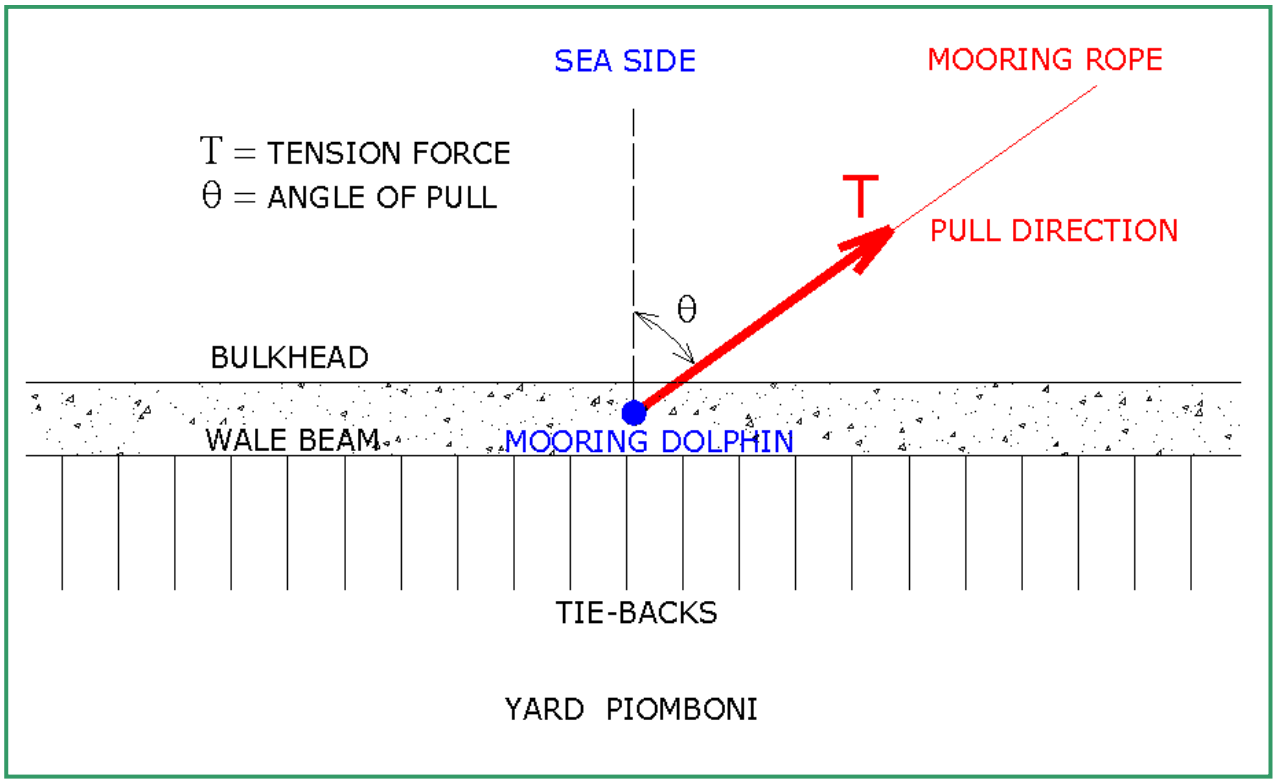
$M_{sd} = \eta F h$

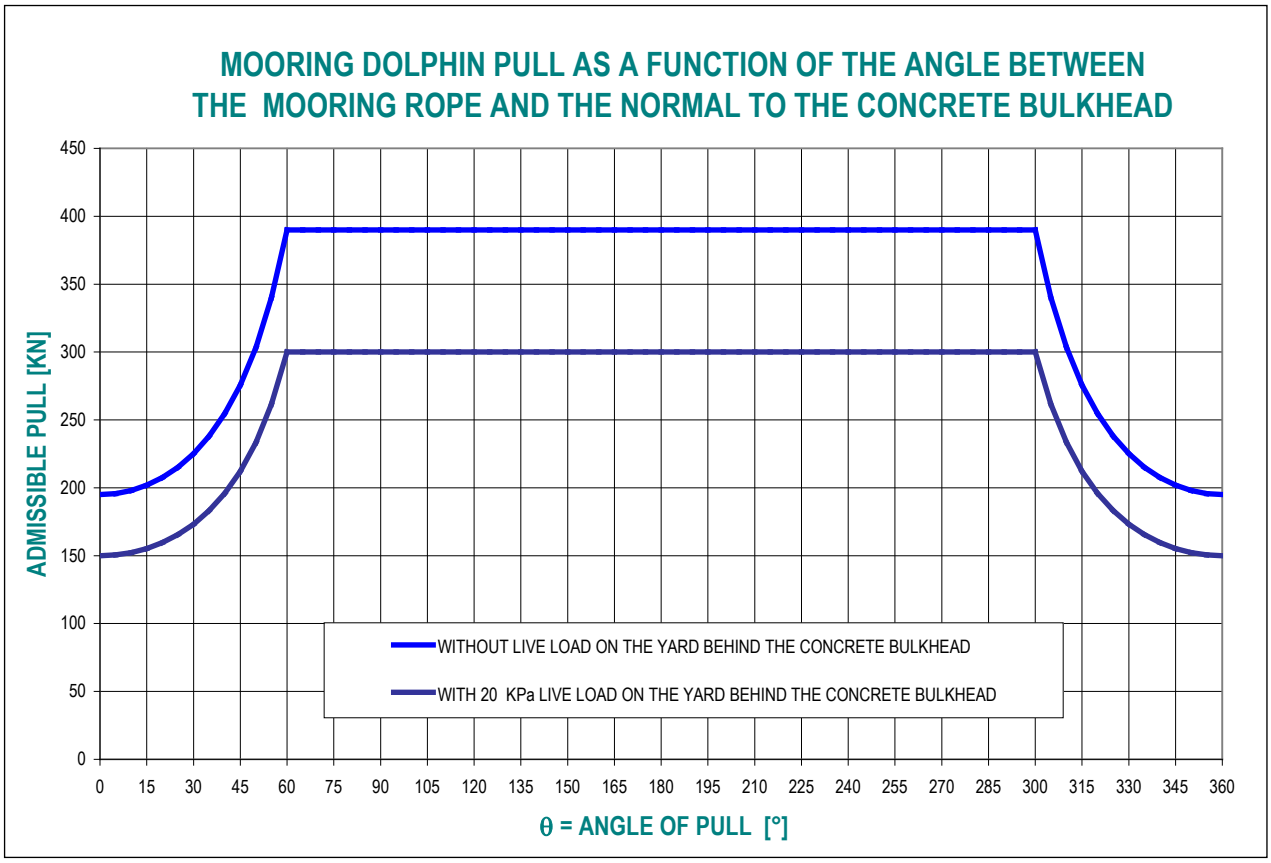
essendo η = 1.35 il coefficiente di amplificazione dinamica dei carichi valutati in condizioni statiche. Eguagliando il momento resistente (capacità) al momento di progetto (domanda) si ricava l'azione massima che può agire sulle bitte ottenendo:

$F = M_{rd} / \eta h \approx 427$ kN

Ferma restando la prescrizione di non superare i 150 kN di componente di sforzo ortogonale alla banchina. con sovraccarico di 20 kPa e di 200 kN senza sovraccarico a tergo della banchina il tiro di ormeggio consentito può crescere da un valore minimo di 200 kN per tiro ortogonale alla banchina sino al valore di 400 kN quando l'angolo di tiro supera 60° di inclinazione nel piano orizzontale, angolo oltre il quale il tiro massimo ammissibile è costante essendo determinato dalla resistenza della bitta (400 kN) e non più da quella dei tiranti.

RMI YPB BOLLARD FROM No 1 TO No 12





ADMISSIBLE PULL - CONCRETE BULKHEAD

□	T	T*		□	T	T*
(°)	(KN)	(KN)		(°)	(KN)	(KN)
0	150	195		180	300	390
5	151	196		185	300	390
10	152	198		190	300	390
15	155	202		195	300	390
20	160	208		200	300	390
25	166	215		205	300	390
30	173	225		210	300	390
35	183	238		215	300	390
40	196	255		220	300	390
45	212	276		225	300	390
50	233	303		230	300	390
55	262	340		235	300	390
60	300	390		240	300	390
65	300	390		245	300	390
70	300	390		250	300	390
75	300	390		255	300	390
80	300	390		260	300	390
85	300	390		265	300	390
90	300	390		270	300	390
95	300	390		275	300	390
100	300	390		280	300	390
105	300	390		285	300	390
110	300	390		290	300	390
115	300	390		295	300	390
120	300	390		300	300	390
125	300	390		305	262	340
130	300	390		310	233	303
135	300	390		315	212	276
140	300	390		320	196	255

145	300	390		325	183	238
150	300	390		330	173	225
155	300	390		335	166	215
160	300	390		340	160	208
165	300	390		345	155	202
170	300	390		350	152	198
175	300	390		355	151	196
180	300	390		360	150	195

TEST REPORT
RAPPORTO DI COLLAUDO

N° P002554-1-1-01.001

RINA file No.: *Pratica RINA N.*	P002554-1-1-01 P002554-2-1-01		
Purchaser: *Committente:*	Rosetti Marino S.p.A.		
Order No.: *Ordine N.:*	1721001190	Intended for: *Destinazione:*	Bollards at Piomboni Yard
Inspection date: *Data di ispezione:*	19th May 2021	Place of inspection: *Luogo di ispezione:*	Marina di Ravenna (RA)

Referenced standards and specifications:
Standard e specifiche di riferimento:
DNVGL-ST-N001 - Marine operations and marine warranty

Attendees:
Partecipanti:

- Mr. Dante Ranzi, *Rosetti Marino Yard Manager*
- Mr. Davide Depasquale, Rosetti Marino – *Quality Control Manager*
- Mr. Riccardo Cherotti – *RINA Inspector*

Tested material, components or equipment:
Materiali, componenti o apparecchi testati:

Item	Description	Qty	Dwgs	Rev.
5 ÷ 23	Bollards	19	79004/504	0

This report is ruled by the General Condition for service provision. As far as the nature of the activity and RINA liability are concerned, please find here below an abstract of the above mentioned General Condition.
3.1 The Document concerns the verification of the conformity of the product, the activity, the service or the process carried out by the Client with respect to a certain document of reference (here included a law), or the carrying out of technical and/or economic analysis demanded by the Client. The Client is the sole responsible of the correct carrying out of the activity and its conformity, or the conformity of its products, to the enforceable laws and to Clients and third parties' expectations in general. 3.3 To no report, declaration, document or information issued or released to implement the Services supplied by the Company can be ascribed legal effects and implications different from the certificate stating that, on the basis of the verifications carried out by the Company, the structure, the materials, the equipment, the machineries or any other element this document or information refer to complies with the document of reference. At the same time, they cannot have legal effects or implications not explicitly envisaged by the parties when requesting the Service. 11.1 In providing the Services, as well as other correlated information or advice, the Company, its Surveyors and employees, operate with due diligence for the proper execution of the activity. However, considering the nature of the activities performed, it is not possible to guarantee absolute accuracy, correctness and completeness of any information or advice supplied. 11.2 Therefore express and implied warranties are specifically disclaimed and nor the Company nor its Technicians or auxiliaries will be liable for any loss, damage or expense of whatever nature sustained by any person, in tort or in contract, derived from carrying out the Services. 11.3 Without prejudice to the provisions of the previous paragraph, if a user of the Company Services can prove to have suffered a loss or a damage because of some negligent act or omission by the Company, its Technicians or employees, the Company will pay compensation to such person for his proved loss, up to, but not exceeding, five times the amount of the fees charged for the specific services, information or opinions from which the loss or damage derives or, if no fee has been charged, a maximum of one million Euro. Where the fees charged are related to a number of Services, the amount of the fees will be apportioned for the purpose of the calculation of the maximum compensation, by reference to the estimated time involved in the performance of the Service from which the damage or loss derives. 11.4 Any liability for indirect or consequential loss, damage or expense is specifically excluded.

Il presente rapportoo è disciplinato dalle Condizioni Generali per la fornitura di servizi. Per quanto concerne la natura delle attività svolte e le responsabilità di RINA si riporta qui di seguito un estratto delle succitate Condizioni Generali.
3.1 Il Documento ha ad oggetto la verifica della conformità del prodotto, dell'attività, del servizio o del processo svolti del Cliente rispetto ad un dato documento, anche normativo, di riferimento, ovvero lo svolgimento di analisi tecniche e/o economiche richieste dal Cliente. Il Cliente è e rimane l'unico responsabile, sia verso se stesso, sia verso i terzi, del corretto svolgimento della propria attività e della conformità della stessa e/o dei propri prodotti alle normative applicabili ed alle aspettative dei clienti e dei terzi in genere. 3.3 A nessun rapporto, dichiarazione, documento o informazione emessi o rilasciati in esecuzione dei Servizi prestati dalla Società possono essere attribuiti effetti o implicazioni legali diversi dall'attestazione che, sulla base degli accertamenti eseguiti dalla Società, la struttura, i materiali, le apparecchiature, i macchinari o qualsiasi altro elemento cui tale documento o informazione si riferiscono sono conformi al documento di riferimento, ovvero non espressamente contemplati dalle parti all'atto della richiesta del Servizio. 11.1 Nel prestare i Servizi, come pure nel dare informazioni o pareri ad essi correlati, la Società, i suoi Tecnici, dipendenti operano con la dovuta diligenza al fine di una corretta esecuzione dell'incarico. Tuttavia, stante la natura complessa delle attività svolte, non è possibile garantire l'assoluta precisione, correttezza e completezza delle informazioni o dei pareri forniti. 11.2 La Società, pertanto, non presta alcuna garanzia esplicita od implicita e, né la stessa, né alcuno dei suoi Tecnici o ausiliari saranno responsabili di perdite, danni o spese di qualunque natura patiti da qualsiasi soggetto, sia in via contrattuale, sia in via extracontrattuale, e derivanti dall'esecuzione dei Servizi. 11.3 Ferme restando le disposizioni di cui al precedente paragrafo, qualora un utente dei Servizi della Società dimostri di aver subito una perdita o un danno a causa di qualche azione od omissione negligente da parte della Società, dei suoi Tecnici o dipendenti, la Società risarcirà il danno dimostrato fino a concorrenza della somma non superiore a cinque volte l'ammontare dei compensi dovuti per le specifiche prestazioni, informazioni o pareri da cui è derivata la perdita o il danno o, se non sono stati fatturati compensi, fino a un massimo di un milione di Euro. Qualora i compensi fatturati siano relativi a diversi Servizi, al fine di calcolare il limite massimo risarcibile, l'ammontare dei compensi sarà determinato con riferimento alla stima del tempo impiegato nell'esecuzione del Servizio dal quale è derivato il danno o la perdita. 11.4 Qualsiasi responsabilità per perdite o danni indiretti o "consequenziali" e per le relative spese è espressamente esclusa.

The calibration status and adequacy of the test measurements devices:

Lo stato di taratura e l'adeguatezza degli strumenti di misura utilizzati per il collaudo:

- Flexible tape meter 0÷5000mm, new and suitable for the purpose;
- Ultrasonic Flaw Detector "GE - USM35X LEMO", S.N.16859, calibrated before use;
- UT calibration Block "V1", Certificate No.162046 valid till May 2026.

Inspections and tests carried out, results and remark (if any):

Accertamenti e prove di collaudo effettuati, risultati ed eventuali prescrizioni:

Purpose of the visit was the inspection of the Bollards from No.5 to No.23 at Pier in Marino Rosetti SpA, Piomboni Yard.
The scope of the inspection was:

- visual inspection of the Bollards in order to verify their general conditions (integrity, concrete filling, coating);
- thickness check of the Bollards;
- visual inspection of the quay bulkhead in order to verify the integrity and general conditions.

Visual inspection of the Bollards in order to verify general their conditions (integrity, concrete filling, coating)

The Bollards have been 100% visual inspected in order to verify general conditions of the same.

Majority of the Bollards presented diffuse or localized areas affected by corrosion, concentrated at the ground level. In the below Table are reported the:

- location of the affected areas (North, South, West, East)
- elevation of the affected areas (considering the ground level as 0)
- extension of the affected areas (length and high)

Coating of the Bollards has been found damaged at the ground level, in correspondence of the normal position of mooring ropes.

Except for the Bollard No.19 (which is of different type compared to design drawings and, on the top, is of closed type), all the Bollards have been found filled with concrete as minimum till the top extremity. Some of the same were provided with concrete over-cap, other were damaged in some areas. In the below Table, the status of the concrete at the Bollards top level is reported.

Thickness check of the Bollards

Rosetti Marino presented the ultrasonic thickness check reports relevant to the Bollards No.5÷18, No.20, No.22 and No.23. The Report for the Bollard No.19 and No.21 has not yet been issued since, at the examination date, the same were engaged by mooring ropes and not accessible.

Thickness check of the Bollards has been repeated on the affected areas (by ISO 9712 Lev.2 qualified UT Operator Mr. Stefano Annese) in order to identify the minimum available value. For each Bollard, the measured minimum thickness was found matching with the one indicated in the relevant Reports.

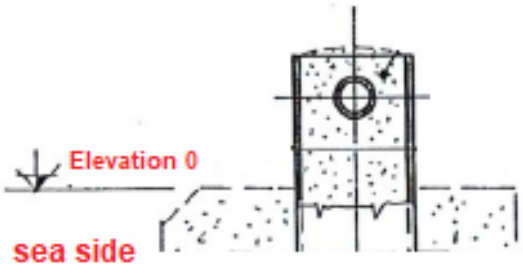
The Bollard No.19, of recent manufacturing, was found undamaged without traces of corrosion. For Bollard No. 21, the minimum measured thickness in the corrosion affected areas was 9,80 mm. Anyway, these two bollards are not included in the scope of this report, due to their partial inaccessibility at the time of inspection.

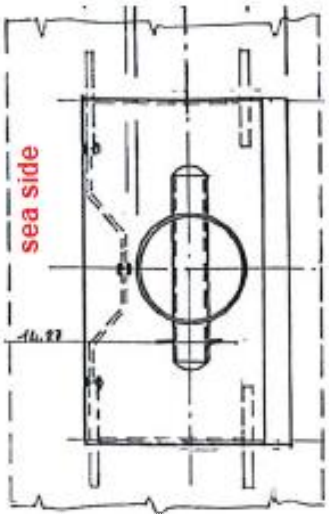
Visual inspection of the quay bulkhead in order to verify the integrity

The reinforced concrete bulkhead was found in general good conditions, intact and free of damage along the entire pier.

Bollard No.	Accessibility for inspection	Visual inspection observations (Bollard main pipe)	Elevation of the affected area (ground level 0)	Location of the affected area (N – S – W - E)	Extension of the affected area (L x H)	Coating	Concrete
5	90%	Localized corrosion	0	SW	50 x 50 mm	Acceptable except on damaged area	Acceptable
			0	NE	50 x 50 mm		
6	100%	Diffuse corrosion	0	360°	H 60 mm at 360°	Acceptable except on damaged area	Acceptable
7	100%	Localized corrosion	0	NE	100 x 70 mm	Acceptable except on damaged area	Acceptable
8	90%	Localized corrosion	0	NW	150 x 90 mm	Acceptable except on damaged area	Damages on top area

9	90%	Localized corrosion	0 0	NW SE	300 x 100 mm 300 x 60 mm	Acceptable except on damaged area	Acceptable
10	100%	• Localized corrosion • Damaged top side	0 + 430	NE S - SE	600 x 60 mm 90 x 60 mm	Acceptable except on damaged area	Damages on top area
11	100%	Localized corrosion	0	360°	H 60 mm	Acceptable except on damaged area	Damages on top area
12	90%	• Diffuse corrosion • Damaged transversal pipe	0 /	360° S	H 70 mm	Acceptable except on damaged area	Acceptable
13	90%	Localized corrosion	0	S	150 x 60 mm	Acceptable except on damaged area	Damages on top area
14	100%	Localized linear corrosion	+ 20 + 20	NW S	L 200 mm L 150 mm	Acceptable except on damaged area	Damages on top area
15	100%	Corrosion traces	0	360°	H 40 mm at 360°	Acceptable except on damaged area	Damages on top area
16	100%	Corrosion traces	0	360°	H 40 mm at 360°	Damaged on the bottom area	Damages on top area
17	100%	Localized corrosion	0 0	NE S	600 x 100 mm 400 x 60 mm	Acceptable except on damaged area	Damages on top area
18	100%	Localized corrosion	0	N	300 x 100 mm	Acceptable except on damaged area	Damages on top area
19	100%	Acceptable	/	/	/	Damaged on the bottom area	Not inspectable
20	100%	Diffuse corrosion	0	360°	H 100 mm at 360°	Acceptable except on damaged area	Damages on top area
21	100%	Diffuse corrosion	0	360°	H 100÷200 mm at 360°	Acceptable except on damaged area	Damages on top area
22	100%	Diffuse corrosion	0	360°	H 80 mm at 360°	Acceptable except on damaged area	Damages on top area
23	100%	Corrosion indication	0	360°	H 5 mm at 360°	Acceptable except on damaged area	Damages on top area

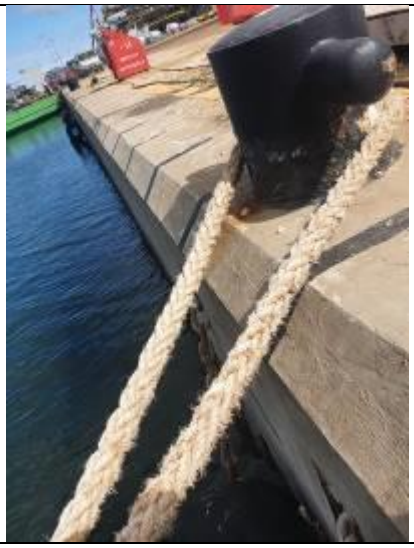






Pictures:
Foto:

BOLLARD No. 5	
	
Bollard visual inspection	***Bollard visual inspection***
	
Reinforced concrete Bulkhead integrity check	***Bollard corrosion affected area visual inspection***
BOLLARD No. 6	
	
Bollard visual inspection	***Bollard visual inspection***



Reinforced concrete Bulkhead integrity check



Bollard corrosion affected area visual inspection



Bollard corrosion affected area visual inspection



Bollard corrosion affected area visual inspection

BOLLARD No. 7



Bollard visual inspection



Bollard visual inspection



Reinforced concrete Bulkhead integrity check



Bollard corrosion affected area visual inspection and dimensional check

BOLLARD No. 8



Bollard visual inspection



Bollard visual inspection



Bollard corrosion affected area visual inspection



Bollard concrete filling visual inspection

BOLLARD No. 9



Bollard visual inspection



Bollard visual inspection



Reinforced concrete Bulkhead integrity check



Bollard corrosion affected area visual inspection

BOLLARD No. 10



Bollard visual inspection



Bollard visual inspection

	
Bollard corrosion affected area visual inspection	***Bollard corrosion affected area visual inspection***
	
Bollard damaged are visual inspection	***Bollard damaged are visual inspection and dimensional check***
BOLLARD No. 11	
	
Bollard visual inspection	***Bollard visual inspection***

	
Reinforced concrete Bulkhead integrity check	***Bollard corrosion affected area visual inspection***
BOLLARD No. 12	
	
Bollard visual inspection	***Bollard visual inspection***
	
Reinforced concrete Bulkhead integrity check	***Bollard corrosion affected area visual inspection***



Description



Damaged transversal pipe

BOLLARD No. 13



Bollard visual inspection



Reinforced concrete Bulkhead integrity check



Bollard corrosion affected area visual inspection



Bollard concrete filling visual inspection

BOLLARD No. 14



Bollard visual inspection



Bollard visual inspection



Reinforced concrete Bulkhead integrity check



Bollard corrosion affected area visual inspection



Bollard corrosion affected area visual inspection



Bollard corrosion affected area visual inspection

BOLLARD No. 15



Bollard visual inspection



Reinforced concrete Bulkhead integrity check



Bollard corrosion affected area visual inspection



Bollard concrete filling visual inspection

BOLLARD No. 16



Bollard visual inspection



Bollard visual inspection



Reinforced concrete Bulkhead integrity check



Bollard corrosion affected area visual inspection

BOLLARD No. 17



Bollard visual inspection



Bollard corrosion affected area visual inspection



Bollard corrosion affected area visual inspection



Bollard concrete filling visual inspection

BOLLARD No. 18



Bollard visual inspection



Bollard corrosion affected area visual inspection



Bollard corrosion affected area visual inspection



Bollard concrete filling visual inspection

BOLLARD No. 19



Bollard visual inspection



Bollard visual inspection – coating damaged

BOLLARD No. 20



Bollard visual inspection



Bollard corrosion affected area visual inspection



Bollard corrosion affected area visual inspection and dimensional check

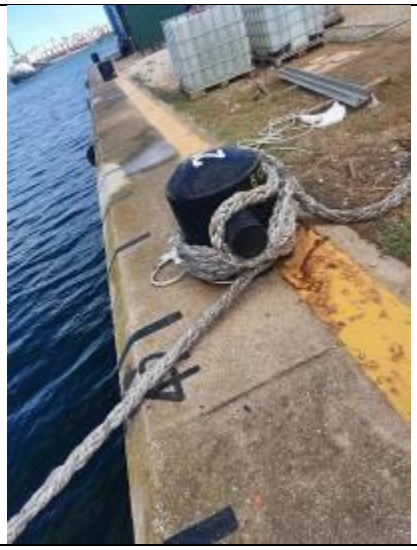


Bollard concrete filling visual inspection

BOLLARD No. 21



Bollard visual inspection



Reinforced concrete Bulkhead integrity check



Bollard corrosion affected area visual inspection



Bollard concrete filling visual inspection

BOLLARD No. 22



Bollard visual inspection



Bollard visual inspection



Reinforced concrete Bulkhead integrity check



Bollard corrosion affected area visual inspection

BOLLARD No. 23



Bollard visual inspection



Reinforced concrete Bulkhead integrity check



Bollard corrosion affected area visual inspection



Bollard concrete filling visual inspection

	
Ultrasonic Flaw detector calibration	***Ultrasonic Flaw detector calibration***
	
Ultrasonic thickness check of corrosion affected areas	***Ultrasonic thickness check of corrosion affected areas***

Marking: ***Marcature apposte:***	Not Applicable for this visit

Bollard Design Verification
Verifica della progettazione delle bitte

RINA engineering staff (EOGOF) has examined the followings documents related to the structural check of the bollards and their foundation:

Doc No.	Titolo	Rev.
79004-42	Sezione tipo - casseratura ed armatura	3
79004-43	Particolari costruttivi	3
79004-73	Banchina con fondale -11.50 (-9.50) Pianta palancolato bitte e tiranti banchina - dettagli di bitte staffe e palancole	4
79004-73 A	Banchina con fondale -11.50 (-9.50) Pianta palancolato bitte e tiranti banchina - dettagli di bitte staffe e palancole	4
79004/54	Banchina con fondale -11.50 (-9.50)	0

	Tratto "36÷46" _ linea di varo "2" Trave di coronamento - planimetria 1:500 con posizione delle bitte di ormeggio	
79004/494	Banchina con fondale -11.50 (-9.50) Tratto "24÷36" _ linea di varo 1" Trave di coronamento - planimetria 1:500 con posizione delle bitte di ormeggio	0
-	Progetto di banchina nel porto di Ravenna in località "Piomboni", per fondale di 9,60 m - Relazione di calcolo	-
-	Realizzazione di un diaframma metallico e di una linea di varo in località Piomboni - Relazione di calcolo	1
-	Summary.pdf – RMI YPB BOLLARD FROM No 1 to No 12 & RMI YPB BOLLARD FROM No 13 to No 23	-
-	Addendum alla relazione di calcolo della banchina metallica del Cantiere Rosetti – Piomboni	2

The design reports have been developed according to the Rules in force at the time of the quay construction, they confirm the adequacy of the bollards, as described in the drawings, to withstand the design pull force.

In addition, the calculation demonstrates that, even considering a certain amount of corrosion (thickness reduction assumed), the bollards are still adequate for the maximum allowable pull force reported in the capacity diagrams (maximum pull vs. pull angle).

Results:
Risultati

Inspection results are related to bollards No. from 5 to 18, 20, 22 and 23 only.
Examination of the bollards shows a certain level of thickness reduction due to corrosion and wear, anyway such reduction does not reach the limits assumed in the examined structural calculations and therefore does not affect the bollard capacity to withstand the nominal loads.

Enclosures: UT Thickness check Reports from No.001/2021 to 015/2021, from No.017/2021 to 018/2021
Allegati: Addendum alla relazione di calcolo della banchina metallica del Cantiere Rosetti – Piomboni

Issued at: Marina di Ravenna (RA) - Italy **on:** 19th May 2021
Rilasciato a: ***il:***

RINA W R IT 105 Date: 19 MAY 2021 Company:

RINA

ROSETTI MARINO

TEST REPORT - NDT ACTIVITIES

RAPPORTO DI ESAME CON ULTRASUONI PER CONTROLLO SPESSIMETRICO

THICKNESS MEASUREMENT ULTRASONIC TEST REPORT

REPORT N° 001/2021

DATA DELL'ESAME Examination Date 15/05/2021

FOGLIO / Sheet n° 1 of 1

COMMESSA / JOB	PROGETTO / Project	CLIENTE / Client	NUMERO ORDINE / Order number	DISCIPLINA / Discipline
N.D.	CONTROLLO BITTE YARD PIOMBONI	N.D.	N.D.	ST Structure

CODICE PROCEDURA / Procedure code	CODICE SPECIFICA / Standard Code	ISTRUZIONE DI LAVORO UT / UT Work instruction
PRC-UTM 16-ASME Rev. 3	N.D.	N.D. Rev. -

CRITERIO DI ACCETTABILITÀ / Acceptance criteria	FASE DEL CONTROLLO / Exam. Phase	INSPECTION TEST PLAN / ITP	FASE ITP / ITP Phase
N.D.	N.D.	N.D. Rev. -	-

OGGETTO / Object	MATERIALE / Material	TRATTAMENTO TERMICO / Post Weld Heat Treatment
[X] MAT. BASE Parent mat. [ ] SALDATURA Weld metal	ACCIAIO AL CARBONIO	[ ] PRIMA del TT Before PWHT [ ] DOPO TT After PWHT [X] NON APPLICABILE Not Applicable

STATO SUPERFICIALE / Surface condition

[ ] SALDATO As Welded [ ] SPAZZOLATO As brushed [ ] LAVORATO A MACCHINA As Machined [ ] CLADDATO As cladded [X] MOLATO As Grounded

[ ] LAMINATO As rolled [ ] GREZZO As forged [ ] SABBIATO As Sand Blasted [ ] VERNICIATO As painted [ ] ALTRO Other

APPARECCHIATURA Equipment	TIPO Type	NUMERO DI SERIE Serial number	LIQUIDO D'ACCOPPIAMENTO Couplant medium	SMORZAMENTO Damping	SOGLIA Reject
OLYMPUS	27 MG	190657402	GLUE	-	-

BLOCCO DI CALIBRAZIONE Calibration block	CONTROLLO MATERIALE BASE Parent material inspection	BLOCCO DI RIFERIMENTO Reference block	SENSIBILITÀ DI TARATURA Calibration sensitivity	TECNICA DI CONTROLLO Examination techinque	TARATURA SCALA Time base calibration
23 BCS (S.N.1179)	-	23 BCS (S.N.1179)	-	-	-

COSTRUTTORE SONDA Probe manufacturer	NUMERO DI SERIE Serial number	FREQUENZA Frequency (MHz)	DIMENSIONE Size (mm)	ANGOLO Beams Angle NOMINALE Nominal (°)	ANGOLO Beams Angle EFFETTIVO Actual (°)	EMISS. FASCIO Probe index (mm)	GUADAGNO Gain setting (dB)	SENSIBILITÀ SCANSIONE Scan sensitivity (dB)	PERDITA DI TRASFERIMENTO Transfer correction (dB)	ONDE Wave
OLYMPUS - D7910	1153166	5	10	0°	-	-	-	-	-	Longitudinal

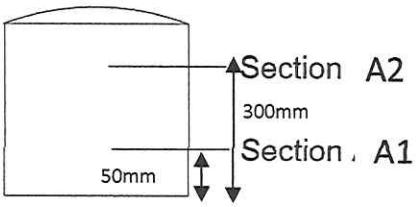
LO STATO FISICO E L'ASPETTO ESTERNO DELL'APPARECCHIATURA COMBINATA E' STATO VERIFICATO PRIMA DELL'UTILIZZO E RISULTA CONFORME AI REQUISITI APPLICABILI
The combined equipment physical state and external aspect has been checked before using and it complies with the applicable requirements

OGGETTO CONTROLLATO / Tested object

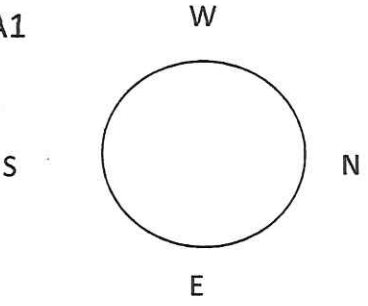
COMPONENTE / Item BITTE BANCHINA YARD PIOMBONI

ITEM	DISEGNO / FOGLIO Drawing Nr / Sheet	MARCA Mark	DIMENSIONE PEZZO Item Dimension	Sp. Thk (mm)	CONDIZIONI ESTERNE (verniciato-isolamento termico) External Condition (painted- thermal	ESITO Result
-	-	-	ø510mm	-	-	-

Sketch



Bollard N°5



BOLLARD N°5

SECTION	VALVALUES (mm)
A1 - N	11,70
A1 - S	9,60
A1 - E	9,20
A1 - W	10,10
A2 - N	10,50
A2 - S	13,90
A2 - E	13,40
A2 - W	13,20

NOTE / Remarks

TECNICO CND Livello 2 NDT Technician Level 2	CONTROLLO QUALITA Quality Control Supervisor	ISPETTORE CONTRATTISTA Contractor Repr.	ISPETTORE CLIENTE Company Rep.	ISPETTORE TERZA PARTE Third Part Inspector
Company: CONTROL snc Operator: ANNESE STEFANO MOD-QCI-34 Rev. 2020-00	ROSETTI MARINO S.p.A Responsabile Controllo Qualità Quality Control Manager D. Depasquale 19/05/21			W R IT 105 Date: 19 MAY 2021 Company:

ROSETTI MARINO

TEST REPORT - NDT ACTIVITIES

RAPPORTO DI ESAME CON ULTRASUONI PER CONTROLLO SPESSIMETRICO

THICKNESS MEASUREMENT ULTRASONIC TEST REPORT

REPORT N° 002/2021

DATA DELL'ESAME Examination Date 15/05/2021

FOGLIO / Sheet n° 1 of 1

COMMESSA / JOB	PROGETTO / Project	CLIENTE / Client	NUMERO ORDINE / Order number	DISCIPLINA / Discipline
N.D.	CONTROLLO BITTE YARD PIOMBONI	N.D.	N.D.	ST Structure

CODICE PROCEDURA / Procedure code	CODICE SPECIFICA / Standard Code	ISTRUZIONE DI LAVORO UT / UT Work instruction
PRC-UTM 16-ASME Rev. 3	N.D.	N.D. Rev. -

CRITERIO DI ACCETTABILITÀ / Acceptance criteria	FASE DEL CONTROLLO / Exam. Phase	INSPECTION TEST PLAN / ITP	FASE ITP / ITP Phase
N.D.	N.D.	N.D. Rev. -	-

OGGETTO / Object	MATERIALE / Material	TRATTAMENTO TERMICO / Post Weld Heat Treatment
[X] MAT. BASE Parent mat. [ ] SALDATURA Weld metal	ACCIAIO AL CARBONIO	[ ] PRIMA del TT Before PWHT [ ] DOPO TT After PWHT [X] NON APPLICABILE Not Applicable

STATO SUPERFICIALE / Surface condition

[ ] SALDATO As Welded [ ] SPAZZOLATO As brushed [ ] LAVORATO A MACCHINA As Machined [ ] CLADDATO As cladded [X] MOLATO As Grounded

[ ] LAMINATO As rolled [ ] GREZZO As forged [ ] SABBIATO As Sand Blasted [ ] VERNICIATO As painted [ ] ALTRO Other

APPARECCHIATURA Equipment	TIPO Type	NUMERO DI SERIE Serial number	LIQUIDO D'ACCOPPIAMENTO Couplant medium	SMORZAMENTO Damping	SOGLIA Reject
OLYMPUS	27 MG	190657402	GLUE	-	-

BLOCCO DI CALIBRAZIONE Calibration block	CONTROLLO MATERIALE BASE Parent material inspection	BLOCCO DI RIFERIMENTO Reference block	SENSIBILITÀ DI TARATURA Calibration sensitivity	TECNICA DI CONTROLLO Examination techinque	TARATURA SCALA Time base calibration
23 BCS (S.N.1179)	-	23 BCS (S.N.1179)	-	-	-

COSTRUTTORE SONDA Probe manufacturer	NUMERO DI SERIE Serial number	FREQUENZA Frequency (MHz)	DIMENSIONE Size (mm)	ANGOLO Beams Angle NOMINALE Nominal (°)	ANGOLO Beams Angle EFFETTIVO Actual (°)	EMISS. FASCIO Probe index (mm)	GUADAGNO Gain setting (dB)	SENSIBILITÀ SCANSIONE Scan sensitivity (dB)	PERDITA DI TRASFERIMENTO Transfer correction (dB)	ONDE Wave
OLYMPUS - D7910	1153166	5	10	0°	-	-	-	-	-	Longitudinal

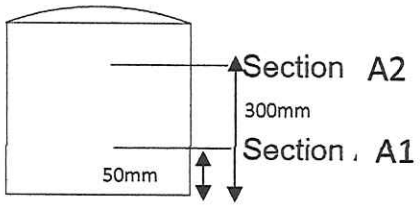
LO STATO FISICO E L'ASPETTO ESTERNO DELL'APPARECCHIATURA COMBINATA E' STATO VERIFICATO PRIMA DELL'UTILIZZO E RISULTA CONFORME AI REQUISITI APPLICABILI
The combined equipment physical state and external aspect has been checked before using and it complies with the applicable requirements

OGGETTO CONTROLLATO / Tested object

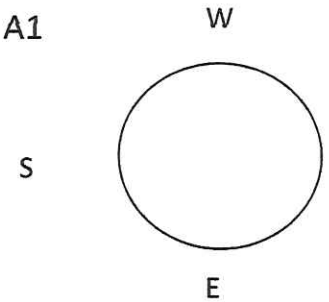
COMPONENTE / Item BITTE BANCHINA YARD PIOMBONI

ITEM	DISEGNO / FOGLIO Drawing Nr / Sheet	MARCA Mark	DIMENSIONE PEZZO Item Dimension	Sp. Thk (mm)	CONDIZIONI ESTERNE (verniciato-isolamento termico) External Condition (painted- thermal	ESITO Result
-	-	-	ø510mm	-	-	-

Sketch



Bollard N°6



BOLLARD N°6

SECTION	VALVALUES (mm)
A1 - N	n.d.
A1 - S	n.d.
A1 - E	n.d.
A1 - W	n.d.
A2 - N	5,51
A2 - S	8,90
A2 - E	8,85
A2 - W	12,80

NOTE / Remarks

TECNICO CND Livello 2 NDT Technician Level 2	CONTROLLO QUALITÀ Quality Control Supervisor	ISPETTORE CONTRATTISTA Contractor Repr.	ISPETTORE CLIENTE Company Rep.	ISPETTORE TERZA PARTE Third Part Inspector
Company: CONTROL snc Operator: ANNESE STEFANO MOD-QCI-34 Rev. 2020-00	ROSETTI MARINO S.p.A Responsabile Controllo Qualità Quality Control Manager D. Depaoli 19/05/21			W R IT 105 RINA Date: 19 MAY 2021 Company:

ROSETTI MARINO

TEST REPORT - NDT ACTIVITIES

RAPPORTO DI ESAME CON ULTRASUONI PER CONTROLLO SPESSIMETRICO

THICKNESS MEASUREMENT ULTRASONIC TEST REPORT

REPORT N° 003/2021

DATA DELL'ESAME Examination Date 15/05/2021

FOGLIO / Sheet n° 1 of 1

COMMESSA / JOB	PROGETTO / Project	CLIENTE / Client	NUMERO ORDINE / Order number	DISCIPLINA / Discipline
N.D.	CONTROLLO BITTE YARD PIOMBONI	N.D.	N.D.	ST Structure

CODICE PROCEDURA / Procedure code	CODICE SPECIFICA / Standard Code	ISTRUZIONE DI LAVORO UT / UT Work instruction
PRC-UTM 16-ASME Rev. 3	N.D.	N.D. Rev. -

CRITERIO DI ACCETTABILITÀ / Acceptance criteria	FASE DEL CONTROLLO / Exam. Phase	INSPECTION TEST PLAN / ITP	FASE ITP / ITP Phase
N.D.	N.D.	N.D. Rev. -	-

OGGETTO / Object	MATERIALE / Material	TRATTAMENTO TERMICO / Post Weld Heat Treatment
[X] MAT. BASE Parent mat. [ ] SALDATURA Weld metal	ACCIAIO AL CARBONIO	[ ] PRIMA del TT Before PWHT [ ] DOPO TT After PWHT [X] NON APPLICABILE Not Applicable

STATO SUPERFICIALE / Surface condition

[ ] SALDATO As Welded [ ] SPAZZOLATO As brushed [ ] LAVORATO A MACCHINA As Machined [ ] CLADDATO As cladded [X] MOLATO As Grounded

[ ] LAMINATO As rolled [ ] GREZZO As forged [ ] SABBIATO As Sand Blasted [ ] VERNICIATO As painted [ ] ALTRO Other

APPARECCHIATURA Equipment	TIPO Type	NUMERO DI SERIE Serial number	LIQUIDO D'ACCOPPIAMENTO Couplant medium	SMORZAMENTO Damping	SOGLIA Reject
OLYMPUS	27 MG	190657402	GLUE	-	-

BLOCCO DI CALIBRAZIONE Calibration block	CONTROLLO MATERIALE BASE Parent material inspection	BLOCCO DI RIFERIMENTO Reference block	SENSIBILITÀ DI TARATURA Calibration sensitivity	TECNICA DI CONTROLLO Examination techinque	TARATURA SCALA Time base calibration
23 BCS (S.N.1179)	-	23 BCS (S.N.1179)	-	-	-

COSTRUTTORE SONDA Probe manufacturer	NUMERO DI SERIE Serial number	FREQUENZA Frequency (MHz)	DIMENSIONE Size (mm)	ANGOLO Beams Angle NOMINALE Nominal (°)	ANGOLO Beams Angle EFFETTIVO Actual (°)	EMISS. FASCIO Probe index (mm)	GUADAGNO Gain setting (dB)	SENSIBILITÀ SCANSIONE Scan sensitivity (dB)	PERDITA DI TRASFERIMENTO Transfer correction (dB)	ONDE Wave
OLYMPUS - D7910	1153166	5	10	0°	-	-	-	-	-	Longitudinal

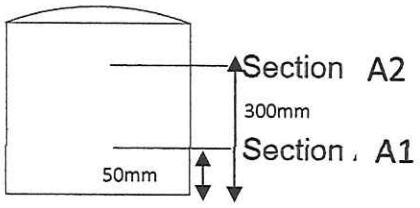
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The combined equipment physical state and external aspect has been checked before using and it complies with the applicable requirements

OGGETTO CONTROLLATO / Tested object

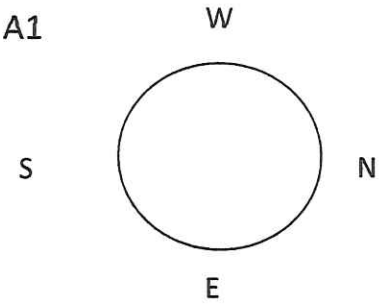
COMPONENTE / Item BITTE BANCHINA YARD PIOMBONI

ITEM	DISEGNO / FOGLIO Drawing Nr / Sheet	MARCA Mark	DIMENSIONE PEZZO Item Dimension	Sp. Thk (mm)	CONDIZIONI ESTERNE (verniciato-isolamento termico) External Condition (painted- thermal	ESITO Result
-	-	-	ø510mm	-	-	-

Sketch



Bollard N°7



BOLLARD N°7

SECTION	VALVALUES (mm)
A1 - N	8,10
A1 - S	12,30
A1 - E	11,97
A1 - W	11,70
A2 - N	11,49
A2 - S	12,40
A2 - E	11,98
A2 - W	12,20

NOTE / Remarks

TECNICO CND Livello 2 NDT Technician Level 2	CONTROLLO QUALITA Quality Control Supervisor	ISPETTORE CONTRATTISTA Contractor Repr.	ISPETTORE CLIENTE Company Rep.	ISPETTORE TERZA PARTE Third Part Inspector
Company: CONTROL snc Operator: ANNESE STEFANO MOD-QCI-34 Rev. 2020-00	ROSETTI MARINO S.p.A Responsabile Controllo Qualità Quality Control Manager D. Depasquale 19/05/21			W: R IT 105 Date: 19 MAY 2021 Company:

ROSETTI MARINO

TEST REPORT - NDT ACTIVITIES

RAPPORTO DI ESAME CON ULTRASUONI PER CONTROLLO SPESSIMETRICO

THICKNESS MEASUREMENT ULTRASONIC TEST REPORT

REPORT N° 004/2021

DATA DELL'ESAME Examination Date 15/05/2021

FOGLIO / Sheet n° 1 of 1

COMMESSA / JOB	PROGETTO / Project	CLIENTE / Client	NUMERO ORDINE / Order number	DISCIPLINA / Discipline
N.D.	CONTROLLO BITTE YARD PIOMBONI	N.D.	N.D.	ST Structure

CODICE PROCEDURA / Procedure code	CODICE SPECIFICA / Standard Code	ISTRUZIONE DI LAVORO UT / UT Work instruction
PRC-UTM 16-ASME Rev. 3	N.D.	N.D. Rev. -

CRITERIO DI ACCETTABILITÀ / Acceptance criteria	FASE DEL CONTROLLO / Exam. Phase	INSPECTION TEST PLAN / ITP	FASE ITP / ITP Phase
N.D.	N.D.	N.D. Rev. -	-

OGGETTO / Object	MATERIALE / Material	TRATTAMENTO TERMICO / Post Weld Heat Treatment
[X] MAT. BASE Parent mat. [ ] SALDATURA Weld metal	ACCIAIO AL CARBONIO	[ ] PRIMA del TT Before PWHT [ ] DOPO TT After PWHT [X] NON APPLICABILE Not Applicable

STATO SUPERFICIALE / Surface condition

[ ] SALDATO As Welded [ ] SPAZZOLATO As brushed [ ] LAVORATO A MACCHINA As Machined [ ] CLADDATO As cladded [X] MOLATO As Grounded

[ ] LAMINATO As rolled [ ] GREZZO As forged [ ] SABBIATO As Sand Blasted [ ] VERNICIATO As painted [ ] ALTRO Other

APPARECCHIATURA Equipment	TIPO Type	NUMERO DI SERIE Serial number	LIQUIDO D'ACCOPPIAMENTO Couplant medium	SMORZAMENTO Damping	SOGLIA Reject
OLYMPUS	27 MG	190657402	GLUE	-	-

BLOCCO DI CALIBRAZIONE Calibration block	CONTROLLO MATERIALE BASE Parent material inspection	BLOCCO DI RIFERIMENTO Reference block	SENSIBILITÀ DI TARATURA Calibration sensitivity	TECNICA DI CONTROLLO Examination techinque	TARATURA SCALA Time base calibration
23 BCS (S.N.1179)	-	23 BCS (S.N.1179)	-	-	-

COSTRUTTORE SONDA Probe manufacturer	NUMERO DI SERIE Serial number	FREQUENZA Frequency (MHz)	DIMENSIONE Size (mm)	ANGOLO Beams Angle NOMINALE Nominal (°)	ANGOLO Beams Angle EFFETTIVO Actual (°)	EMISS. FASCIO Probe index (mm)	GUADAGNO Gain setting (dB)	SENSIBILITÀ SCANSIONE Scan sensitivity (dB)	PERDITA DI TRASFERIMENTO Transfer correction (dB)	ONDE Wave
OLYMPUS - D7910	1153166	5	10	0°	-	-	-	-	-	Longitudinal

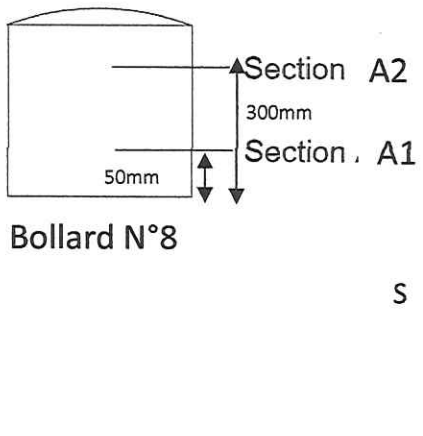
LO STATO FISICO E L'ASPETTO ESTERNO DELL'APPARECCHIATURA COMBINATA E' STATO VERIFICATO PRIMA DELL'UTILIZZO E RISULTA CONFORME AI REQUISITI APPLICABILI
The combined equipment physical state and external aspect has been checked before using and it complies with the applicable requirements

OGGETTO CONTROLLATO / Tested object

COMPONENTE / Item BITTE BANCHINA YARD PIOMBONI

ITEM	DISEGNO / FOGLIO Drawing Nr / Sheet	MARCA Mark	DIMENSIONE PEZZO Item Dimension	Sp. Thk (mm)	CONDIZIONI ESTERNE (verniciato-isolamento termico) External Condition (painted- thermal	ESITO Result
-	-	-	ø510mm	-	-	-

Sketch



BOLLARD N°8

SECTION	VALVALUES (mm)
A1 - N	12,70
A1 - S	13,10
A1 - E	13,00
A1 - W	12,90
A2 - N	12,30
A2 - S	13,30
A2 - E	13,20
A2 - W	13,10

NOTE / Remarks

TECNICO CND Livello 2 NDT Technician Level 2	CONTROLLO QUALITA Quality Control Supervisor	ISPETTORE CONTRATTISTA Contractor Repr.	ISPETTORE CLIENTE Company Rep.	ISPETTORE TERZA PARTE Third Part Inspector
Company: CONTROL snc Operator: ANNESE STEFANO MOD-QCI-34 Rev. 2020-00	ROSETTI MARINO S.p.A Responsabile Controllo Qualità Quality Control Manager D. Depastorale 19/05/21			[ ] W [X] R IT 105 Date: 19 MAY 2021 Company: RINA

ROSETTI MARINO

TEST REPORT - NDT ACTIVITIES

RAPPORTO DI ESAME CON ULTRASUONI PER CONTROLLO SPESSIMETRICO

THICKNESS MEASUREMENT ULTRASONIC TEST REPORT

REPORT N° 005/2021

DATA DELL'ESAME / Examination Date 15/05/2021

FOGLIO / Sheet n° 1 of 1

COMMESSA / JOB	PROGETTO / Project	CLIENTE / Client	NUMERO ORDINE / Order number	DISCIPLINA / Discipline
N.D.	CONTROLLO BITTE YARD PIOMBONI	N.D.	N.D.	ST Structure

CODICE PROCEDURA / Procedure code	CODICE SPECIFICA / Standard Code	ISTRUZIONE DI LAVORO UT / UT Work instruction
PRC-UTM 16-ASME Rev. 3	N.D.	N.D. Rev. -

CRITERIO DI ACCETTABILITÀ / Acceptance criteria	FASE DEL CONTROLLO / Exam. Phase	INSPECTION TEST PLAN / ITP	FASE ITP / ITP Phase
N.D.	N.D.	N.D. Rev. -	-

OGGETTO / Object	MATERIALE / Material	TRATTAMENTO TERMICO / Post Weld Heat Treatment
[X] MAT. BASE Parent mat. [ ] SALDATURA Weld metal	ACCIAIO AL CARBONIO	[ ] PRIMA del TT Before PWHT [ ] DOPO TT After PWHT [X] NON APPLICABILE Not Applicable

STATO SUPERFICIALE / Surface condition

[ ] SALDATO As Welded [ ] SPAZZOLATO As brushed [ ] LAVORATO A MACCHINA As Machined [ ] CLADDATO As cladded [X] MOLATO As Grounded

[ ] LAMINATO As rolled [ ] GREZZO As forged [ ] SABBIATO As Sand Blasted [ ] VERNICIATO As painted [ ] ALTRO Other

APPARECCHIATURA Equipment	TIPO Type	NUMERO DI SERIE Serial number	LIQUIDO D'ACCOPPIAMENTO Couplant medium	SMORZAMENTO Damping	SOGLIA Reject
OLYMPUS	27 MG	190657402	GLUE	-	-

BLOCCO DI CALIBRAZIONE Calibration block	CONTROLLO MATERIALE BASE Parent material inspection	BLOCCO DI RIFERIMENTO Reference block	SENSIBILITÀ DI TARATURA Calibration sensitivity	TECNICA DI CONTROLLO Examination techinque	TARATURA SCALA Time base calibration
23 BCS (S.N.1179)	-	23 BCS (S.N.1179)	-	-	-

COSTRUTTORE SONDA Probe manufacturer	NUMERO DI SERIE Serial number	FREQUENZA Frequency (MHz)	DIMENSIONE Size (mm)	ANGOLO Beams Angle NOMINALE Nominal (°)	ANGOLO Beams Angle EFFETTIVO Actual (°)	EMISS. FASCIO Probe index (mm)	GUADAGNO Gain setting (dB)	SENSIBILITÀ SCANSIONE Scan sensitivity (dB)	PERDITA DI TRASFERIMENTO Transfer correction (dB)	ONDE Wave
OLYMPUS - D7910	1153166	5	10	0°	-	-	-	-	-	Longitudinal

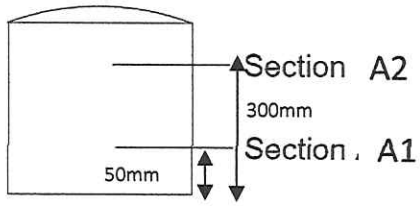
LO STATO FISICO E L'ASPETTO ESTERNO DELL'APPARECCHIATURA COMBINATA E' STATO VERIFICATO PRIMA DELL'UTILIZZO E RISULTA CONFORME AI REQUISITI APPLICABILI
The combined equipment physical state and external aspect has been checked before using and it complies with the applicable requirements

OGGETTO CONTROLLATO / Tested object

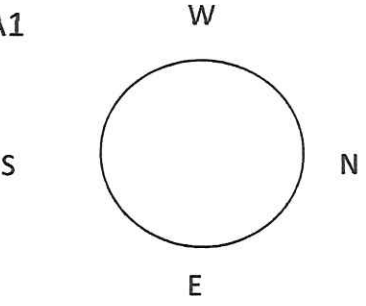
COMPONENTE / Item BITTE BANCHINA YARD PIOMBONI

ITEM	DISEGNO / FOGLIO Drawing Nr / Sheet	MARCA Mark	DIMENSIONE PEZZO Item Dimension	Sp. Thk (mm)	CONDIZIONI ESTERNE (verniciato-isolamento termico) External Condition (painted- thermal	ESITO Result
-	-	-	ø510mm	-	-	-

Sketch



Bollard N°9



BOLLARD N°9

SECTION	VALVALUES (mm)
A1 - N	7,40
A1 - S	12,10
A1 - E	5,10
A1 - W	12,60
A2 - N	13,10
A2 - S	12,20
A2 - E	13,10
A2 - W	12,40

NOTE / Remarks

TECNICO CND Livello 2 NDT Technician Level 2	CONTROLLO QUALITA Quality Control Supervisor	ISPETTORE CONTRATTISTA Contractor Repr.	ISPETTORE CLIENTE Company Rep.	ISPETTORE TERZA PARTE Third Part Inspector
CONTROL snc Company CONTROL Operator: ANNESE STEFANO	ROSETTI MARINO S.p.A Responsabile Controllo Qualità Quality Control Manager			W R IT 105 RINA Date: 19 MAY 2021 Company:

MOD-QCI-34 Rev. 2020-00

ROSETTI MARINO

TEST REPORT - NDT ACTIVITIES

RAPPORTO DI ESAME CON ULTRASUONI PER CONTROLLO SPESSIMETRICO

THICKNESS MEASUREMENT ULTRASONIC TEST REPORT

REPORT N° 006/2021

DATA DELL'ESAME Examination Date 15/05/2021

FOGLIO / Sheet n° 1 of 1

COMMESSA / JOB	PROGETTO / Project	CLIENTE / Client	NUMERO ORDINE / Order number	DISCIPLINA / Discipline
N.D.	CONTROLLO BITTE YARD PIOMBONI	N.D.	N.D.	ST Structure

CODICE PROCEDURA / Procedure code	CODICE SPECIFICA / Standard Code	ISTRUZIONE DI LAVORO UT / UT Work instruction
PRC-UTM 16-ASME Rev. 3	N.D.	N.D. Rev. -

CRITERIO DI ACCETTABILITÀ / Acceptance criteria	FASE DEL CONTROLLO / Exam. Phase	INSPECTION TEST PLAN / ITP	FASE ITP / ITP Phase
N.D.	N.D.	N.D. Rev. -	-

OGGETTO / Object	MATERIALE / Material	TRATTAMENTO TERMICO / Post Weld Heat Treatment
[X] MAT. BASE Parent mat. [ ] SALDATURA Weld metal	ACCIAIO AL CARBONIO	[ ] PRIMA del TT Before PWHT [ ] DOPO TT After PWHT [X] NON APPLICABILE Not Applicable

STATO SUPERFICIALE / Surface condition

[ ] SALDATO As Welded [ ] SPAZZOLATO As brushed [ ] LAVORATO A MACCHINA As Machined [ ] CLADDATO As cladded [X] MOLATO As Grounded

[ ] LAMINATO As rolled [ ] GREZZO As forged [ ] SABBIATO As Sand Blasted [ ] VERNICIATO As painted [ ] ALTRO Other

APPARECCHIATURA Equipment	TIPO Type	NUMERO DI SERIE Serial number	LIQUIDO D'ACCOPPIAMENTO Couplant medium	SMORZAMENTO Damping	SOGLIA Reject
OLYMPUS	27 MG	190657402	GLUE	-	-

BLOCCO DI CALIBRAZIONE Calibration block	CONTROLLO MATERIALE BASE Parent material inspection	BLOCCO DI RIFERIMENTO Reference block	SENSIBILITÀ DI TARATURA Calibration sensitivity	TECNICA DI CONTROLLO Examination techinque	TARATURA SCALA Time base calibration
23 BCS (S.N.1179)	-	23 BCS (S.N.1179)	-	-	-

COSTRUTTORE SONDA Probe manufacturer	NUMERO DI SERIE Serial number	FREQUENZA Frequency (MHz)	DIMENSIONE Size (mm)	ANGOLO Beams Angle NOMINALE Nominal (°)	ANGOLO Beams Angle EFFETTIVO Actual (°)	EMISS. FASCIO Probe index (mm)	GUADAGNO Gain setting (dB)	SENSIBILITÀ SCANSIONE Scan sensitivity (dB)	PERDITA DI TRASFERIMENTO Transfer correction (dB)	ONDE Wave
OLYMPUS - D7910	1153166	5	10	0°	-	-	-	-	-	Longitudinal

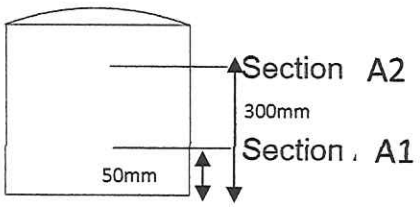
LO STATO FISICO E L'ASPETTO ESTERNO DELL'APPARECCHIATURA COMBINATA E' STATO VERIFICATO PRIMA DELL'UTILIZZO E RISULTA CONFORME AI REQUISITI APPLICABILI
The combined equipment physical state and external aspect has been checked before using and it complies with the applicable requirements

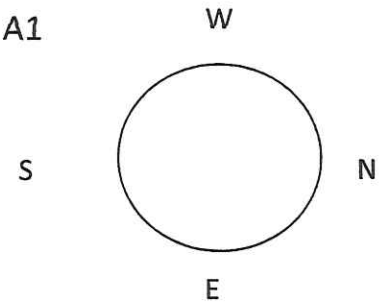
OGGETTO CONTROLLATO / Tested object

COMPONENTE / Item BITTE BANCHINA YARD PIOMBONI

ITEM	DISEGNO / FOGLIO Drawing Nr / Sheet	MARCA Mark	DIMENSIONE PEZZO Item Dimension	Sp. Thk (mm)	CONDIZIONI ESTERNE (verniciato-isolamento termico) External Condition (painted- thermal	ESITO Result
-	-	-	ø510mm	-	-	-

Sketch





BOLLARD N°10

SECTION	VALVALUES (mm)
A1 - N	11,70
A1 - S	7,80
A1 - E	7,46
A1 - W	12,20
A2 - N	13,20
A2 - S	13,80
A2 - E	13,90
A2 - W	11,70

NOTE / Remarks

TECNICO CND Livello 2 NDT Technician Level 2	CONTROLLO QUALITÀ Quality Control Supervisor	ISPETTORE CONTRATTISTA Contractor Repr.	ISPETTORE CLIENTE Company Rep.	ISPETTORE TERZA PARTE Third Part Inspector
Company: CONTROL srl Operator: ANNESE STEFANO MOD-QCI-34 Rev. 2020-00	ROSETTI MARINO S.p.A Responsabile Controllo Qualità Quality Control Manager 12/05/21			W R IT 105 Date: 19 MAY 2021 Company:

ROSETTI MARINO

TEST REPORT - NDT ACTIVITIES

RAPPORTO DI ESAME CON ULTRASUONI PER CONTROLLO SPESSIMETRICO

THICKNESS MEASUREMENT ULTRASONIC TEST REPORT

REPORT N° 007/2021

DATA DELL'ESAME Examination Date 15/05/2021

FOGLIO / Sheet n° 1 of 1

COMMESSA / JOB	PROGETTO / Project	CLIENTE / Client	NUMERO ORDINE / Order number	DISCIPLINA / Discipline
N.D.	CONTROLLO BITTE YARD PIOMBONI	N.D.	N.D.	ST Structure

CODICE PROCEDURA / Procedure code	CODICE SPECIFICA / Standard Code	ISTRUZIONE DI LAVORO UT / UT Work instruction
PRC-UTM 16-ASME Rev. 3	N.D.	N.D. Rev. -

CRITERIO DI ACCETTABILITÀ / Acceptance criteria	FASE DEL CONTROLLO / Exam. Phase	INSPECTION TEST PLAN / ITP	FASE ITP / ITP Phase
N.D.	N.D.	N.D. Rev. -	-

OGGETTO / Object	MATERIALE / Material	TRATTAMENTO TERMICO / Post Weld Heat Treatment
[X] MAT. BASE Parent mat. [ ] SALDATURA Weld metal	ACCIAIO AL CARBONIO	[ ] PRIMA del TT Before PWHT [ ] DOPO TT After PWHT [X] NON APPLICABILE Not Applicable

STATO SUPERFICIALE / Surface condition

[ ] SALDATO As Welded [ ] SPAZZOLATO As brushed [ ] LAVORATO A MACCHINA As Machined [ ] CLADDATO As cladded [X] MOLATO As Grounded

[ ] LAMINATO As rolled [ ] GREZZO As forged [ ] SABBIATO As Sand Blasted [ ] VERNICIATO As painted [ ] ALTRO Other

APPARECCHIATURA Equipment	TIPO Type	NUMERO DI SERIE Serial number	LIQUIDO D'ACCOPPIAMENTO Couplant medium	SMORZAMENTO Damping	SOGLIA Reject
OLYMPUS	27 MG	190657402	GLUE	-	-

BLOCCO DI CALIBRAZIONE Calibration block	CONTROLLO MATERIALE BASE Parent material inspection	BLOCCO DI RIFERIMENTO Reference block	SENSIBILITÀ DI TARATURA Calibration sensitivity	TECNICA DI CONTROLLO Examination techinque	TARATURA SCALA Time base calibration
23 BCS (S.N.1179)	-	23 BCS (S.N.1179)	-	-	-

COSTRUTTORE SONDA Probe manufacturer	NUMERO DI SERIE Serial number	FREQUENZA Frequency (MHz)	DIMENSIONE Size (mm)	ANGOLO Beams Angle NOMINALE Nominal (°)	ANGOLO Beams Angle EFFETTIVO Actual (°)	EMISS. FASCIO Probe index (mm)	GUADAGNO Gain setting (dB)	SENSIBILITÀ SCANSIONE Scan sensitivity (dB)	PERDITA DI TRASFERIMENTO Transfer correction (dB)	ONDE Wave
OLYMPUS - D7910	1153166	5	10	0°	-	-	-	-	-	Longitudinal

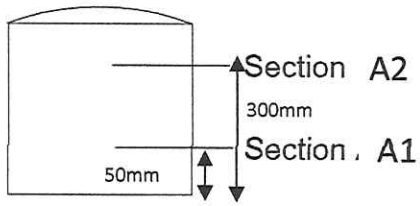
LO STATO FISICO E L'ASPETTO ESTERNO DELL'APPARECCHIATURA COMBINATA E' STATO VERIFICATO PRIMA DELL'UTILIZZO E RISULTA CONFORME AI REQUISITI APPLICABILI
The combined equipment physical state and external aspect has been checked before using and it complies with the applicable requirements

OGGETTO CONTROLLATO / Tested object

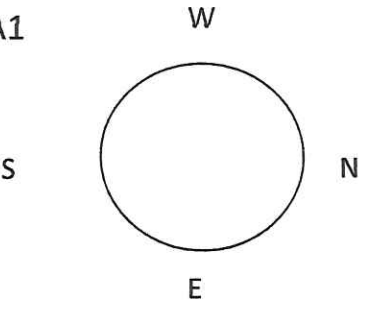
COMPONENTE / Item BITTE BANCHINA YARD PIOMBONI

ITEM	DISEGNO / FOGLIO Drawing Nr / Sheet	MARCA Mark	DIMENSIONE PEZZO Item Dimension	Sp. Thk (mm)	CONDIZIONI ESTERNE (verniciato-isolamento termico) External Condition (painted- thermal	ESITO Result
-	-	-	ø510mm	-	-	-

Sketch



Bollard N°11



BOLLARD N°11

SECTION	VALVALUES (mm)
A1 - N	10,10
A1 - S	11,80
A1 - E	9,50
A1 - W	11,70
A2 - N	12,20
A2 - S	12,50
A2 - E	13,20
A2 - W	11,70

NOTE / Remarks

TECNICO CND Livello 2 NDT Technician Level 2	CONTROLLO QUALITÀ Quality Control Supervisor	ISPETTORE CONTRATTISTA Contractor Repr.	ISPETTORE CLIENTE Company Rep.	ISPETTORE TERZA PARTE Third Part Inspector
Operator: CONTROL snc Operator: ANNESE STEFANO MOD-QCI-34 Rev. 2020-00	ROSETTI MARINO S.p.A Responsabile Controllo Qualità Quality Control Manager D. Depasquale 17/05/21			W R IT 105 Date: 19 MAY 2021 Company:

ROSETTI MARINO

TEST REPORT - NDT ACTIVITIES

RAPPORTO DI ESAME CON ULTRASUONI PER CONTROLLO SPESSIMETRICO

THICKNESS MEASUREMENT ULTRASONIC TEST REPORT

REPORT N° 008/2021

DATA DELL'ESAME Examination Date 15/05/2021

FOGLIO / Sheet n° 1 of 1

COMMESSA / JOB	PROGETTO / Project	CLIENTE / Client	NUMERO ORDINE / Order number	DISCIPLINA / Discipline
N.D.	CONTROLLO BITTE YARD PIOMBONI	N.D.	N.D.	ST Structure

CODICE PROCEDURA / Procedure code	CODICE SPECIFICA / Standard Code	ISTRUZIONE DI LAVORO UT / UT Work instruction
PRC-UTM 16-ASME Rev. 3	N.D.	N.D. Rev. -

CRITERIO DI ACCETTABILITÀ / Acceptance criteria	FASE DEL CONTROLLO / Exam. Phase	INSPECTION TEST PLAN / ITP	FASE ITP / ITP Phase
N.D.	N.D.	N.D. Rev. -	-

OGGETTO / Object	MATERIALE / Material	TRATTAMENTO TERMICO / Post Weld Heat Treatment
[X] MAT. BASE Parent mat. [ ] SALDATURA Weld metal	ACCIAIO AL CARBONIO	[ ] PRIMA del TT Before PWHT [ ] DOPO TT After PWHT [X] NON APPLICABILE Not Applicable

STATO SUPERFICIALE / Surface condition

[ ] SALDATO As Welded [ ] SPAZZOLATO As brushed [ ] LAVORATO A MACCHINA As Machined [ ] CLADDATO As cladded [X] MOLATO As Grounded

[ ] LAMINATO As rolled [ ] GREZZO As forged [ ] SABBIATO As Sand Blasted [ ] VERNICIATO As painted [ ] ALTRO Other

APPARECCHIATURA Equipment	TIPO Type	NUMERO DI SERIE Serial number	LIQUIDO D'ACCOPPIAMENTO Couplant medium	SMORZAMENTO Damping	SOGLIA Reject
OLYMPUS	27 MG	190657402	GLUE	-	-

BLOCCO DI CALIBRAZIONE Calibration block	CONTROLLO MATERIALE BASE Parent material inspection	BLOCCO DI RIFERIMENTO Reference block	SENSIBILITÀ DI TARATURA Calibration sensitivity	TECNICA DI CONTROLLO Examination techinque	TARATURA SCALA Time base calibration
23 BCS (S.N.1179)	-	23 BCS (S.N.1179)	-	-	-

COSTRUTTORE SONDA Probe manufacturer	NUMERO DI SERIE Serial number	FREQUENZA Frequency (MHz)	DIMENSIONE Size (mm)	ANGOLO Beams Angle NOMINALE Nominal (°)	ANGOLO Beams Angle EFFETTIVO Actual (°)	EMISS. FASCIO Probe index (mm)	GUADAGNO Gain setting (dB)	SENSIBILITÀ SCANSIONE Scan sensitivity (dB)	PERDITA DI TRASFERIMENTO Transfer correction (dB)	ONDE Wave
OLYMPUS - D7910	1153166	5	10	0°	-	-	-	-	-	Longitudinal

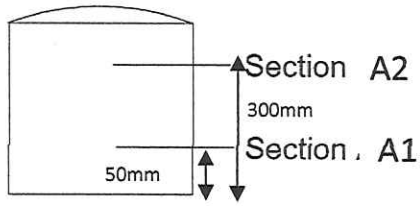
LO STATO FISICO E L'ASPETTO ESTERNO DELL'APPARECCHIATURA COMBINATA E' STATO VERIFICATO PRIMA DELL'UTILIZZO E RISULTA CONFORME AI REQUISITI APPLICABILI
The combined equipment physical state and external aspect has been checked before using and it complies with the applicable requirements

OGGETTO CONTROLLATO / Tested object

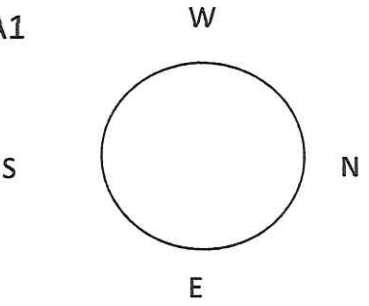
COMPONENTE / Item BITTE BANCHINA YARD PIOMBONI

ITEM	DISEGNO / FOGLIO Drawing Nr / Sheet	MARCA Mark	DIMENSIONE PEZZO Item Dimension	Sp. Thk (mm)	CONDIZIONI ESTERNE (verniciato-isolamento termico) External Condition (painted- thermal	ESITO Result
-	-	-	ø510mm	-	-	-

Sketch



Bollard N°12



BOLLARD N°12

SECTION	VALVALUES (mm)
A1 - N	6,00
A1 - S	7,74
A1 - E	6,00
A1 - W	11,90
A2 - N	12,30
A2 - S	12,80
A2 - E	11,90
A2 - W	12,60

NOTE / Remarks

TECNICO CND Livello 2 NDT Technician Level 2	CONTROLLO QUALITA Quality Control Supervisor	ISPETTORE CONTRATTISTA Contractor Repr.	ISPETTORE CLIENTE Company Rep.	ISPETTORE TERZA PARTE Third Part Inspector
Company: CONTROL snc Operator: ANNESE STEFANO MOD-QCI-34 Rev. 2020-00	ROSETTI MARINO S.p.A Responsabile Controllo Qualità Quality Control Manager D. Depasquale 12/05/21			W R IT 105 Date: 19 MAY 2021 Company:

ROSETTI MARINO

TEST REPORT - NDT ACTIVITIES

RAPPORTO DI ESAME CON ULTRASUONI PER CONTROLLO SPESSIMETRICO

THICKNESS MEASUREMENT ULTRASONIC TEST REPORT

REPORT N° 009/2021

DATA DELL'ESAME Examination Date 15/05/2021

FOGLIO / Sheet n° 1 of 1

COMMESSA / JOB	PROGETTO / Project	CLIENTE / Client	NUMERO ORDINE / Order number	DISCIPLINA / Discipline
N.D.	CONTROLLO BITTE YARD PIOMBONI	N.D.	N.D.	ST Structure

CODICE PROCEDURA / Procedure code	CODICE SPECIFICA / Standard Code	ISTRUZIONE DI LAVORO UT / UT Work instruction
PRC-UTM 16-ASME Rev. 3	N.D.	N.D. Rev. -

CRITERIO DI ACCETTABILITÀ / Acceptance criteria	FASE DEL CONTROLLO / Exam. Phase	INSPECTION TEST PLAN / ITP	FASE ITP / ITP Phase
N.D.	N.D.	N.D. Rev. -	-

OGGETTO / Object	MATERIALE / Material	TRATTAMENTO TERMICO / Post Weld Heat Treatment
[X] MAT. BASE Parent mat. [ ] SALDATURA Weld metal	ACCIAIO AL CARBONIO	[ ] PRIMA del TT Before PWHT [ ] DOPO TT After PWHT [X] NON APPLICABILE Not Applicable

STATO SUPERFICIALE / Surface condition

[ ] SALDATO As Welded [ ] SPAZZOLATO As brushed [ ] LAVORATO A MACCHINA As Machined [ ] CLADDATO As cladded [X] MOLATO As Grounded

[ ] LAMINATO As rolled [ ] GREZZO As forged [ ] SABBIATO As Sand Blasted [ ] VERNICIATO As painted [ ] ALTRO Other

APPARECCHIATURA Equipment	TIPO Type	NUMERO DI SERIE Serial number	LIQUIDO D'ACCOPPIAMENTO Couplant medium	SMORZAMENTO Damping	SOGLIA Reject
OLYMPUS	27 MG	190657402	GLUE	-	-

BLOCCO DI CALIBRAZIONE Calibration block	CONTROLLO MATERIALE BASE Parent material inspection	BLOCCO DI RIFERIMENTO Reference block	SENSIBILITÀ DI TARATURA Calibration sensitivity	TECNICA DI CONTROLLO Examination techinque	TARATURA SCALA Time base calibration
23 BCS (S.N.1179)	-	23 BCS (S.N.1179)	-	-	-

COSTRUTTORE SONDA Probe manufacturer	NUMERO DI SERIE Serial number	FREQUENZA Frequency (MHz)	DIMENSIONE Size (mm)	ANGOLO Beams Angle NOMINALE Nominal (°)	ANGOLO Beams Angle EFFETTIVO Actual (°)	EMISS. FASCIO Probe index (mm)	GUADAGNO Gain setting (dB)	SENSIBILITÀ SCANSIONE Scan sensitivity (dB)	PERDITA DI TRASFERIMENTO Transfer correction (dB)	ONDE Wave
OLYMPUS - D7910	1153166	5	10	0°	-	-	-	-	-	Longitudinal

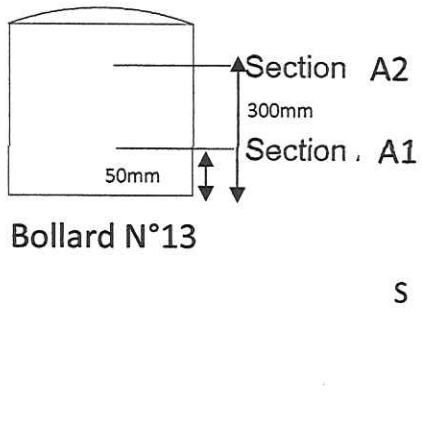
LO STATO FISICO E L'ASPETTO ESTERNO DELL'APPARECCHIATURA COMBINATA E' STATO VERIFICATO PRIMA DELL'UTILIZZO E RISULTA CONFORME AI REQUISITI APPLICABILI
The combined equipment physical state and external aspect has been checked before using and it complies with the applicable requirements

OGGETTO CONTROLLATO / Tested object

COMPONENTE / Item BITTE BANCHINA YARD PIOMBONI

ITEM	DISEGNO / FOGLIO Drawing Nr / Sheet	MARCA Mark	DIMENSIONE PEZZO Item Dimension	Sp. Thk (mm)	CONDIZIONI ESTERNE (verniciato-isolamento termico) External Condition (painted- thermal	ESITO Result
-	-	-	ø510mm	-	-	-

Sketch



BOLLARD N°13

SECTION	VALVALUES (mm)
A1 - N	12,10
A1 - S	13,70
A1 - E	13,00
A1 - W	13,10
A2 - N	12,20
A2 - S	13,60
A2 - E	12,50
A2 - W	12,80

NOTE / Remarks

TECNICO CND Livello 2 NDT Technician Level 2	CONTROLLO QUALITÀ Quality Control Supervisor	ISPETTORE CONTRATTISTA Contractor Repr.	ISPETTORE CLIENTE Company Rep.	ISPETTORE TERZA PARTE Third Part Inspector
Company: CONTROL s.r.l. Operator: ANNESE STEFANO MOD-QCI-34 Rev. 2020-00	ROSETTI MARINO S.p.A Responsabile Controllo Qualità Quality Control Manager D. Denaquale 17/5/21			W - R IT 105 RINA Date: 19 MAY 2021 Company:

ROSETTI MARINO

TEST REPORT - NDT ACTIVITIES

RAPPORTO DI ESAME CON ULTRASUONI PER CONTROLLO SPESSIMETRICO

THICKNESS MEASUREMENT ULTRASONIC TEST REPORT

REPORT N° 010/2021

DATA DELL'ESAME Examination Date 15/05/2021

FOGLIO / Sheet n° 1 of 1

COMMESSA / JOB	PROGETTO / Project	CLIENTE / Client	NUMERO ORDINE / Order number	DISCIPLINA / Discipline
N.D.	CONTROLLO BITTE YARD PIOMBONI	N.D.	N.D.	ST Structure

CODICE PROCEDURA / Procedure code	CODICE SPECIFICA / Standard Code	ISTRUZIONE DI LAVORO UT / UT Work instruction
PRC-UTM 16-ASME Rev. 3	N.D.	N.D. Rev. -

CRITERIO DI ACCETTABILITÀ / Acceptance criteria	FASE DEL CONTROLLO / Exam. Phase	INSPECTION TEST PLAN / ITP	FASE ITP / ITP Phase
N.D.	N.D.	N.D. Rev. -	-

OGGETTO / Object	MATERIALE / Material	TRATTAMENTO TERMICO / Post Weld Heat Treatment
[X] MAT. BASE Parent mat. [ ] SALDATURA Weld metal	ACCIAIO AL CARBONIO	[ ] PRIMA del TT Before PWHT [ ] DOPO TT After PWHT [X] NON APPLICABILE Not Applicable

STATO SUPERFICIALE / Surface condition

[ ] SALDATO As Welded [ ] SPAZZOLATO As brushed [ ] LAVORATO A MACCHINA As Machined [ ] CLADDATO As cladded [X] MOLATO As Grounded

[ ] LAMINATO As rolled [ ] GREZZO As forged [ ] SABBIATO As Sand Blasted [ ] VERNICIATO As painted [ ] ALTRO Other

APPARECCHIATURA Equipment	TIPO Type	NUMERO DI SERIE Serial number	LIQUIDO D'ACCOPPIAMENTO Couplant medium	SMORZAMENTO Damping	SOGLIA Reject
OLYMPUS	27 MG	190657402	GLUE	-	-

BLOCCO DI CALIBRAZIONE Calibration block	CONTROLLO MATERIALE BASE Parent material inspection	BLOCCO DI RIFERIMENTO Reference block	SENSIBILITÀ DI TARATURA Calibration sensitivity	TECNICA DI CONTROLLO Examination techinque	TARATURA SCALA Time base calibration
23 BCS (S.N.1179)	-	23 BCS (S.N.1179)	-	-	-

COSTRUTTORE SONDA Probe manufacturer	NUMERO DI SERIE Serial number	FREQUENZA Frequency (MHz)	DIMENSIONE Size (mm)	ANGOLO Beams Angle NOMINALE Nominal (°)	ANGOLO Beams Angle EFFETTIVO Actual (°)	EMISS. FASCIO Probe index (mm)	GUADAGNO Gain setting (dB)	SENSIBILITÀ SCANSIONE Scan sensitivity (dB)	PERDITA DI TRASFERIMENTO Transfer correction (dB)	ONDE Wave
OLYMPUS - D7910	1153166	5	10	0°	-	-	-	-	-	Longitudinal

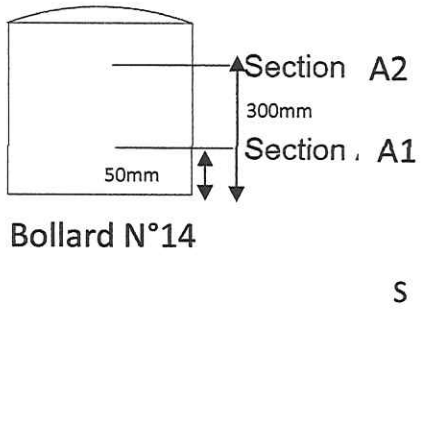
LO STATO FISICO E L'ASPETTO ESTERNO DELL'APPARECCHIATURA COMBINATA E' STATO VERIFICATO PRIMA DELL'UTILIZZO E RISULTA CONFORME AI REQUISITI APPLICABILI
The combined equipment physical state and external aspect has been checked before using and it complies with the applicable requirements

OGGETTO CONTROLLATO / Tested object

COMPONENTE / Item BITTE BANCHINA YARD PIOMBONI

ITEM	DISEGNO / FOGLIO Drawing Nr / Sheet	MARCA Mark	DIMENSIONE PEZZO Item Dimension	Sp. Thk (mm)	CONDIZIONI ESTERNE (verniciato-isolamento termico) External Condition (painted- thermal	ESITO Result
-	-	-	ø510mm	-	-	-

Sketch



BOLLARD N°14

SECTION	VALVALUES (mm)
A1 - N	13,80
A1 - S	13,80
A1 - E	11,80
A1 - W	12,70
A2 - N	13,70
A2 - S	13,50
A2 - E	12,40
A2 - W	12,30

NOTE / Remarks

TECNICO CND Livello 2 NDT Technician Level 2	CONTROLLO QUALITA Quality Control Supervisor	ISPETTORE CONTRATTISTA Contractor Repr.	ISPETTORE CLIENTE Company Rep.	ISPETTORE TERZA PARTE Third Part Inspector
CONTROL snc Company CONTROL Operator: ANNESE STEFANO	ROSETTI MARINO S.p.A Responsabile Controllo Qualità Quality Control Manager 18/05/21			W R IT 105 RINA Date: 19 MAY 2021 Company:

MOD-QCI-34 Rev. 2020-00

ROSETTI MARINO

TEST REPORT - NDT ACTIVITIES

RAPPORTO DI ESAME CON ULTRASUONI PER CONTROLLO SPESSIMETRICO

THICKNESS MEASUREMENT ULTRASONIC TEST REPORT

REPORT N° 011/2021

DATA DELL'ESAME Examination Date 15/05/2021

FOGLIO / Sheet n° 1 of 1

COMMESSA / JOB	PROGETTO / Project	CLIENTE / Client	NUMERO ORDINE / Order number	DISCIPLINA / Discipline
N.D.	CONTROLLO BITTE YARD PIOMBONI	N.D.	N.D.	ST Structure

CODICE PROCEDURA / Procedure code	CODICE SPECIFICA / Standard Code	ISTRUZIONE DI LAVORO UT / UT Work instruction
PRC-UTM 16-ASME Rev. 3	N.D.	N.D. Rev. -

CRITERIO DI ACCETTABILITÀ / Acceptance criteria	FASE DEL CONTROLLO / Exam. Phase	INSPECTION TEST PLAN / ITP	FASE ITP / ITP Phase
N.D.	N.D.	N.D. Rev. -	-

OGGETTO / Object	MATERIALE / Material	TRATTAMENTO TERMICO / Post Weld Heat Treatment
[X] MAT. BASE Parent mat. [ ] SALDATURA Weld metal	ACCIAIO AL CARBONIO	[ ] PRIMA del TT Before PWHT [ ] DOPO TT After PWHT [X] NON APPLICABILE Not Applicable

STATO SUPERFICIALE / Surface condition

[ ] SALDATO As Welded [ ] SPAZZOLATO As brushed [ ] LAVORATO A MACCHINA As Machined [ ] CLADDATO As cladded [X] MOLATO As Grounded

[ ] LAMINATO As rolled [ ] GREZZO As forged [ ] SABBIATO As Sand Blasted [ ] VERNICIATO As painted [ ] ALTRO Other

APPARECCHIATURA Equipment	TIPO Type	NUMERO DI SERIE Serial number	LIQUIDO D'ACCOPPIAMENTO Couplant medium	SMORZAMENTO Damping	SOGLIA Reject
OLYMPUS	27 MG	190657402	GLUE	-	-

BLOCCO DI CALIBRAZIONE Calibration block	CONTROLLO MATERIALE BASE Parent material inspection	BLOCCO DI RIFERIMENTO Reference block	SENSIBILITÀ DI TARATURA Calibration sensitivity	TECNICA DI CONTROLLO Examination techinque	TARATURA SCALA Time base calibration
23 BCS (S.N.1179)	-	23 BCS (S.N.1179)	-	-	-

COSTRUTTORE SONDA Probe manufacturer	NUMERO DI SERIE Serial number	FREQUENZA Frequency (MHz)	DIMENSIONE Size (mm)	ANGOLO Beams Angle NOMINALE Nominal (°)	ANGOLO Beams Angle EFFETTIVO Actual (°)	EMISS. FASCIO Probe index (mm)	GUADAGNO Gain setting (dB)	SENSIBILITÀ SCANSIONE Scan sensitivity (dB)	PERDITA DI TRASFERIMENTO Transfer correction (dB)	ONDE Wave
OLYMPUS - D7910	1153166	5	10	0°	-	-	-	-	-	Longitudinal

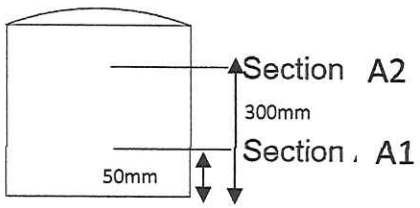
LO STATO FISICO E L'ASPETTO ESTERNO DELL'APPARECCHIATURA COMBINATA E' STATO VERIFICATO PRIMA DELL'UTILIZZO E RISULTA CONFORME AI REQUISITI APPLICABILI
The combined equipment physical state and external aspect has been checked before using and it complies with the applicable requirements

OGGETTO CONTROLLATO / Tested object

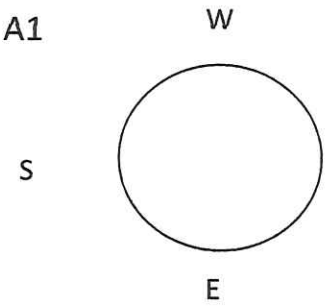
COMPONENTE / Item BITTE BANCHINA YARD PIOMBONI

ITEM	DISEGNO / FOGLIO Drawing Nr / Sheet	MARCA Mark	DIMENSIONE PEZZO Item Dimension	Sp. Thk (mm)	CONDIZIONI ESTERNE (verniciato-isolamento termico) External Condition (painted- thermal	ESITO Result
-	-	-	ø510mm	-	-	-

Sketch



Bollard N°15



BOLLARD N°15

SECTION	VALVALUES (mm)
A1 - N	13,00
A1 - S	13,00
A1 - E	11,90
A1 - W	12,70
A2 - N	12,40
A2 - S	13,20
A2 - E	12,50
A2 - W	12,80

NOTE / Remarks

TECNICO CND Livello 2 NDT Technician Level 2	CONTROLLO QUALITA Quality Control Supervisor	ISPETTORE CONTRATTISTA Contractor Repr.	ISPETTORE CLIENTE Company Rep.	ISPETTORE TERZA PARTE Third Part Inspector
Company: CONTROL snc Operator: ANNESE STEFANO MOD-QCI-34 Rev. 2020-00	ROSETTI MARINO S.p.A Responsabile Controllo Qualità Quality Control Manager 13/05/21			W - R IT 105 Date: 19 MAY 2021 Company:

ROSETTI MARINO

TEST REPORT - NDT ACTIVITIES

RAPPORTO DI ESAME CON ULTRASUONI PER CONTROLLO SPESSIMETRICO

THICKNESS MEASUREMENT ULTRASONIC TEST REPORT

REPORT N° 012/2021

DATA DELL'ESAME / Examination Date 15/05/2021

FOGLIO / Sheet n° 1 of 1

COMMESSA / JOB	PROGETTO / Project	CLIENTE / Client	NUMERO ORDINE / Order number	DISCIPLINA / Discipline
N.D.	CONTROLLO BITTE YARD PIOMBONI	N.D.	N.D.	ST Structure

CODICE PROCEDURA / Procedure code	CODICE SPECIFICA / Standard Code	ISTRUZIONE DI LAVORO UT / UT Work instruction
PRC-UTM 16-ASME Rev. 3	N.D.	N.D. Rev. -

CRITERIO DI ACCETTABILITÀ / Acceptance criteria	FASE DEL CONTROLLO / Exam. Phase	INSPECTION TEST PLAN / ITP	FASE ITP / ITP Phase
N.D.	N.D.	N.D. Rev. -	-

OGGETTO / Object	MATERIALE / Material	TRATTAMENTO TERMICO / Post Weld Heat Treatment
[X] MAT. BASE Parent mat. [ ] SALDATURA Weld metal	ACCIAIO AL CARBONIO	[ ] PRIMA del TT Before PWHT [ ] DOPO TT After PWHT [X] NON APPLICABILE Not Applicable

STATO SUPERFICIALE / Surface condition

[ ] SALDATO As Welded [ ] SPAZZOLATO As brushed [ ] LAVORATO A MACCHINA As Machined [ ] CLADDATO As cladded [X] MOLATO As Grounded

[ ] LAMINATO As rolled [ ] GREZZO As forged [ ] SABBIATO As Sand Blasted [ ] VERNICIATO As painted [ ] ALTRO Other

APPARECCHIATURA Equipment	TIPO Type	NUMERO DI SERIE Serial number	LIQUIDO D'ACCOPPIAMENTO Couplant medium	SMORZAMENTO Damping	SOGLIA Reject
OLYMPUS	27 MG	190657402	GLUE	-	-

BLOCCO DI CALIBRAZIONE Calibration block	CONTROLLO MATERIALE BASE Parent material inspection	BLOCCO DI RIFERIMENTO Reference block	SENSIBILITÀ DI TARATURA Calibration sensitivity	TECNICA DI CONTROLLO Examination techinque	TARATURA SCALA Time base calibration
23 BCS (S.N.1179)	-	23 BCS (S.N.1179)	-	-	-

COSTRUTTORE SONDA Probe manufacturer	NUMERO DI SERIE Serial number	FREQUENZA Frequency (MHz)	DIMENSIONE Size (mm)	ANGOLO Beams Angle NOMINALE Nominal (°)	ANGOLO Beams Angle EFFETTIVO Actual (°)	EMISS. FASCIO Probe index (mm)	GUADAGNO Gain setting (dB)	SENSIBILITÀ SCANSIONE Scan sensitivity (dB)	PERDITA DI TRASFERIMENTO Transfer correction (dB)	ONDE Wave
OLYMPUS - D7910	1153166	5	10	0°	-	-	-	-	-	Longitudinal

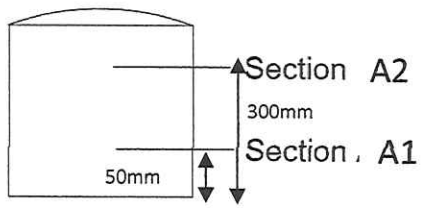
LO STATO FISICO E L'ASPETTO ESTERNO DELL'APPARECCHIATURA COMBINATA E' STATO VERIFICATO PRIMA DELL'UTILIZZO E RISULTA CONFORME AI REQUISITI APPLICABILI
The combined equipment physical state and external aspect has been checked before using and it complies with the applicable requirements

OGGETTO CONTROLLATO / Tested object

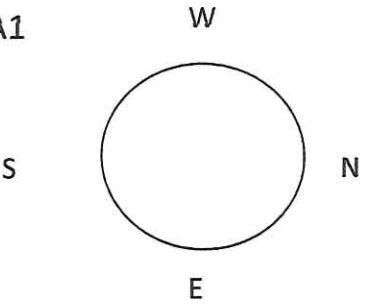
COMPONENTE / Item BITTE BANCHINA YARD PIOMBONI

ITEM	DISEGNO / FOGLIO Drawing Nr / Sheet	MARCA Mark	DIMENSIONE PEZZO Item Dimension	Sp. Thk (mm)	CONDIZIONI ESTERNE (verniciato-isolamento termico) External Condition (painted- thermal	ESITO Result
-	-	-	ø510mm	-	-	-

Sketch



Bollard N°16



BOLLARD N°16

SECTION	VALVALUES (mm)
A1 - N	12,40
A1 - S	12,50
A1 - E	11,60
A1 - W	13,10
A2 - N	12,90
A2 - S	12,60
A2 - E	11,80
A2 - W	13,40

NOTE / Remarks

TECNICO CND Livello 2 NDT Technician Level 2	CONTROLLO QUALITA Quality Control Supervisor	ISPETTORE CONTRATTISTA Contractor Repr.	ISPETTORE CLIENTE Company Rep.	ISPETTORE TERZA PARTE Third Part Inspector
Company: CONTROL snc Operator: ANNESE STEFANO MOD-QCI-34 Rev. 2020-00	ROSETTI MARINO S.p.A Responsabile Controllo Qualità Quality Control Manager 17/05/21			[ ] W [X] R IT 105 Date: 19 MAY 2021 Company:

ROSETTI MARINO

TEST REPORT - NDT ACTIVITIES

RAPPORTO DI ESAME CON ULTRASUONI PER CONTROLLO SPESSIMETRICO

THICKNESS MEASUREMENT ULTRASONIC TEST REPORT

REPORT N° 013/2021

DATA DELL'ESAME Examination Date 15/05/2021

FOGLIO / Sheet n° 1 of 1

COMMESSA / JOB	PROGETTO / Project	CLIENTE / Client	NUMERO ORDINE / Order number	DISCIPLINA / Discipline
N.D.	CONTROLLO BITTE YARD PIOMBONI	N.D.	N.D.	ST Structure

CODICE PROCEDURA / Procedure code	CODICE SPECIFICA / Standard Code	ISTRUZIONE DI LAVORO UT / UT Work instruction
PRC-UTM 16-ASME Rev. 3	N.D.	N.D. Rev. -

CRITERIO DI ACCETTABILITÀ / Acceptance criteria	FASE DEL CONTROLLO / Exam. Phase	INSPECTION TEST PLAN / ITP	FASE ITP / ITP Phase
N.D.	N.D.	N.D. Rev. -	-

OGGETTO / Object	MATERIALE / Material	TRATTAMENTO TERMICO / Post Weld Heat Treatment
[X] MAT. BASE Parent mat. [ ] SALDATURA Weld metal	ACCIAIO AL CARBONIO	[ ] PRIMA del TT Before PWHT [ ] DOPO TT After PWHT [X] NON APPLICABILE Not Applicable

STATO SUPERFICIALE / Surface condition

[ ] SALDATO As Welded [ ] SPAZZOLATO As brushed [ ] LAVORATO A MACCHINA As Machined [ ] CLADDATO As cladded [X] MOLATO As Grounded

[ ] LAMINATO As rolled [ ] GREZZO As forged [ ] SABBIATO As Sand Blasted [ ] VERNICIATO As painted [ ] ALTRO Other

APPARECCHIATURA Equipment	TIPO Type	NUMERO DI SERIE Serial number	LIQUIDO D'ACCOPPIAMENTO Couplant medium	SMORZAMENTO Damping	SOGLIA Reject
OLYMPUS	27 MG	190657402	GLUE	-	-

BLOCCO DI CALIBRAZIONE Calibration block	CONTROLLO MATERIALE BASE Parent material inspection	BLOCCO DI RIFERIMENTO Reference block	SENSIBILITÀ DI TARATURA Calibration sensitivity	TECNICA DI CONTROLLO Examination techinque	TARATURA SCALA Time base calibration
23 BCS (S.N.1179)	-	23 BCS (S.N.1179)	-	-	-

COSTRUTTORE SONDA Probe manufacturer	NUMERO DI SERIE Serial number	FREQUENZA Frequency (MHz)	DIMENSIONE Size (mm)	ANGOLO Beams Angle NOMINALE Nominal (°)	ANGOLO Beams Angle EFFETTIVO Actual (°)	EMISS. FASCIO Probe index (mm)	GUADAGNO Gain setting (dB)	SENSIBILITÀ SCANSIONE Scan sensitivity (dB)	PERDITA DI TRASFERIMENTO Transfer correction (dB)	ONDE Wave
OLYMPUS - D7910	1153166	5	10	0°	-	-	-	-	-	Longitudinal

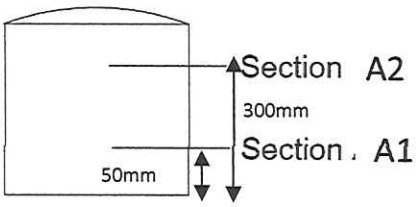
LO STATO FISICO E L'ASPETTO ESTERNO DELL'APPARECCHIATURA COMBINATA E' STATO VERIFICATO PRIMA DELL'UTILIZZO E RISULTA CONFORME AI REQUISITI APPLICABILI
The combined equipment physical state and external aspect has been checked before using and it complies with the applicable requirements

OGGETTO CONTROLLATO / Tested object

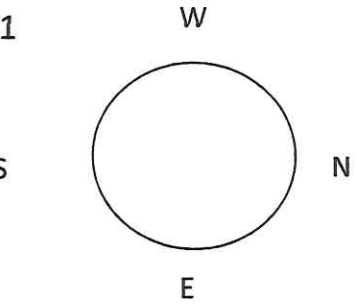
COMPONENTE / Item BITTE BANCHINA YARD PIOMBONI

ITEM	DISEGNO / FOGLIO Drawing Nr / Sheet	MARCA Mark	DIMENSIONE PEZZO Item Dimension	Sp. Thk (mm)	CONDIZIONI ESTERNE (verniciato-isolamento termico) External Condition (painted- thermal	ESITO Result
-	-	-	ø510mm	-	-	-

Sketch



Bollard N°17



BOLLARD N°17

SECTION	VALVALUES (mm)
A1 - N	12,40
A1 - S	12,20
A1 - E	10,10
A1 - W	12,30
A2 - N	12,30
A2 - S	12,90
A2 - E	12,34
A2 - W	12,40

NOTE / Remarks

TECNICO CND Livello 2 NDT Technician Level 2	CONTROLLO QUALITA Quality Control Supervisor	ISPETTORE CONTRATTISTA Contractor Repr.	ISPETTORE CLIENTE Company Rep.	ISPETTORE TERZA PARTE Third Part Inspector
CONTROL snc Company: CONTROL Operator: ANNESE STEFANO MOD-QCI-34 Rev. 2020-00	ROSETTI MARINO S.p.A Responsabile Controllo Qualità Quality Control Manager D. Desogus 17/05/21			[ ] W [X] R IT 105- Date: 19 MAY 2021 Company:

ROSETTI MARINO

TEST REPORT - NDT ACTIVITIES

RAPPORTO DI ESAME CON ULTRASUONI PER CONTROLLO SPESSIMETRICO

THICKNESS MEASUREMENT ULTRASONIC TEST REPORT

REPORT N° 014/2021

DATA DELL'ESAME / Examination Date 15/05/2021

FOGLIO / Sheet n° 1 of 1

COMMESSA / JOB	PROGETTO / Project	CLIENTE / Client	NUMERO ORDINE / Order number	DISCIPLINA / Discipline
N.D.	CONTROLLO BITTE YARD PIOMBONI	N.D.	N.D.	ST Structure

CODICE PROCEDURA / Procedure code	CODICE SPECIFICA / Standard Code	ISTRUZIONE DI LAVORO UT / UT Work instruction
PRC-UTM 16-ASME Rev. 3	N.D.	N.D. Rev. -

CRITERIO DI ACCETTABILITÀ / Acceptance criteria	FASE DEL CONTROLLO / Exam. Phase	INSPECTION TEST PLAN / ITP	FASE ITP / ITP Phase
N.D.	N.D.	N.D. Rev. -	-

OGGETTO / Object	MATERIALE / Material	TRATTAMENTO TERMICO / Post Weld Heat Treatment
[X] MAT. BASE Parent mat. [ ] SALDATURA Weld metal	ACCIAIO AL CARBONIO	[ ] PRIMA del TT Before PWHT [ ] DOPO TT After PWHT [X] NON APPLICABILE Not Applicable

STATO SUPERFICIALE / Surface condition

[ ] SALDATO As Welded [ ] SPAZZOLATO As brushed [ ] LAVORATO A MACCHINA As Machined [ ] CLADDATO As cladded [X] MOLATO As Grounded

[ ] LAMINATO As rolled [ ] GREZZO As forged [ ] SABBIATO As Sand Blasted [ ] VERNICIATO As painted [ ] ALTRO Other

APPARECCHIATURA Equipment	TIPO Type	NUMERO DI SERIE Serial number	LIQUIDO D'ACCOPPIAMENTO Couplant medium	SMORZAMENTO Damping	SOGLIA Reject
OLYMPUS	27 MG	190657402	GLUE	-	-

BLOCCO DI CALIBRAZIONE Calibration block	CONTROLLO MATERIALE BASE Parent material inspection	BLOCCO DI RIFERIMENTO Reference block	SENSIBILITÀ DI TARATURA Calibration sensitivity	TECNICA DI CONTROLLO Examination techinque	TARATURA SCALA Time base calibration
23 BCS (S.N.1179)	-	23 BCS (S.N.1179)	-	-	-

COSTRUTTORE SONDA Probe manufacturer	NUMERO DI SERIE Serial number	FREQUENZA Frequency (MHz)	DIMENSIONE Size (mm)	ANGOLO Beams Angle NOMINALE Nominal (°)	ANGOLO Beams Angle EFFETTIVO Actual (°)	EMISS. FASCIO Probe index (mm)	GUADAGNO Gain setting (dB)	SENSIBILITÀ SCANSIONE Scan sensitivity (dB)	PERDITA DI TRASFERIMENTO Transfer correction (dB)	ONDE Wave
OLYMPUS - D7910	1153166	5	10	0°	-	-	-	-	-	Longitudinal

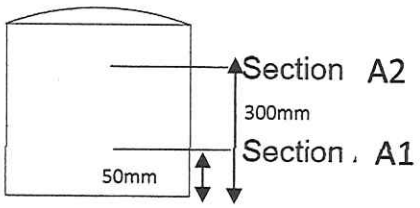
LO STATO FISICO E L'ASPETTO ESTERNO DELL'APPARECCHIATURA COMBINATA E' STATO VERIFICATO PRIMA DELL'UTILIZZO E RISULTA CONFORME AI REQUISITI APPLICABILI
The combined equipment physical state and external aspect has been checked before using and it complies with the applicable requirements

OGGETTO CONTROLLATO / Tested object

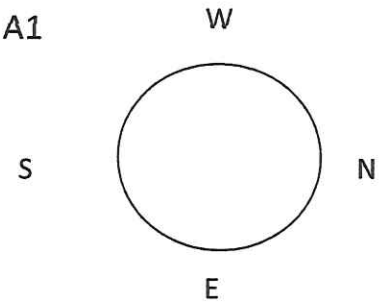
COMPONENTE / Item BITTE BANCHINA YARD PIOMBONI

ITEM	DISEGNO / FOGLIO Drawing Nr / Sheet	MARCA Mark	DIMENSIONE PEZZO Item Dimension	Sp. Thk (mm)	CONDIZIONI ESTERNE (verniciato-isolamento termico) External Condition (painted- thermal	ESITO Result
-	-	-	ø510mm	-	-	-

Sketch



Bollard N°18



BOLLARD N°18

SECTION	VALVALUES (mm)
A1 - N	16,00
A1 - S	16,70
A1 - E	15,90
A1 - W	16,50
A2 - N	16,20
A2 - S	16,80
A2 - E	15,80
A2 - W	16,20

NOTE / Remarks

TECNICO CND Livello 2 NDT Technician Level 2	CONTROLLO QUALITA Quality Control Supervisor	ISPETTORE CONTRATTISTA Contractor Repr.	ISPETTORE CLIENTE Company Rep.	ISPETTORE TERZA PARTE Third Part Inspector
Operator: CONTROL snc Operator: ANNESE STEFANO MOD-QCI-34 Rev. 2020-00	ROSETTI MARINO S.p.A Responsabile Controllo Qualità Quality Control Manager D. Debacquale 12/05/21			W R IT 105 Date: 19 MAY 2021 Company:

ROSETTI MARINO

TEST REPORT - NDT ACTIVITIES

RAPPORTO DI ESAME CON ULTRASUONI PER CONTROLLO SPESSIMETRICO

THICKNESS MEASUREMENT ULTRASONIC TEST REPORT

REPORT N° 015/2021

DATA DELL'ESAME Examination Date 15/05/2021

FOGLIO / Sheet n° 1 of 1

COMMESSA / JOB	PROGETTO / Project	CLIENTE / Client	NUMERO ORDINE / Order number	DISCIPLINA / Discipline
N.D.	CONTROLLO BITTE YARD PIOMBONI	N.D.	N.D.	ST Structure

CODICE PROCEDURA / Procedure code	CODICE SPECIFICA / Standard Code	ISTRUZIONE DI LAVORO UT / UT Work instruction
PRC-UTM 16-ASME Rev. 3	N.D.	N.D. Rev. -

CRITERIO DI ACCETTABILITÀ / Acceptance criteria	FASE DEL CONTROLLO / Exam. Phase	INSPECTION TEST PLAN / ITP	FASE ITP / ITP Phase
N.D.	N.D.	N.D. Rev. -	-

OGGETTO / Object	MATERIALE / Material	TRATTAMENTO TERMICO / Post Weld Heat Treatment
[X] MAT. BASE Parent mat. [ ] SALDATURA Weld metal	ACCIAIO AL CARBONIO	[ ] PRIMA del TT Before PWHT [ ] DOPO TT After PWHT [X] NON APPLICABILE Not Applicable

STATO SUPERFICIALE / Surface condition

[ ] SALDATO As Welded [ ] SPAZZOLATO As brushed [ ] LAVORATO A MACCHINA As Machined [ ] CLADDATO As cladded [X] MOLATO As Grounded

[ ] LAMINATO As rolled [ ] GREZZO As forged [ ] SABBIATO As Sand Blasted [ ] VERNICIATO As painted [ ] ALTRO Other

APPARECCHIATURA Equipment	TIPO Type	NUMERO DI SERIE Serial number	LIQUIDO D'ACCOPPIAMENTO Couplant medium	SMORZAMENTO Damping	SOGLIA Reject
OLYMPUS	27 MG	190657402	GLUE	-	-

BLOCCO DI CALIBRAZIONE Calibration block	CONTROLLO MATERIALE BASE Parent material inspection	BLOCCO DI RIFERIMENTO Reference block	SENSIBILITÀ DI TARATURA Calibration sensitivity	TECNICA DI CONTROLLO Examination techinque	TARATURA SCALA Time base calibration
23 BCS (S.N.1179)	-	23 BCS (S.N.1179)	-	-	-

COSTRUTTORE SONDA Probe manufacturer	NUMERO DI SERIE Serial number	FREQUENZA Frequency (MHz)	DIMENSIONE Size (mm)	ANGOLO Beams Angle NOMINALE Nominal (°)	ANGOLO Beams Angle EFFETTIVO Actual (°)	EMISS. FASCIO Probe index (mm)	GUADAGNO Gain setting (dB)	SENSIBILITÀ SCANSIONE Scan sensitivity (dB)	PERDITA DI TRASFERIMENTO Transfer correction (dB)	ONDE Wave
OLYMPUS - D7910	1153166	5	10	0°	-	-	-	-	-	Longitudinal

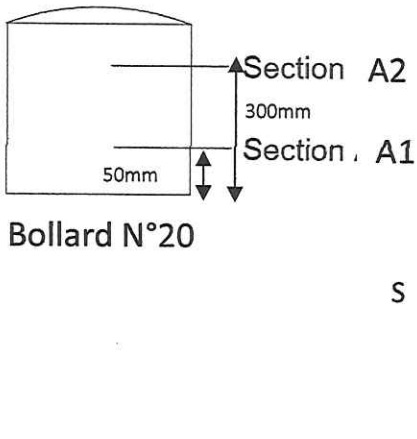
LO STATO FISICO E L'ASPETTO ESTERNO DELL'APPARECCHIATURA COMBINATA E' STATO VERIFICATO PRIMA DELL'UTILIZZO E RISULTA CONFORME AI REQUISITI APPLICABILI
The combined equipment physical state and external aspect has been checked before using and it complies with the applicable requirements

OGGETTO CONTROLLATO / Tested object

COMPONENTE / Item BITTE BANCHINA YARD PIOMBONI

ITEM	DISEGNO / FOGLIO Drawing Nr / Sheet	MARCA Mark	DIMENSIONE PEZZO Item Dimension	Sp. Thk (mm)	CONDIZIONI ESTERNE (verniciato-isolamento termico) External Condition (painted- thermal	ESITO Result
-	-	-	ø510mm	-	-	-

Sketch



BOLLARD N°20

SECTION	VALVALUES (mm)
A1 - N	9,80
A1 - S	14,60
A1 - E	18,40
A1 - W	18,30
A2 - N	18,70
A2 - S	18,30
A2 - E	10,70
A2 - W	18,60

NOTE / Remarks

TECNICO CND Livello 2 NDT Technician Level 2	CONTROLLO QUALITA Quality Control Supervisor	ISPETTORE CONTRATTISTA Contractor Repr.	ISPETTORE CLIENTE Company Rep.	ISPETTORE TERZA PARTE Third Part Inspector
CONTROL snc Company: CONTROL Operator: ANNESE STEFANO	ROSETTI MARINO S.p.A Responsabile Controllo Qualità Quality Control Manager D. Deneselle 17/05/21			[ ] W [X] R IT 105 RINA Date: 19 MAY 2021 Company:

MOD-QCI-34 Rev. 2020-00

ROSETTI MARINO

TEST REPORT - NDT ACTIVITIES

RAPPORTO DI ESAME CON ULTRASUONI PER CONTROLLO SPESSIMETRICO

THICKNESS MEASUREMENT ULTRASONIC TEST REPORT

REPORT N° 017/2021

DATA DELL'ESAME Examination Date 15/05/2021

FOGLIO / Sheet n° 1 of 1

COMMESSA / JOB	PROGETTO / Project	CLIENTE / Client	NUMERO ORDINE / Order number	DISCIPLINA / Discipline
N.D.	CONTROLLO BITTE YARD PIOMBONI	N.D.	N.D.	ST Structure

CODICE PROCEDURA / Procedure code	CODICE SPECIFICA / Standard Code	ISTRUZIONE DI LAVORO UT / UT Work instruction
PRC-UTM 16-ASME Rev. 3	N.D.	N.D. Rev. -

CRITERIO DI ACCETTABILITÀ / Acceptance criteria	FASE DEL CONTROLLO / Exam. Phase	INSPECTION TEST PLAN / ITP	FASE ITP / ITP Phase
N.D.	N.D.	N.D. Rev. -	-

OGGETTO / Object	MATERIALE / Material	TRATTAMENTO TERMICO / Post Weld Heat Treatment
[X] MAT. BASE Parent mat. [ ] SALDATURA Weld metal	ACCIAIO AL CARBONIO	[ ] PRIMA del TT Before PWHT [ ] DOPO TT After PWHT [X] NON APPLICABILE Not Applicable

STATO SUPERFICIALE / Surface condition

[ ] SALDATO As Welded [ ] SPAZZOLATO As brushed [ ] LAVORATO A MACCHINA As Machined [ ] CLADDATO As cladded [X] MOLATO As Grounded

[ ] LAMINATO As rolled [ ] GREZZO As forged [ ] SABBIATO As Sand Blasted [ ] VERNICIATO As painted [ ] ALTRO Other

APPARECCHIATURA Equipment	TIPO Type	NUMERO DI SERIE Serial number	LIQUIDO D'ACCOPPIAMENTO Couplant medium	SMORZAMENTO Damping	SOGLIA Reject
OLYMPUS	27 MG	190657402	GLUE	-	-

BLOCCO DI CALIBRAZIONE Calibration block	CONTROLLO MATERIALE BASE Parent material inspection	BLOCCO DI RIFERIMENTO Reference block	SENSIBILITÀ DI TARATURA Calibration sensitivity	TECNICA DI CONTROLLO Examination techinque	TARATURA SCALA Time base calibration
23 BCS (S.N.1179)	-	23 BCS (S.N.1179)	-	-	-

COSTRUTTORE SONDA Probe manufacturer	NUMERO DI SERIE Serial number	FREQUENZA Frequency (MHz)	DIMENSIONE Size (mm)	ANGOLO Beams Angle NOMINALE Nominal (°)	ANGOLO Beams Angle EFFETTIVO Actual (°)	EMISS. FASCIO Probe index (mm)	GUADAGNO Gain setting (dB)	SENSIBILITÀ SCANSIONE Scan sensitivity (dB)	PERDITA DI TRASFERIMENTO Transfer correction (dB)	ONDE Wave
OLYMPUS - D7910	1153166	5	10	0°	-	-	-	-	-	Longitudinal

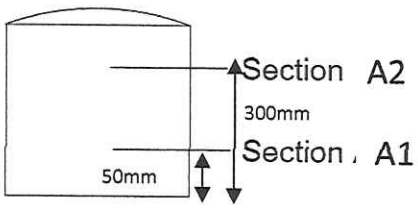
LO STATO FISICO E L'ASPETTO ESTERNO DELL'APPARECCHIATURA COMBINATA E' STATO VERIFICATO PRIMA DELL'UTILIZZO E RISULTA CONFORME AI REQUISITI APPLICABILI
The combined equipment physical state and external aspect has been checked before using and it complies with the applicable requirements

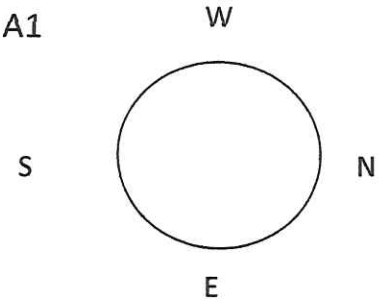
OGGETTO CONTROLLATO / Tested object

COMPONENTE / Item BITTE BANCHINA YARD PIOMBONI

ITEM	DISEGNO / FOGLIO Drawing Nr / Sheet	MARCA Mark	DIMENSIONE PEZZO Item Dimension	Sp. Thk (mm)	CONDIZIONI ESTERNE (verniciato-isolamento termico) External Condition (painted- thermal	ESITO Result
-	-	-	ø510mm	-	-	-

Sketch





BOLLARD N°22

SECTION	VALVALUES (mm)
A1 - N	18,10
A1 - S	10,88
A1 - E	11,20
A1 - W	18,40
A2 - N	18,60
A2 - S	18,40
A2 - E	18,50
A2 - W	18,70

NOTE / Remarks

TECNICO CND Livello 2 NDT Technician Level 2	CONTROLLO QUALITÀ Quality Control Supervisor	ISPETTORE CONTRATTISTA Contractor Repr.	ISPETTORE CLIENTE Company Rep.	ISPETTORE TERZA PARTE Third Part Inspector
Company: CONTROL snc Operator: ANTONIO STEFANO	ROSETTI MARINO S.p.A Responsabile Controllo Qualità Quality Control Manager			[ ] W [X] R IT 105 RINA Date: 19 MAY 2021 Company:

MOD-QCI-34 Rev. 2020-00

ROSETTI MARINO

TEST REPORT - NDT ACTIVITIES

RAPPORTO DI ESAME CON ULTRASUONI PER CONTROLLO SPESSIMETRICO

THICKNESS MEASUREMENT ULTRASONIC TEST REPORT

REPORT N° 018/2021

DATA DELL'ESAME Examination Date 15/05/2021

FOGLIO / Sheet n° 1 of 1

COMMESSA / JOB	PROGETTO / Project	CLIENTE / Client	NUMERO ORDINE / Order number	DISCIPLINA / Discipline
N.D.	CONTROLLO BITTE YARD PIOMBONI	N.D.	N.D.	ST Structure

CODICE PROCEDURA / Procedure code	CODICE SPECIFICA / Standard Code	ISTRUZIONE DI LAVORO UT / UT Work instruction
PRC-UTM 16-ASME Rev. 3	N.D.	N.D. Rev. -

CRITERIO DI ACCETTABILITÀ / Acceptance criteria	FASE DEL CONTROLLO / Exam. Phase	INSPECTION TEST PLAN / ITP	FASE ITP / ITP Phase
N.D.	N.D.	N.D. Rev. -	-

OGGETTO / Object	MATERIALE / Material	TRATTAMENTO TERMICO / Post Weld Heat Treatment
[X] MAT. BASE Parent mat. [ ] SALDATURA Weld metal	ACCIAIO AL CARBONIO	[ ] PRIMA del TT Before PWHT [ ] DOPO TT After PWHT [X] NON APPLICABILE Not Applicable

STATO SUPERFICIALE / Surface condition

[ ] SALDATO As Welded [ ] SPAZZOLATO As brushed [ ] LAVORATO A MACCHINA As Machined [ ] CLADDATO As cladded [X] MOLATO As Grounded

[ ] LAMINATO As rolled [ ] GREZZO As forged [ ] SABBIATO As Sand Blasted [ ] VERNICIATO As painted [ ] ALTRO Other

APPARECCHIATURA Equipment	TIPO Type	NUMERO DI SERIE Serial number	LIQUIDO D'ACCOPPIAMENTO Couplant medium	SMORZAMENTO Damping	SOGLIA Reject
OLYMPUS	27 MG	190657402	GLUE	-	-

BLOCCO DI CALIBRAZIONE Calibration block	CONTROLLO MATERIALE BASE Parent material inspection	BLOCCO DI RIFERIMENTO Reference block	SENSIBILITÀ DI TARATURA Calibration sensitivity	TECNICA DI CONTROLLO Examination techinque	TARATURA SCALA Time base calibration
23 BCS (S.N.1179)	-	23 BCS (S.N.1179)	-	-	-

COSTRUTTORE SONDA Probe manufacturer	NUMERO DI SERIE Serial number	FREQUENZA Frequency (MHz)	DIMENSIONE Size (mm)	ANGOLO Beams Angle NOMINALE Nominal (°)	ANGOLO Beams Angle EFFETTIVO Actual (°)	EMISS. FASCIO Probe index (mm)	GUADAGNO Gain setting (dB)	SENSIBILITÀ SCANSIONE Scan sensitivity (dB)	PERDITA DI TRASFERIMENTO Transfer correction (dB)	ONDE Wave
OLYMPUS - D7910	1153166	5	10	0°	-	-	-	-	-	Longitudinal

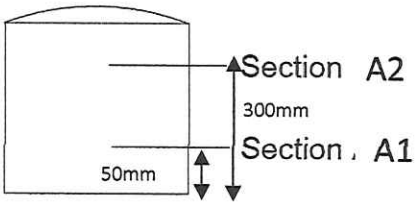
LO STATO FISICO E L'ASPETTO ESTERNO DELL'APPARECCHIATURA COMBINATA E' STATO VERIFICATO PRIMA DELL'UTILIZZO E RISULTA CONFORME AI REQUISITI APPLICABILI
The combined equipment physical state and external aspect has been checked before using and it complies with the applicable requirements

OGGETTO CONTROLLATO / Tested object

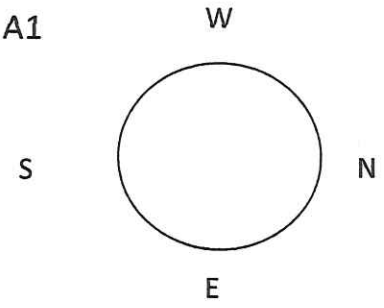
COMPONENTE / Item BITTE BANCHINA YARD PIOMBONI

ITEM	DISEGNO / FOGLIO Drawing Nr / Sheet	MARCA Mark	DIMENSIONE PEZZO Item Dimension	Sp. Thk (mm)	CONDIZIONI ESTERNE (verniciato-isolamento termico) External Condition (painted- thermal	ESITO Result
-	-	-	ø510mm	-	-	-

Sketch



Bollard N°23



BOLLARD N°23

SECTION	VALVALUES (mm)
A1 - N	18,60
A1 - S	18,40
A1 - E	18,60
A1 - W	18,40
A2 - N	18,30
A2 - S	18,20
A2 - E	18,70
A2 - W	18,60

NOTE / Remarks

TECNICO CND Livello 2 NDT Technician Level 2	CONTROLLO QUALITA Quality Control Supervisor	ISPETTORE CONTRATTISTA Contractor Repr.	ISPETTORE CLIENTE Company Rep.	ISPETTORE TERZA PARTE Third Part Inspector
CONTROL snc Operator: ANNESE STEFANO MOD-QCI-34 Rev. 2020-00	ROSETTI MARINO S.p.A Responsabile Controllo Qualità Quality Control Manager D. Depasquale 18/05/21			W - R IT 105 RINA Date: 19 MAY 2021 Company:

Addendum alla relazione di calcolo della banchina metallica del Cantiere Rosetti – Piomboni

Premessa

Nella presente nota si riporta la valutazione dello stato di sollecitazione nelle bitte di ormeggio della banchina metallica costituente il fronte di approdo principale realizzato lungo il Canale Piombone in destra idraulica all'interno del Cantiere Rosetti di Marina di Ravenna.

La banchina metallica è costituita da profili portanti PSP 808 N (king piles) e da palancole PZ 610 (sheet piles) solidarizzati in testa ad una trave di coronamento di forma quadrata di lato di 1.50 m (J_c = 0.422 m^4). La paratia metallica è vincolata in sommità a tiranti metallici in acciaio Fe52 sub-orizzontali lunghi 26 m, del diametro di 58 mm (A=2640 mm^2) disposti ad interasse di 1.68 m ancorati a piastre di contrasto costituite da coppie di palancole Larsenn 61. La trave di coronamento alloggia bitte in acciaio API 5L Gr. X52, di sezione cava del diametro di 508 mm e 15.09 mm di spessore riempite di calcestruzzo. L'altezza utile della bitta è di 500 mm mentre la parte immersa nella trave di coronamento è si 1500 mm. Le bitte sono soggette ad un tiro di progetto ortogonale alla banchina di intensità pari a P=500 kN. Nel seguito si riportano le verifiche di resistenza delle bitte e dei tiranti della banchina facendo riferimento alla normativa vigente all'epoca della costruzione dell'opera portuale (1987-1988) ed in particolare al metodo delle tensioni ammissibili allora adottato.

Verifica di resistenza della bitta

La resistenza della bitta è determinata dal modulo resistente della sezione, per la quale si considera lo spessore ridotto al valore minimo di 10 mm previsto alla fine della vita utile, dalla tensione ammissibile dell'acciaio attraverso le relazioni seguenti (De= 497.82 mm Di=477.82 mm; s_{min}= 10 mm; σ_{amm} = 240 N/mm^2):

$W = \pi[D_e^4 - D_i^4]/[32D_e] = 1832 \cdot 10^3\ mm^3$

$\sigma_{amm} = 240\ N/mm^2$

$M_{rd} = \sigma_{amm}\ W = 439.7\ kNm$

Lo sforzo massimo trasferibile alla bitta, considerando un braccio dell'azione orizzontale pari a h= 0.37 m, risulta a sua volta valere:

$M_{sd} = \eta\ F\ h$

essendo η = 1.35 il coefficiente di amplificazione dinamica dei carichi valutati in condizioni statiche. Eguagliando il momento resistente (capacità) al momento di progetto (domanda) si ricava l'azione massima che può agire sulle bitte ottenendo:

$F = M_{rd} / \eta\ h \approx 880\ kN$

Ferma restando la prescrizione di non superare i 500 kN di componente di sforzo ortogonale alla banchina. il tiro di ormeggio consentito può crescere da un valore minimo di 500 kN per tiro ortogonale alla banchina sino al valore di 850 kN quando l'angolo di tiro supera 54° di inclinazione nel piano orizzontale, angolo oltre il quale il tiro massimo ammissibile è costante essendo determinato dalla resistenza della bitta (850 kN) e non più da quella dei tiranti.

Verifica dei tiranti di ancoraggio

Nel seguito si riporta la valutazione dell'incremento di tiro nei tiranti di ancoraggio della banchina indotto dal tiro di ormeggio P = 500 kN in direzione ortogonale alla banchina verso mare. Il modello di riferimento è costituito da una trave si suolo elastico sollecitata nel piano orizzontale costituita dalla trave di coronamento vincolata ai tiranti di ancoraggio la cui rigidezza alla traslazione si può supporre, in virtù del ridoto interasse tra i tiranti, diffusa al continuo. In questo schema statico le grandezze di riferimento sono le seguenti:

Rigidezza specifica del tiranti

$K = E_s A_s \cos^2\alpha/(pL) = 210.000.000 \times 26 \times 10^{-4} \times 1.00 / (1.68 \times 26) = 12500$ kPa/m

Lunghezza caratteristica di interazione

$L_c = [\, 4E_c J_t / K \,]^{1/4} = [\, 4 \times 30.000.000 \times 0.4219 / 12500]^{1/4} = 7.98$ m

In base a tali grandezze si possono determinare lo spostamento della trave di coronamento e l'incremento di sforzo nel tirante in corrispondenza della bitta, rispettivamente pari a:

$w = P L_c^3 / 8E_c J_t = 500 \times 7.98^3 / (8 \times 30.000.000 \times 0.4219) = 2.5$ mm

$\Delta T = p\, kw = 1.68 \times 12500 \times 0.0025 = 52.7$ kN

corrispondente ad un incremento di tensione normale nella sezione d'acciaio dei tiranti pari a:

$\Delta\sigma = \Delta T / A_s = 20$ N/mm^2

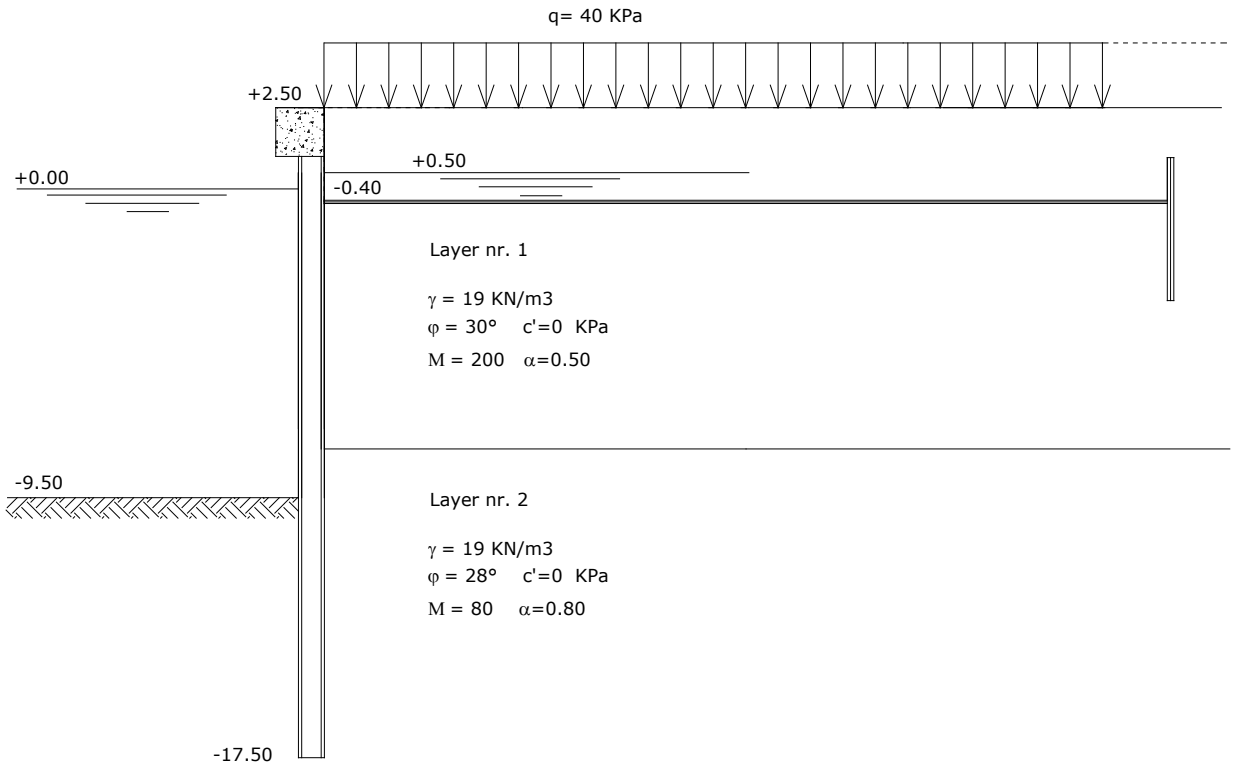
che rappresenta un ridotto incremento (9%) rispetto allo sforzo nel tirante agente in condizione di esercizio con sovraccarico di 40 kPa, pari a 583.9 kN. Lo sforzo massimo attinge così il valore:

$T_{max} = 583.9 + 52.7 = 636.6$ kN

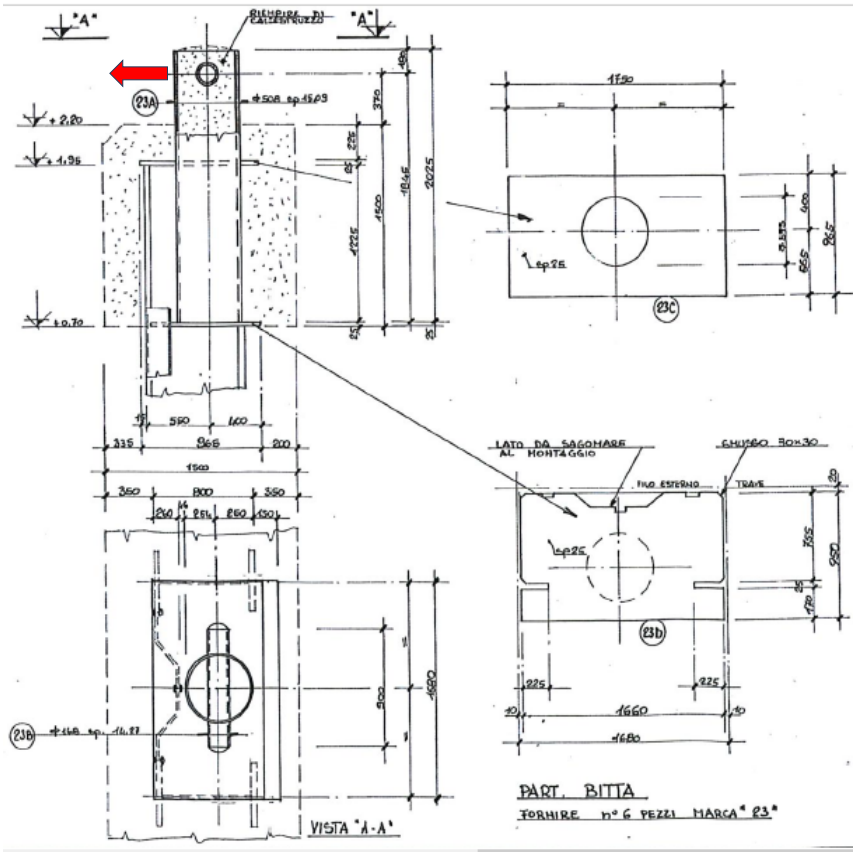
$\sigma_{max} = T_{max} / A_s = 221 + 20 = 241$ N/mm^2 < $\sigma_{amm} = 260$ N/mm^2

che rientra entro i limiti ammissibili di progetto.

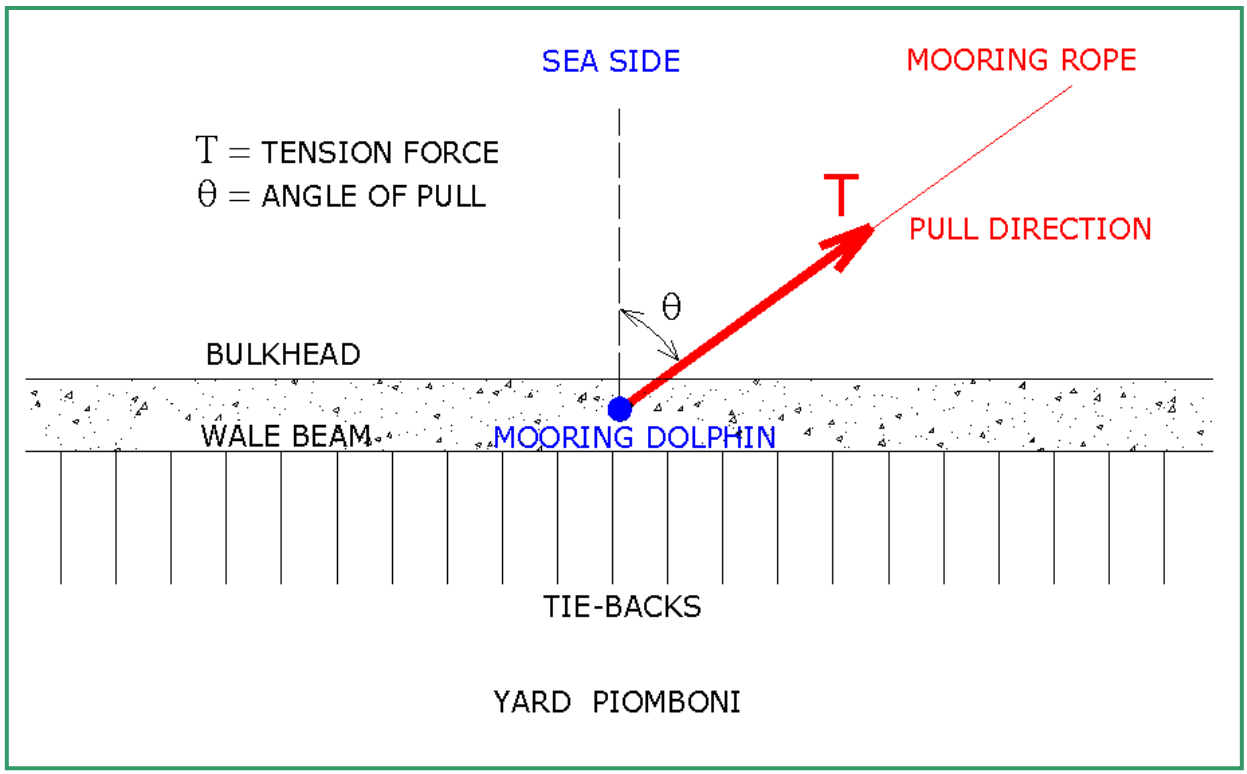
Plane Strain Model
Design Load

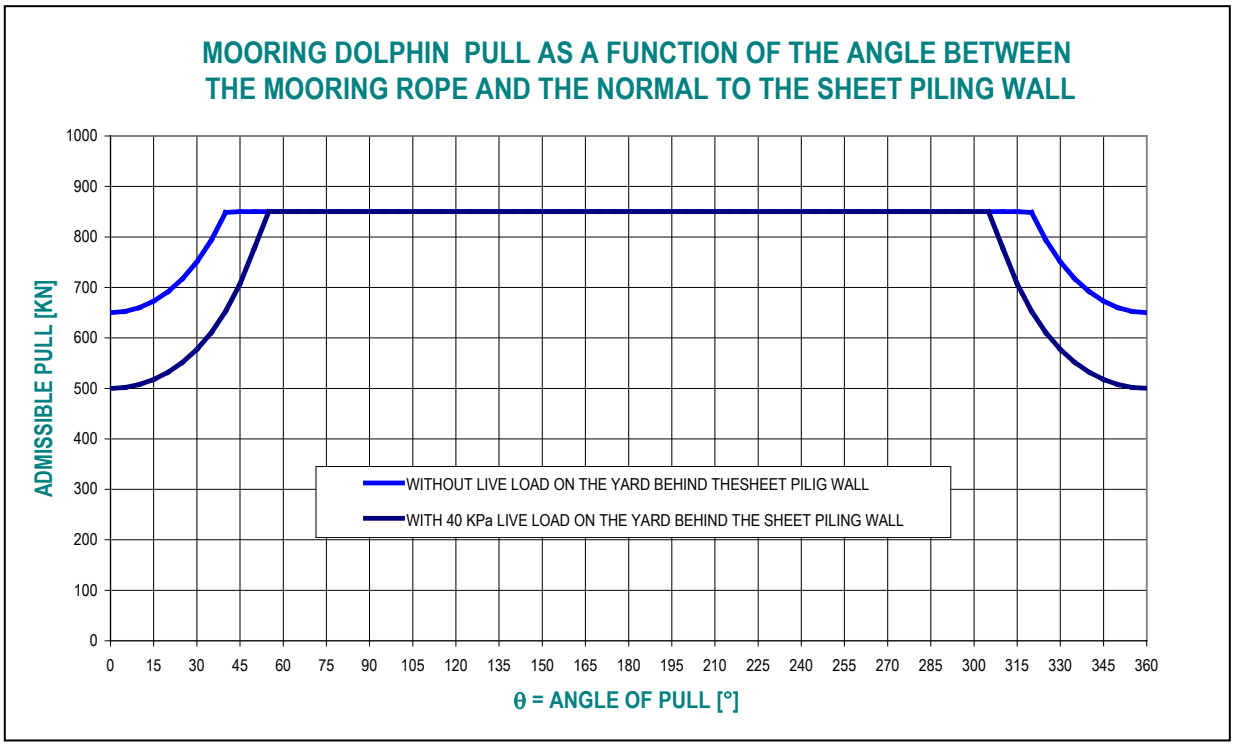


Configurazione di progetto della banchina



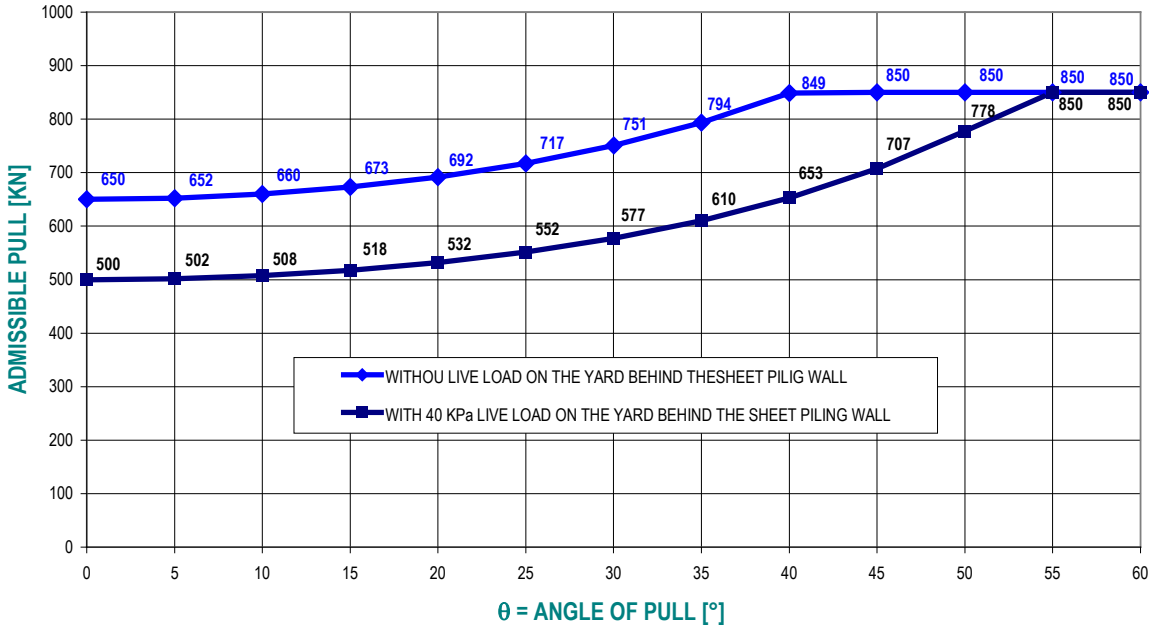
RMI YPB BOLLARD FROM No 13 TO No 23





Configurazione dei tiri di ormeggio ammissibili per le bitte

MOORING DOLPHIN PULL AS A FUNCTION OF THE ANGLE BETWEEN THE MOORING ROPE AND THE NORMAL TO THE SHEET PILING WALL



PULL ON THE BOLLARDS
STEEL SHEET PILING WALL

θ	T	T*
(°)	(KN)	(KN)
0	500	650
5	502	652
10	508	660
15	518	673
20	532	692
25	552	717
30	577	751
35	610	794
40	653	849
45	707	850
50	778	850
55	850	850
60	850	850
65	850	850
70	850	850
75	850	850
80	850	850
90	850	850

T = tiro nella bitta con sovraccarico di 40 kPa

T^* = tiro nella bitta senza sovraccarico nel piazzale

Verifica delle bitte della banchina in cemento armato

All'interno del cantiere Rosetti, sempre in continuità a monte della banchina metallica è presente un'altra banchina , di costruzione antecedente (anni 1970) realizzata con diaframmi cemento armato, sulla cui trave di coronamento sono state installate bitte metalliche delle medesime caratteristiche geometriche (De=508 mm) e meccaniche (acciaio API 5L Gr. X52). Il tiro massimo di progetto è in questo caso di 400 kN

Come in precedenza la resistenza della bitta è determinata dal modulo resistente della sezione, per la quale si considera lo spessore ridotto al valore minimo corroso di 5 mm (limite inferiore), dalla tensione ammissibile dell'acciaio attraverso le relazioni seguenti (D_e= 487.82 mm D_i=477.82 mm; σ_{amm} = 240 N/mm^2):

$W = \pi[D_e^4 - D_i^4]/[32D_e] = 888 \cdot 10^3$ mm^3

σ_{amm} = 240 N/mm^2

$M_{rd} = \sigma_{amm} W$ = 213.2 kNm

Lo sforzo massimo trasferibile alla bitta, considerando un braccio dell'azione orizzontale pari a h= 0.37 m, risulta a sua volta valere:

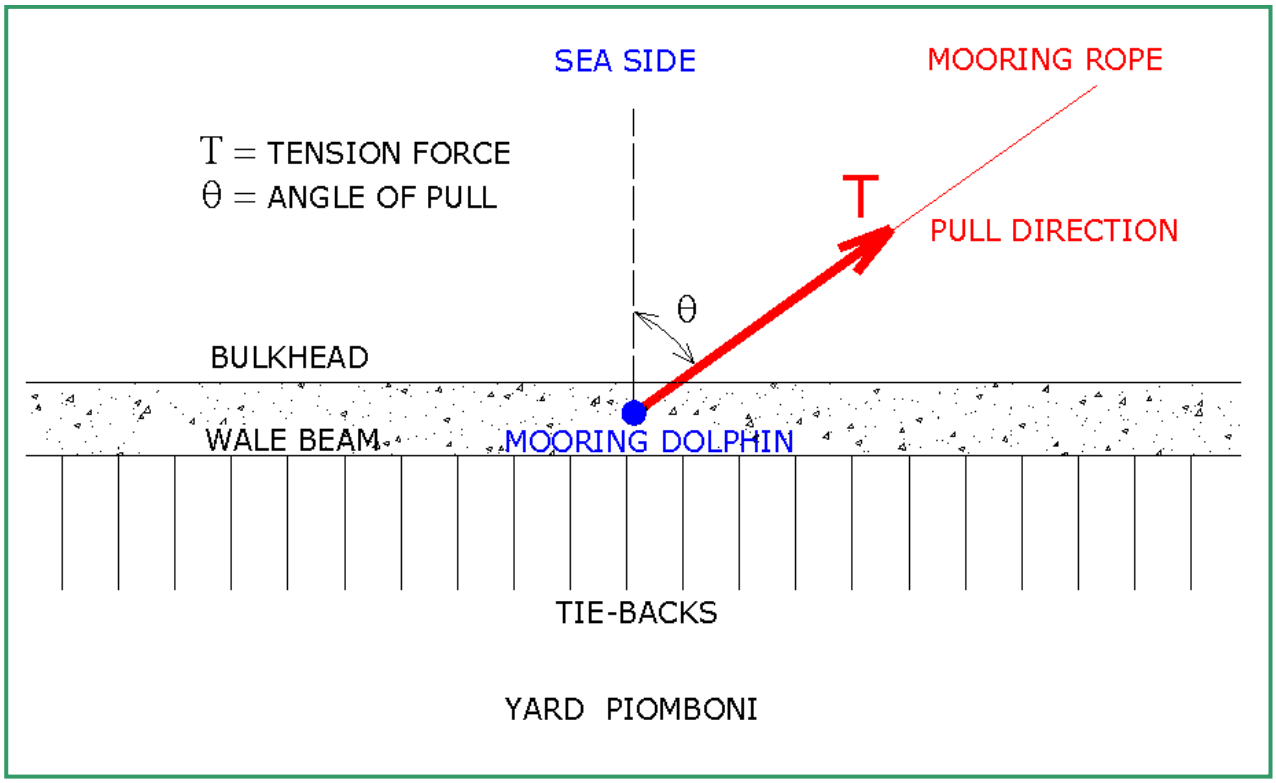
$M_{sd} = \eta F h$

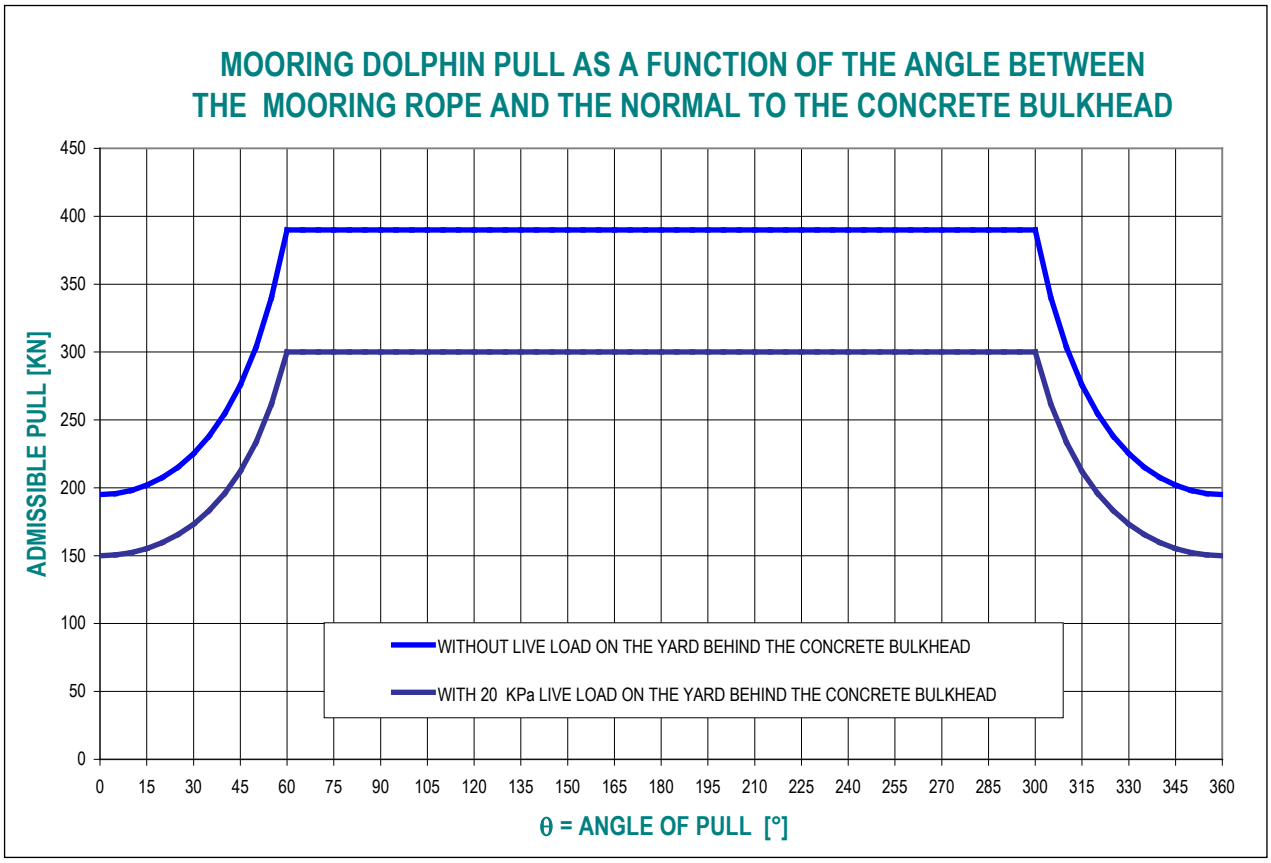
essendo η = 1.35 il coefficiente di amplificazione dinamica dei carichi valutati in condizioni statiche. Eguagliando il momento resistente (capacità) al momento di progetto (domanda) si ricava l'azione massima che può agire sulle bitte ottenendo:

$F = M_{rd} / \eta h \approx 427$ kN

Ferma restando la prescrizione di non superare i 150 kN di componente di sforzo ortogonale alla banchina. con sovraccarico di 20 kPa e di 200 kN senza sovraccarico a tergo della banchina il tiro di ormeggio consentito può crescere da un valore minimo di 200 kN per tiro ortogonale alla banchina sino al valore di 400 kN quando l'angolo di tiro supera 60° di inclinazione nel piano orizzontale, angolo oltre il quale il tiro massimo ammissibile è costante essendo determinato dalla resistenza della bitta (400 kN) e non più da quella dei tiranti.

RMI YPB BOLLARD FROM No 1 TO No 12





ADMISSIBLE PULL - CONCRETE BULKHEAD

□	T	T*		□	T	T*
(°)	(KN)	(KN)		(°)	(KN)	(KN)
0	150	195		180	300	390
5	151	196		185	300	390
10	152	198		190	300	390
15	155	202		195	300	390
20	160	208		200	300	390
25	166	215		205	300	390
30	173	225		210	300	390
35	183	238		215	300	390
40	196	255		220	300	390
45	212	276		225	300	390
50	233	303		230	300	390
55	262	340		235	300	390
60	300	390		240	300	390
65	300	390		245	300	390
70	300	390		250	300	390
75	300	390		255	300	390
80	300	390		260	300	390
85	300	390		265	300	390
90	300	390		270	300	390
95	300	390		275	300	390
100	300	390		280	300	390
105	300	390		285	300	390
110	300	390		290	300	390
115	300	390		295	300	390
120	300	390		300	300	390
125	300	390		305	262	340
130	300	390		310	233	303
135	300	390		315	212	276
140	300	390		320	196	255

145	300	390		325	183	238
150	300	390		330	173	225
155	300	390		335	166	215
160	300	390		340	160	208
165	300	390		345	155	202
170	300	390		350	152	198
175	300	390		355	151	196
180	300	390		360	150	195

ATTACHMENT E – MOORING SCHEMES, FENDERS & BRIDGE PLATES

This document undergoes an issuance cycle within EDMS Fusionlive". Its distribution is electronically controlled. Once printed shall be considered as "NOT CONTROLLED" copy

F1 = 7 T BOW BOLLARDS

BACK UP MOORING LINE

BACK UP MOORING LINE

VERVECE BARGE

WIND FORCE
F = 11 Ton

MOORING LINE 3
T3= 6 Ton

MOORING LINE 1
T1= 6 Ton

82216

79930

52730

2286

43°

36°

41°

35°

8°

6°

F2 = 4 T STERN BOLLARDS

BARGE STERN

30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49

12 13 14 15 16 17 18 19 20 21 22 23

SECTION III SECTION II SECTION I

WINCH TYP 2
A

E
WINCH TYP 1

D
WINCH TYP 1

MOORING LINE 4
T4= 4 Ton

MOORING LINE 2
T2= 4 Ton

WINCH TYP 1
C

WINCH TYP 1
F

WINCH TYP 2
B

ERECTION
AREA
BOURI

23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49

NOTES

1 – ALL DIMENSIONS AND ELEVATIONS ARE IN MILLIMETERS U.N.O.
2 – MAX OPERATIONAL WIND SPEED = 10 m/s
3 – MOORING DESIGN WIND SPEED = 14.9 m/s

REFERENCE DRAWINGS

DWG No.	DESCRIPTION

TECON

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
00	03/03/25	CB	FC	CA	

CROSSWIND

ROSETTI MARINO

TITLE :
BASE LOAD POWER HUB (BLPH)
MOORING SCHEME
PERPENDICULAR TO QUAY

CONTRACT NO./TITLE CW-I-WP4-2023-05/HOLLANDSE KUST NOORD WIND PARK			SCALE
DRAWN C.BENZONI	CHECKED F.CERONI	APPROVED C.ANTONELLINI	DATE 03/03/25
A1	DRAWING NO. 123A90-FDL-MT-DD-00405-00	SHEET 001	REV. 00

F2 = 9 Ton

WIND FORCE
F = 25 Ton

F1 = 16 Ton

1486 | 51244 | 28686 | 10024

79930

52730

WIND CENTER OF EXPOSED AREA

7300

WIND FORCE
F = 13 Ton

MOORING LINE 2
T2= 8 Ton

MOORING LINE 1
T1= 13 Ton

62°
51°
58°
46°

SECTION III
SECTION II
SECTION I

MOORING LINE 4
T4= 10 Ton

MOORING LINE 5
T5= 10 Ton

MOORING LINE 3
T3= 10 Ton

MOORING LINE 6
T6= 10 Ton

ERECTION AREA BOURI

NOTES

1 – ALL DIMENSIONS AND ELEVATIONS ARE IN MILLIMETERS U.N.O.
2 – WIND SPEED 22.6 m/s

REFERENCE DRAWINGS

DWG No.	DESCRIPTION

TECON

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
00	03/03/25	CB	FC	CA	

CROSSWIND

ROSETTI MARINO

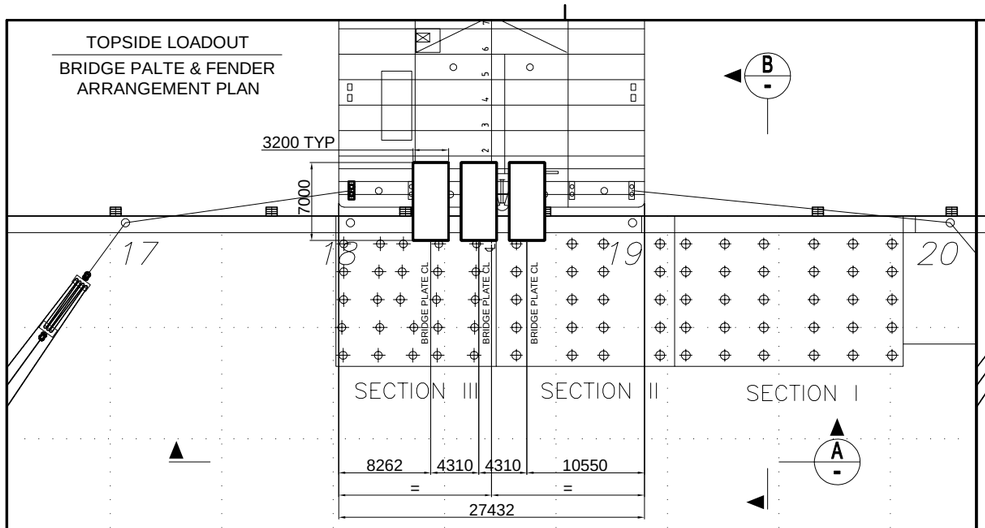
TITLE :
BASE LOAD POWER HUB (BLPH)
MOORING SCHEME
BARGE POST LOADOUT

CONTRACT NO./TITLE CW-I-WP4-2023-05/HOLLANDSE KUST NOORD WIND PARK . | SCALE

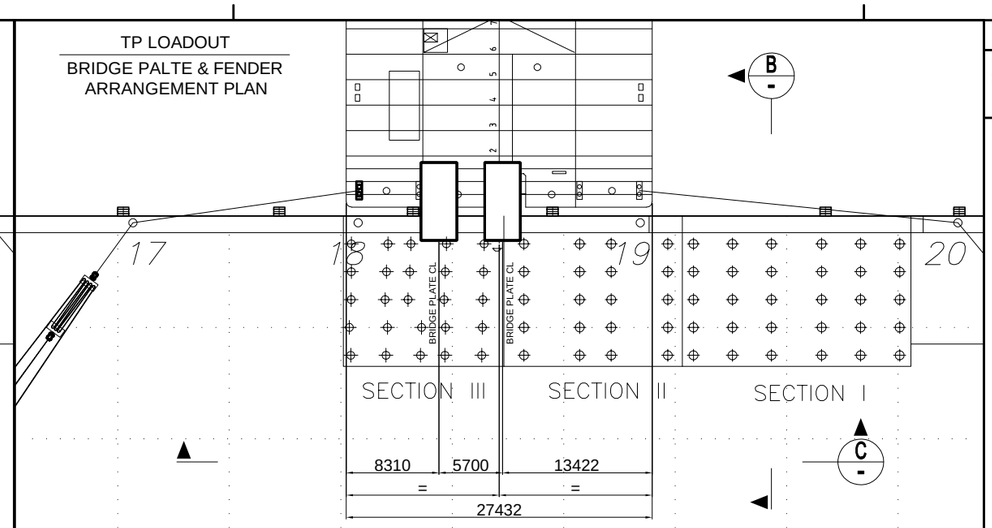
DRAWN C.BENZONI | CHECKED F.CERONI | APPROVED C.ANTONELLINI | DATE 03/03/25

A1 | DRAWING NO. 123A90-FDL-MT-DD-00406-00 | SHEET 001 | REV. 00

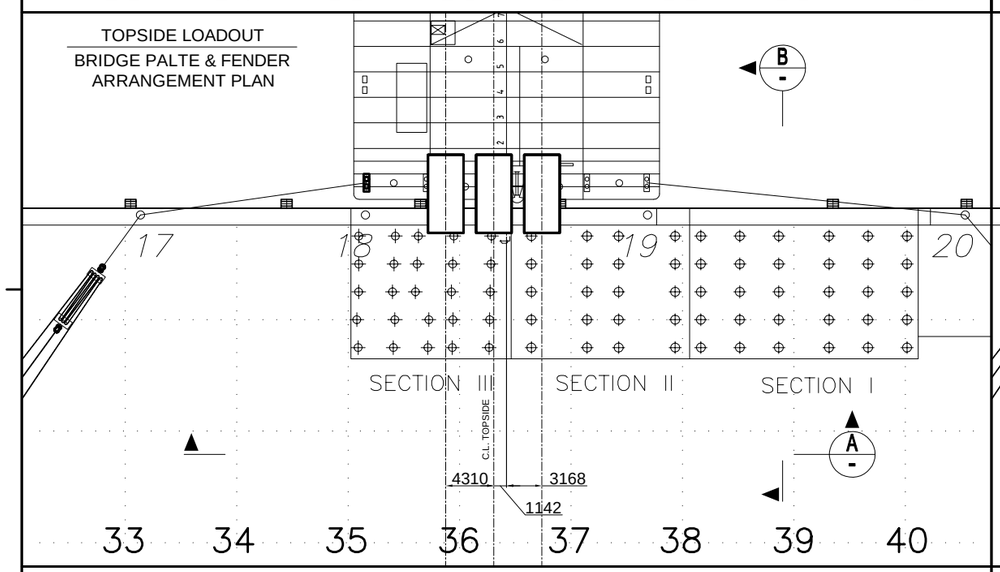
TOPSIDE LOADOUT
BRIDGE PALTE & FENDER
ARRANGEMENT PLAN



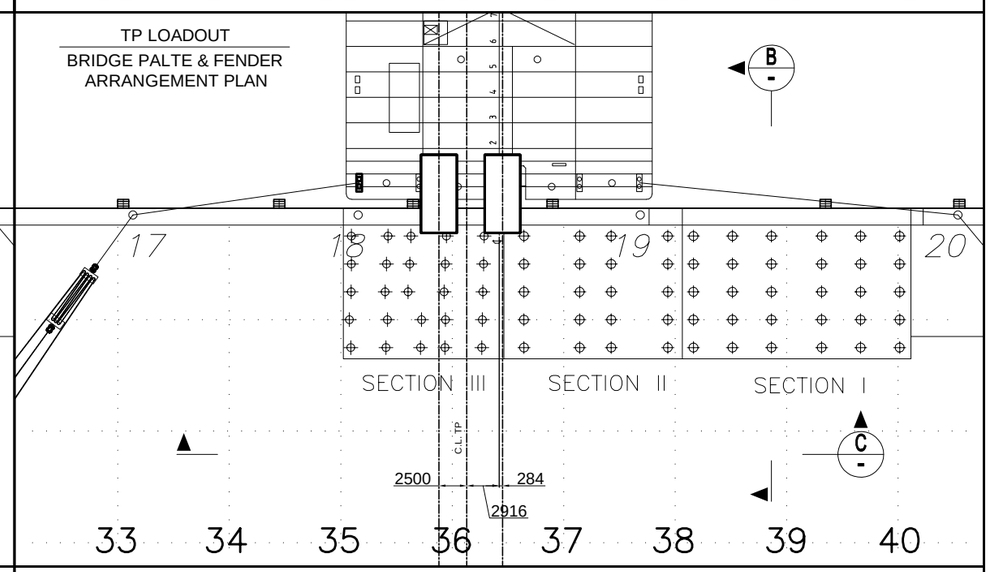
TP LOADOUT
BRIDGE PALTE & FENDER
ARRANGEMENT PLAN



TOPSIDE LOADOUT
BRIDGE PALTE & FENDER
ARRANGEMENT PLAN

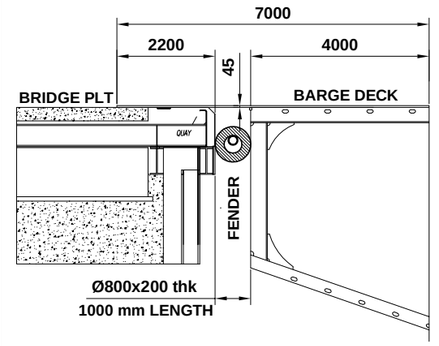


TP LOADOUT
BRIDGE PALTE & FENDER
ARRANGEMENT PLAN



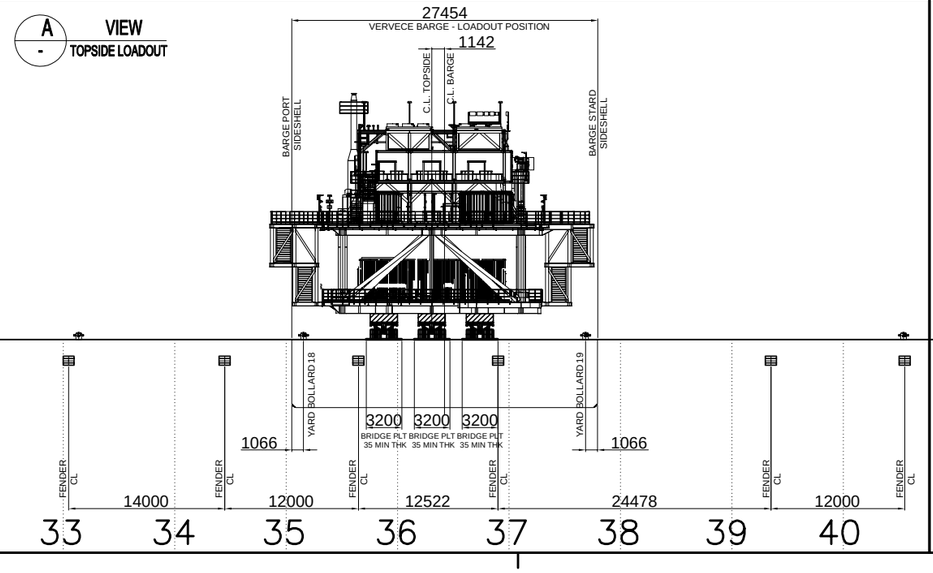
NOTES

1 – ALL DIMENSIONS AND ELEVATIONS ARE IN MILLIMETERS U.N.O.
2 – PLATES FOR LOADOUT ARE 7000x3200x35 min

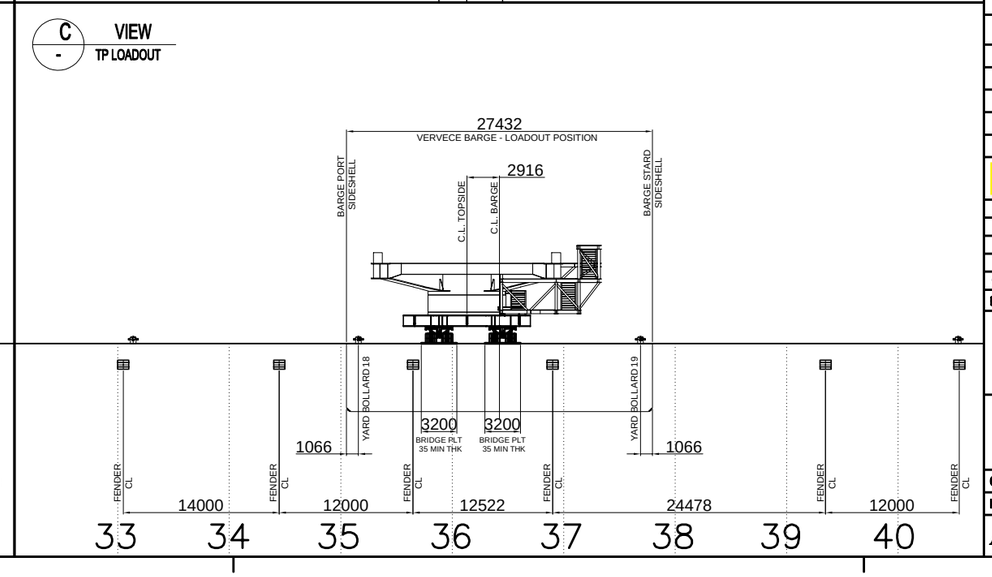


B - VIEW
TYP SECTION

A - VIEW
TOPSIDE LOADOUT



C - VIEW
TP LOADOUT



REFERENCE DRAWINGS

DWG No.	DESCRIPTION

TECON

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
00	03/03/25	CB	FC	CA	

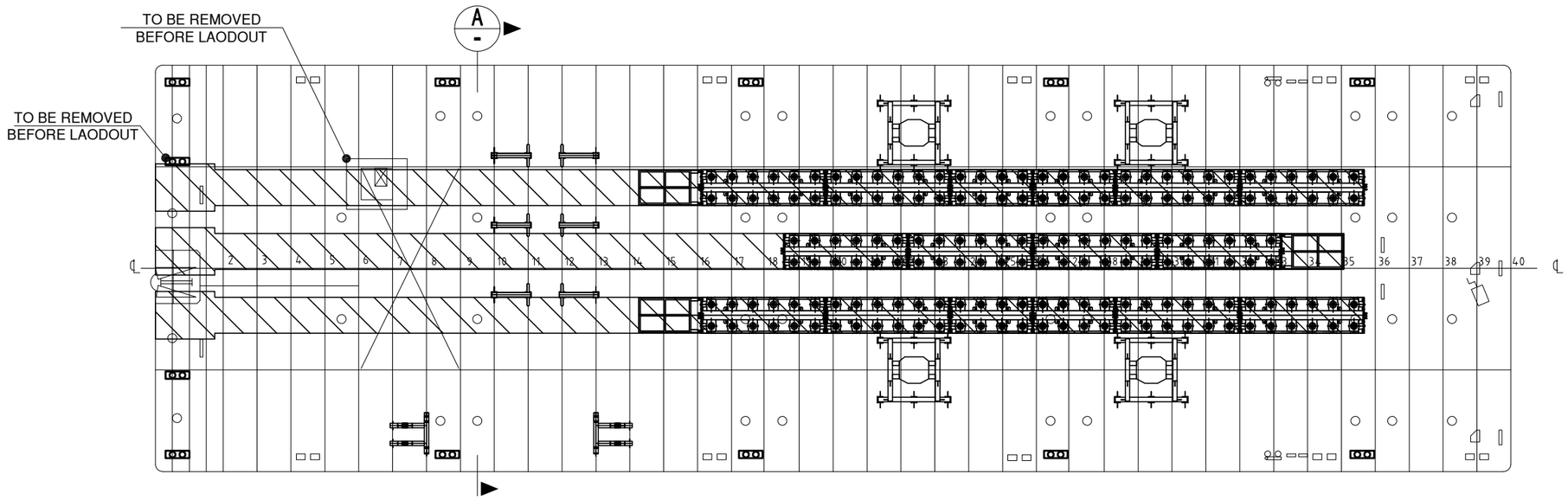
CROSSWIND

ROSETTI MARINO

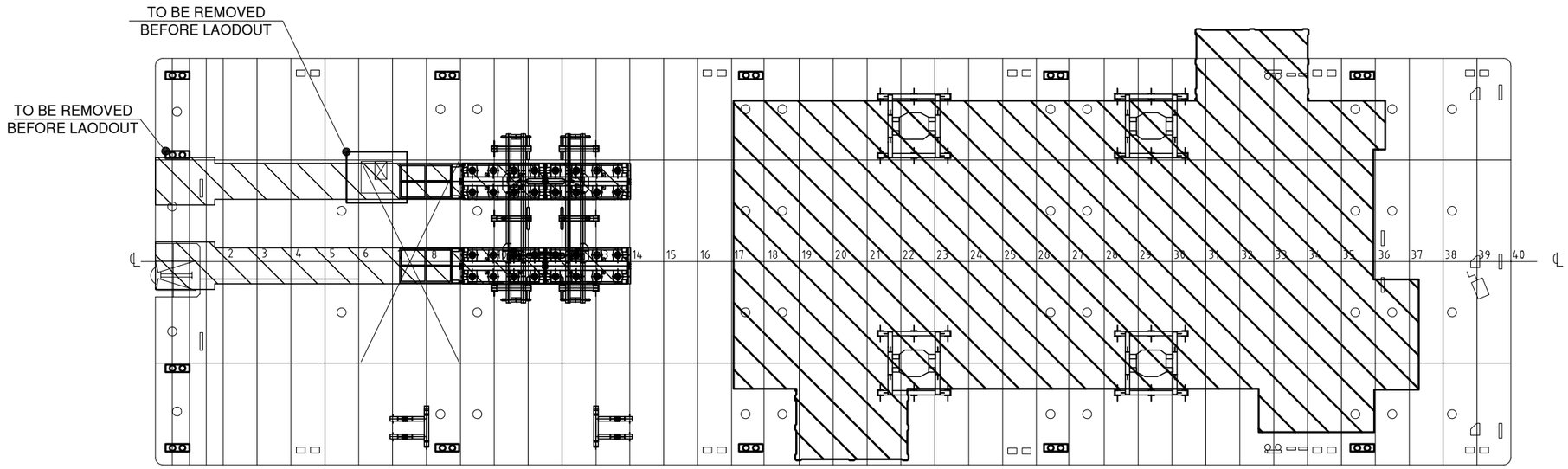
TITLE :
BASE LOAD POWER HUB (BLPH)
BRIDGE PLT & FENDERS
GENERAL ARRANGEMENT

CONTRACT NO./TITLE C#-I-WP4-2023-05/HOLLANDSE KUST NOORD WIND PARK			SCALE
DRAWN C.BENZONI	CHECKED F.CERONI	APPROVED C.ANTONELLINI	DATE 03/03/25

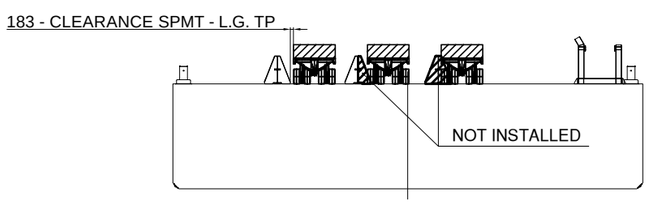
A1	DRAWING NO. 123A90-FDL-MT-DD-00407-00	SHEET 001	REV. 00



PLATFORM LOADOUT



TP LOADOUT



A
-
VIEW
TOPSIDE LOADOUT

NOTES

1 – ALL DIMENSIONS AND ELEVATIONS ARE IN MILLIMETERS U.N.O.

REFERENCE DRAWINGS

DWG No.	DESCRIPTION

TECON

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
00	03/03/25	CB	FC	CA	

CROSSWIND

ROSETTI MARINO

TITLE :
BASE LOAD POWER HUB (BLPH)
LOADOUT TOPSIDE & TP
SPMT PATH ON BARGE

CONTRACT NO./TITLE CW-I-RP4-2023-05/HOLLANDSE KUST NOORD WIND PARK | SCALE

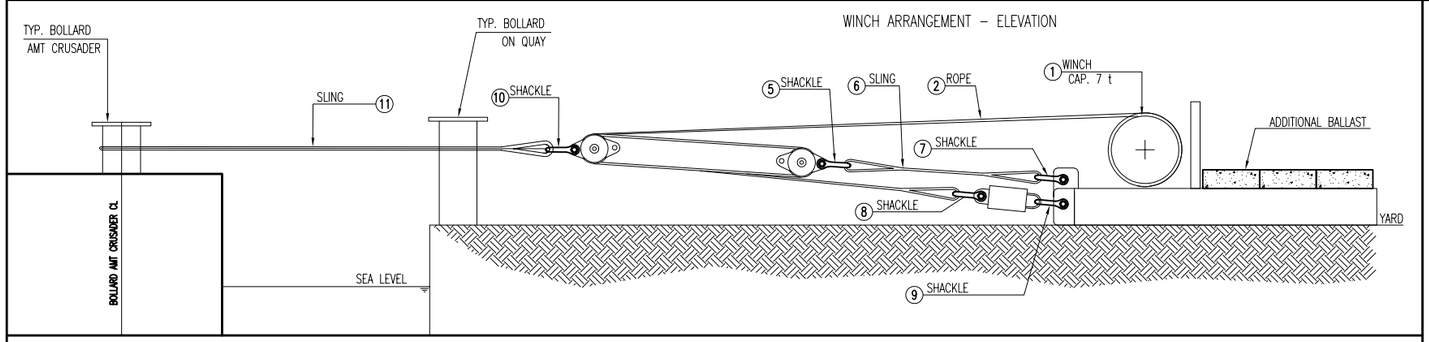
DRAWN C.BENZONI | CHECKED F.CERONI | APPROVED C.ANTONELLINI | DATE 03/03/25

A1	DRAWING NO. 123A90-FDL-MT-DD-00409-00	SHEET 001	REV. 00

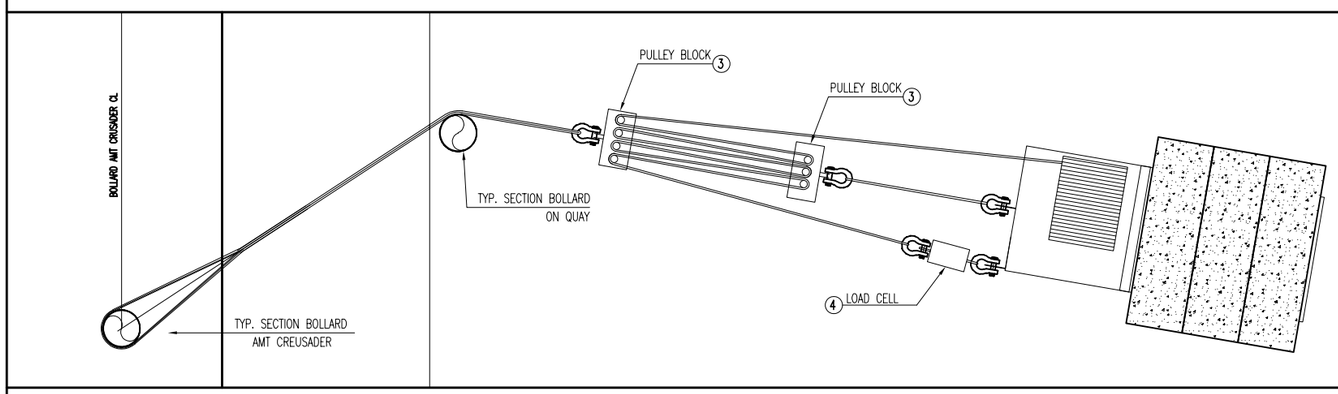
ATTACHMENT F – MOORING EQUIPMENTS

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WINCH TYP 1 ARRANGEMENT - ELEVATION



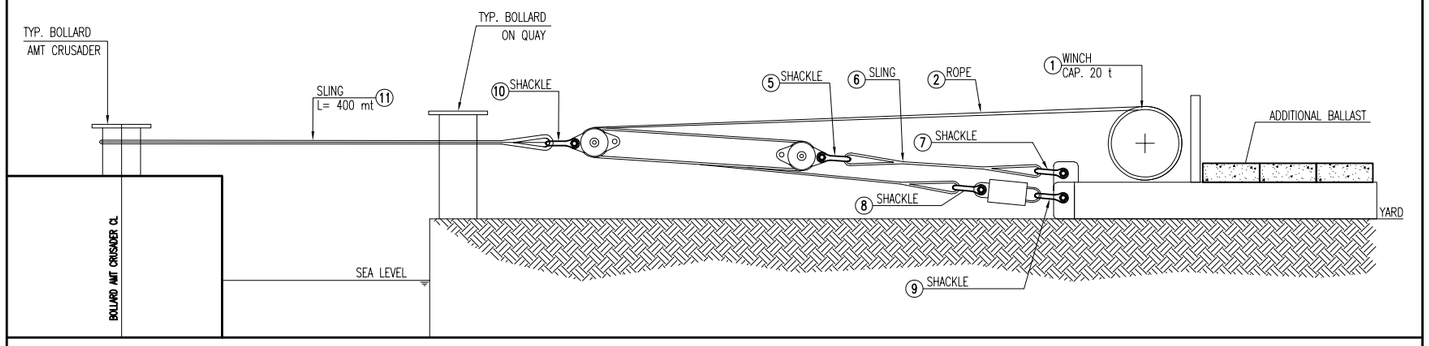
WINCH TYP 1 ARRANGEMENT - PLAN



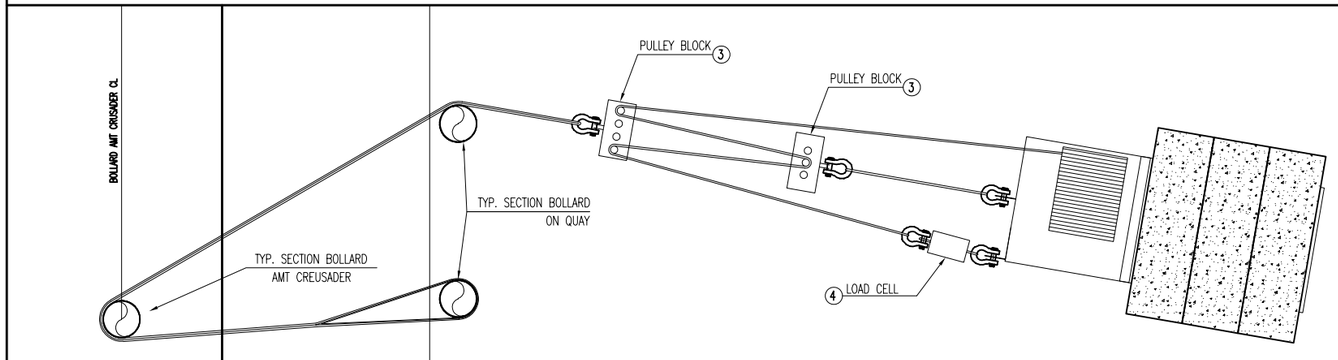
DETAILS

- **WINCH CAPACITY: 7 TON**
- **MIN ADDITIONAL BALLAST 45T FOR LOADOUT MOORING**
- **MIN. ADDITIONAL BALLAST 45T FOR POST LOADOUT MOORING**
- **TAKLE 8 REEVES ARRANGEMENT**

WINCH TYP 2 ARRANGEMENT - ELEVATION



WINCH TYP 2 ARRANGEMENT - PLAN



DETAILS

- **WINCH CAPACITY: 20 TON**
- **MIN ADDITIONAL BALLAST 60T FOR LOADOUT MOORING**
- **MIN. ADDITIONAL BALLAST 60T FOR POST LOADOUT MOORING**
- **TAKLE 4 REEVES ARRANGEMENT**

NOTES

1 – ALL DIMENSIONS AND ELEVATIONS ARE IN MILLIMETERS U.N.O.

REFERENCE DRAWINGS

DWG No.	DESCRIPTION

TECON

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
00	03/03/25	CB	FC	CA	

CROSSWIND

ROSETTI MARINO

TITLE :
BASE LOAD POWER HUB (BLPH)
WINCH TYP 1 & TYP 2
GENERAL ARRANGEMENT

CONTRACT NO./TITLE C#-1-WP4-2023-05/HOLLANDSE KUST NOORD WIND PARK . | SCALE

DRAWN C.BENZONI | CHECKED F.CERONI | APPROVED C.ANTONELLINI | DATE 03/03/25

A1 | DRAWING NO. 123A90-FDL-MT-DD-00408-00 | SHEET 001 | REV. 00

ROSETTI MARINO SpA VIA TRIESTE, 230 48100 RAVENNA - ITALY	WINCH	
DATA SHEET		Date: 06.09.2002

WINCH TYPE	7 tons
FABRICATOR	Rosetti Marino SpA
WINCH CAPACITY	7 tons
DESIGN CODE	CNR-UNI 10021-73 CNR-UNI 7670-84 circ. ENPI 08/06/77 prot. n. G-4049
ENGINE TYPE	tri-phase electrical asynchronous engine
ENGINE POWER	44/37 kW @ 1725/1430 rpm
CABLE TYPE	SFM+216, Ø 24 mm, MBL = 41,4 tons
CABLE LENGTH	200 m
CABLE HEIGHT	800 mm on bottom of skid
DRUM SPEED	14,4 rpm
PULLEY BLOCK	4 sheaves, 60 tons capacity
BASE FRAME	skidded on H-beams
OVERALL DIMENSIONS	2000 x 5400 mm
SELF-WEIGHT	7,0 tons
ADDITIONAL BALLAST	15 tons concrete blocks, as required

INDICE INDEX

DESCRIZIONE DEL DISPOSITIVO DEVICE DESCRIPTION pg.1

NORME DI CALCOLO RULES pg.1

CLASSIFICAZIONE DEL DISPOSITIVO DEVICE CLASSIFICATION pg.1

MATERIALI DEGLI ELEMENTI RESISTENTI DEVICE MATERIALS pg.1

CONDIZIONI DI CARICO LOAD CONDITIONS pg.1

ANALISI DEI CARICHI LOADS ANALYSIS pg.2

VERIFICA DEL TAMBURO DRUM VERIFICATION pg.2

VERIFICA DELL' ALBERO LENTO DRUM SHAFT VERIFICATION pg.3

FUNI ROPES pg.4

DESCRIZIONE DEL DISPOSITIVO DEVICE DESCRIPTION

Oggetto della presente relazione di calcolo e' l'argano di trascinamento di un verricello ad asse orizzontale della "portata" di 7000 Kg. L'argano e' costituito da un motore elettrico trifase asincrono della potenza di 44/37 Kw a 1725/1430 giri/min., un giunto di trasmissione prima dell'ingresso in un riduttore a ruotismi epicicloidali con rapporto di riduzione 1:120 ed una velocita' di rotazione del tamburo avvolgifune di 1725/120 = 14.4 giri/min. Il tamburo è montato a sbalzo sull' albero di uscita del riduttore. La fune, del tipo SFM + 216 formazione n.6 ad anima metallica, si puo' avvolgere sul tamburo in tre strati e presenta un capofisso sul tamburo e l' altro capofisso sulla struttura che costituisce il telaio dell' intero verricello dopo essere passata su una puleggia provvista di gancio per l' attacco del carico da trascinare. Lo schema di montaggio della fune e' tale da realizzare un tiro in seconda. Uno schema del dispositivo e' riportato alla pg.5
La struttura che costituisce il telaio dell' intero verricello non fa parte della presente relazione di calcolo.

NORME DI CALCOLO RULES

CNR-UNI 10021-73
CNR-UNI 7670-84
Circolare E.N.P.I. del 08/06/77 Prot. N. G-4049

CLASSIFICAZIONE DEL DISPOSITIVO DEVICE CLASSIFICATION

Condizione d'impiego: V1
Regime di carico: 2
Classe del meccanismo: 1mA

MATERIALI DEGLI ELEMENTI RESISTENTI DEVICE MATERIALS

Tamburo in Fe 52
Perni del tamburo in C40

CONDIZIONI DI CARICO LOAD CONDITIONS

Si eseguono le verifiche secondo le specifiche della Circolare E.N.P.I. del 08/06/77 Prot. N. G-4049.

1/

ANALISI DEI CARICHI LOADS ANALYSIS

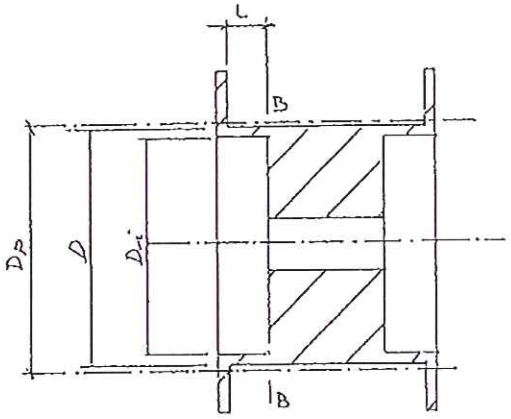
Tiro complessivo = P = 7000 Kg
Peso bozzello + Peso gancio + Peso fune = Non si scaricano come tiro aggiunto sulla fune

VERIFICA DEL TAMBURO DRUM VERIFICATION

Si ha una soluzione costruttiva del tipo illustrata alla figura successiva con le seguenti caratteristiche principali:
Diametro fondogola = D = 655 mm
Diametro primitivo = Dp = 679 mm
Diametro interno = Di = 605 mm (si veda la soluz. costrut.)
Distanza tra i supporti = L = 145 mm (elemento a sbalzo)
Spessore del tamburo = (D - Di)/2 = 25 mm
Passo funi = p = 26 mm

Sollecitazioni ammissibili

A resistenza = σamm = 1736 Kg/cm²
A fatica per compressione = σc = 877 Kg/cm²
A fatica per flessione = σf = 1189 Kg/cm²



Azione T1 = 3500 Kg
Azione equivalente (effetto di piu' strati di fune) = 1.6*3500 = = 5600 Kg

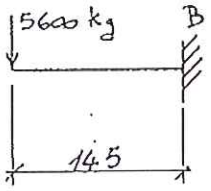
Sezione A-A

La zona centrale del tamburo avvolgifune, data la soluzione costruttiva , risulta meno sollecitata della zona di estremità (si veda figura relativa). Pertanto si procede alla sola verifica di detta sezione.

Sezione B-B

tensione di compressione = σc = 0.8*5600/(2.6*2.5) = 689 Kg/cm²
tensione di flessione locale = σfl = 0.96*5600/(√65.5*2.5^3 = 168 Kg/cm²
tensione di flessione globale = σfg = Mf/W = 81200/7507.5 = 11 Kg/cm²

Mf = T1e*14.5 = 5600*14.5 = 81200 Kg*cm
W = 3.14 * (65.5^4 - 60.5^4)/(32*65.5) = 7507.5 cm^3



Verifica di resistenza

Sez. A-A

Vedere considerazioni precedenti.

Sez. B-B

σ eq = $\sqrt{689^2 + (168 + 11)^2 + 689*(168 + 11)}$ = 794 Kg/cm^2 $\leq$ σamm

Verifica di fatica

Sez. A-A

Vedere considerazioni precedenti.

Sez. B-B

$(689/877)^2 + ((168 + 11)/1189)^2 = 0.64 < 1$

VERIFICA DELL' ALBERO LENTO DRUM SHAFT VERIFICATION

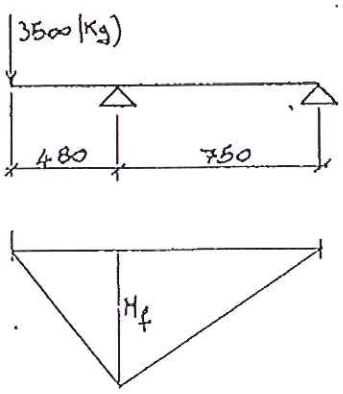
A resistenza = σamm = 2900 Kg/cm^2
τamm = 2900/$\sqrt{3}$ = 1674 Kg/cm^2
A fatica (ciclo alterno simmetrico) = σamm = 3150/(2.35*1.75*1.16) =
= 660 Kg/cm^2
τamm = 660/$\sqrt{3}$ = 381 Kg/cm^2

Il perno ha dimensione di 155 mm
A = Π*15.5^2/4 = 188.7 cm^2
W = Π*15.5^3/32 = 365.6 cm^3
Jp = Π*7.75^4/2 = 5666.7 cm^4

Mt = 3500*(65.5/2 + 2*2.4 +.2.4/2) = 135625 Kg*cm

Punto C (vedere figura)

La condizione di carico è più gravosa quando la fune si trova spostata lateralmente. Risulta:



Mf = 168000 Kg*cm
T = 3500 Kg
σf = 168000/365.6 = 460 Kg/cm²
τMt = 135625*7.75/5666.7 = 185 Kg/cm²
τT = 5.55*3500/(Π*15.5²) = 26 Kg/cm²

Verifica di resistenza

$\sigma eq = \sqrt{460^2 + 3*(185 + 26)^2} = 588$ Kg/cm² ≤ σamm

Verifica di fatica

$(460/660)^2 + ((185 + 26)/1674)^2 = 0.5 < 1$

FUNI . ROPES

Tipo = SFM + 216 formazione n.6 ad anima metallica
σR = 180 Kg/mm²
Carico effettivo di rottura = 42000 Kg

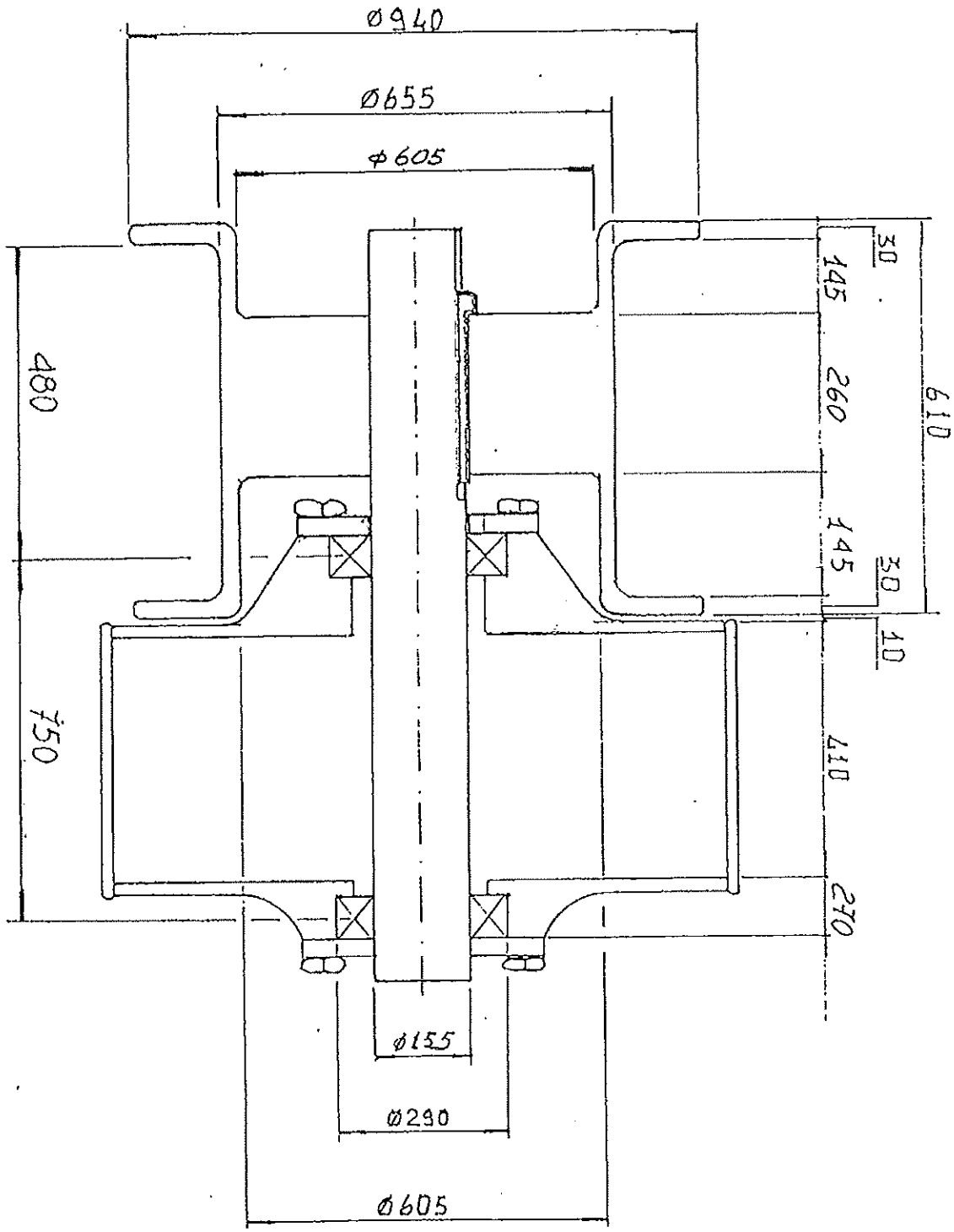
Diametro fune = Df = 24 mm
Diametro max filo = df = 1.33 mm
Diametro primitivo pul. rinvio = Dr = 540 mm

Dp/Df = 655/24 = 27 > 25

Dp/df = 655/1.33 = 492 > 300

Dr/Df = 540/24 = 22.5 > 20

Dr/df = 540/1.33 = 406 > 250


Ø940
Ø655
φ605
480
750
30
145
260
145
30
610
10
410
270
ø155
Ø290
Ø605

aeriver
Società Italiana Derivati Vergelle
80058 Torre Annunziata - Via Terracena, 12
Telegrafo: Deriver - Telex: 710142 Deriver
(081) 8612522 - 5 Linee
Partita IVA N. 00275300630
Reg. Soc. Tribunale Napoli 965/1964
gruppo finsider
Uffici di Vendita:
20122 Milano - Via F. Sforza, 2
780061/2/3/4 - Telex: 312312 Derivcom
80133 Napoli - Via Cervantes, 55
(081) 321216 - Telex 721080 Deriver

CERTIFICATO DI COLLAUDO N. 224/H

LOTTO DI FABBRICAZIONE N. 1230

COPIA CONFORME ALL'ORIGINALE

Si certifica che la fune d'acciaio tucido, le cui caratteristiche sono qui di seguito indicate, è stata fabbricata in conformità ai requisiti stabiliti dal nostro catalogo e in accordo con la norma

Essa è stata collaudata sec. norma UNI 3447

I fili sono stati fabbricati e collaudati sec. norme UNI 1324/FA

CARATTERISTICHE

Tipo di fune SFM+216

Formazione: n. 6

Tipo di anima: metallica/~~tessile~~

Diametro nominale della fune mm. 24

Diametro effettivo della fune mm. 24,5

Massa nominale per metro lineare 2,36 Kg/mt.

Sezione metallica nominale: mmq. 27,6

Resistenza minima dei fili: Kg/mmq. 180 daN/mmq.

Tipo e senso di avvolgimento: S/Z

Preformata / ~~non preformata~~ SI

Zincatura:

Carico di rottura minimo garantito: Kg. 41.400 daN

Carico effettivo di rottura: Kg. 42.000 daN

IL COLLAUDATORE

PER COPIA CONFORME

Torre Annunziata, li

Certificato di Collaudo Sec. D.P.R. 673 del 21/7/1982 pubblicato sulla Gazzetta Ufficiale della Repubblica n. 263 del 23/9/1982

Cod. 32899231

Mod. QUA/0022

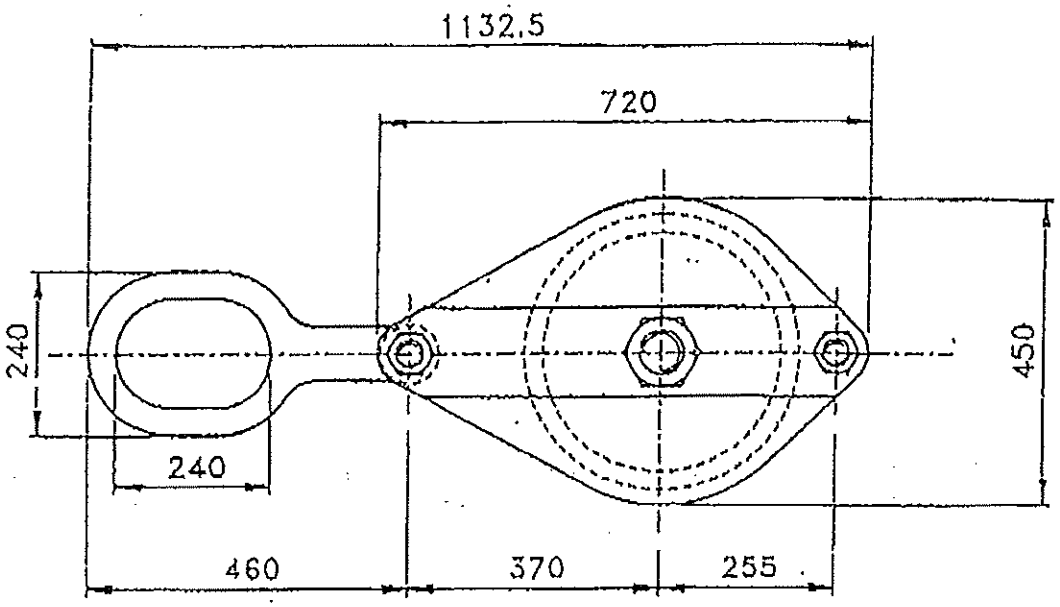
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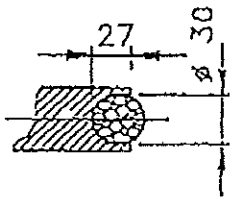
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Data

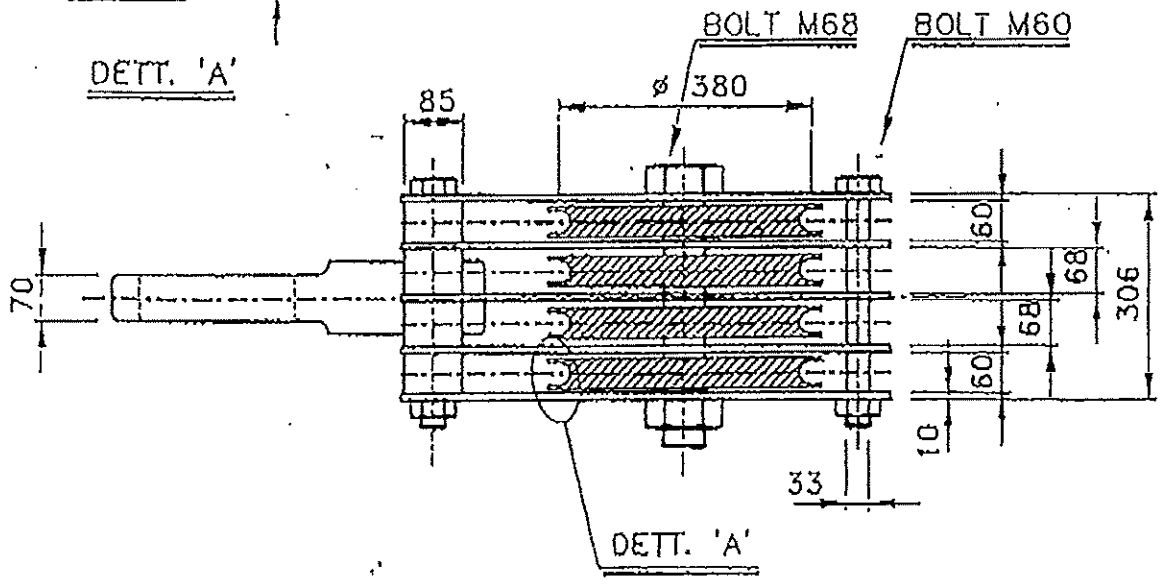
Firma

ENTE DI SPEDIZIONE





DETT. 'A'



NOTA: DISPONIBILITA N°10 TAGLIE

TIRO DI PROVA 60 T. CERT. RINA/ITALNET 3427/95

ROSETTI MARINO S.p.A. RAVENNA ITALY

DESCRIZIONE / DESCRIPTION	DIS. N° / DWG Nr	FOGLIO SHEET	DI OF
TAGLIA A 4 GOLE PER FUNE ø28/30	79005/194	1	1

mi sento sollevato.

Verbale di Esecuzione Lavori

CLIENTE ROSETTI MARINO SPA

RIF. INT. Intervento 2021/2720 **TIPOLOGIA** MRT Controllo magneto-induttivo su funi

CANTIERE YARD PIOMBONI VIA DEL MARCHESATO, 37 - 48122 - MARINA DI RAVENNA (RA)

MACCHINA Argano fisso zavorrato Brissonneau&Lotz Marine Verricello 7t matricola: I02920049 cod. cliente: Ver. N.1 - I 1986 001/2

Data esecuzione lavori **12/05/2021**

Delegato dal Cliente (nome e cognome) **Maurizio Di Bitonto**

DICHIARAZIONE DI CORRETTA ESECUZIONE

Eseguito controllo magneto-induttivo (MRT) sulla fune di ormeggio (diametro nominale 24 mm).

LAVORAZIONE ESEGUITA

Da Preventivo

NOTE

Al presente verbale seguirà invio della documentazione tecnica relativa ai controlli CND eseguiti con metodo MRT-MIT secondo i criteri di accettabilità/scarto indicati nella normativa internazionale numero ISO 4309:2017 e nella normativa nazionale in vigore numero UNI ISO 4309:2019.

CONCLUSIONI

Si dichiara la corretta esecuzione di quanto riportato nel presente verbale.

Firma preposto Imola Gru

Cristian Zuccherini

Il referente, delegato dal cliente a prendere in consegna la macchina, presa visione del presente verbale, a conferma delle dichiarazioni rese, dei lavori eseguiti e delle indicazioni di cui sopra, riceve in consegna la macchina e copia del presente verbale, da utilizzare per la compilazione del registro di controllo e per gli adempimenti di legge.

Firma del delegato dal cliente

in data: 14-05-2021

Maurizio Di Bitonto

mi sento sollevato.

Verbale di Esecuzione Lavori

CLIENTE ROSETTI MARINO SPA

RIF. INT. Intervento 2021/2727 **TIPOLOGIA** MRT Controllo magneto-induttivo su funi

CANTIERE YARD PIOMBONI VIA DEL MARCHESATO, 37 - 48122 - MARINA DI RAVENNA (RA)

MACCHINA Argano fisso zavorrato Brissonneau&Lotz Marine Verricello 7t matricola: I02920050 cod. cliente: Ver. N.2 - I 1986 002/2

Data esecuzione lavori **12/05/2021**

Delegato dal Cliente (nome e cognome) **Fabrizio Di Bitonto**

DICHIARAZIONE DI CORRETTA ESECUZIONE

Eseguito controllo magneto-induttivo (MRT) sulla fune di ormeggio (diametro nominale 24 mm).

LAVORAZIONE ESEGUITA

Da Preventivo

NOTE

Al presente verbale seguirà invio della documentazione tecnica relativa ai controlli CND eseguiti con metodo MRT-MIT secondo i criteri di accettabilità/scarto indicati nella normativa internazionale numero ISO 4309:2017 e nella normativa nazionale in vigore numero UNI ISO 4309:2019.

CONCLUSIONI

Si dichiara la corretta esecuzione di quanto riportato nel presente verbale.

Firma preposto Imola Gru

Cristian Zuccherini

Il referente, delegato dal cliente a prendere in consegna la macchina, presa visione del presente verbale, a conferma delle dichiarazioni rese, dei lavori eseguiti e delle indicazioni di cui sopra, riceve in consegna la macchina e copia del presente verbale, da utilizzare per la compilazione del registro di controllo e per gli adempimenti di legge.

Firma del delegato dal cliente

in data: 14-05-2021

Fabrizio Di Bitonto

mi sento sollevato.

Verbale di Esecuzione Lavori

CLIENTE ROSETTI MARINO SPA

RIF. INT. Intervento 2021/2729 **TIPOLOGIA** MRT Controllo magneto-induttivo su funi

CANTIERE YARD PIOMBONI VIA DEL MARCHESATO, 37 - 48122 - MARINA DI RAVENNA (RA)

MACCHINA Argano fisso zavorrato Brissonneau&Lotz Marine Verricello 7t matricola: I02920051 cod. cliente: Ver. N.3 - I 1986 003/2

Data esecuzione lavori **12/05/2021**

Delegato dal Cliente (nome e cognome) **Fabrizio Di Bitonto**

DICHIARAZIONE DI CORRETTA ESECUZIONE

Eseguito controllo magneto-induttivo (MRT) sulla fune di ormeggio (diametro nominale 24 mm).

LAVORAZIONE ESEGUITA

Da Preventivo

NOTE

Al presente verbale seguirà invio della documentazione tecnica relativa ai controlli CND eseguiti con metodo MRT-MIT secondo i criteri di accettabilità/scarto indicati nella normativa internazionale numero ISO 4309:2017 e nella normativa nazionale in vigore numero UNI ISO 4309:2019.

CONCLUSIONI

Si dichiara la corretta esecuzione di quanto riportato nel presente verbale.

Firma preposto Imola Gru

Cristian Zuccherini

Il referente, delegato dal cliente a prendere in consegna la macchina, presa visione del presente verbale, a conferma delle dichiarazioni rese, dei lavori eseguiti e delle indicazioni di cui sopra, riceve in consegna la macchina e copia del presente verbale, da utilizzare per la compilazione del registro di controllo e per gli adempimenti di legge.

Firma del delegato dal cliente

in data: 14-05-2021

Fabrizio Di Bitonto

mi sento sollevato.

Verbale di Esecuzione Lavori

CLIENTE ROSETTI MARINO SPA

RIF. INT. Intervento 2021/2730 **TIPOLOGIA** MRT Controllo magneto-induttivo su funi

CANTIERE YARD PIOMBONI VIA DEL MARCHESATO, 37 - 48122 - MARINA DI RAVENNA (RA)

MACCHINA Argano fisso zavorrato Brissonneau&Lotz Marine Verricello 7t matricola: I02920052 cod. cliente: Ver. N.4 - I 1986 004/2

Data esecuzione lavori **12/05/2021**

Delegato dal Cliente (nome e cognome) **Fabrizio Di Bitonto**

DICHIARAZIONE DI CORRETTA ESECUZIONE

Eseguito controllo magneto-induttivo (MRT) sulla fune di ormeggio (diametro nominale 24 mm).

LAVORAZIONE ESEGUITA

Da Preventivo

NOTE

Al presente verbale seguirà invio della documentazione tecnica relativa ai controlli CND eseguiti con metodo MRT-MIT secondo i criteri di accettabilità/scarto indicati nella normativa internazionale numero ISO 4309:2017 e nella normativa nazionale in vigore numero UNI ISO 4309:2019.

CONCLUSIONI

Si dichiara la corretta esecuzione di quanto riportato nel presente verbale.

Firma preposto Imola Gru

Cristian Zuccherini

Il referente, delegato dal cliente a prendere in consegna la macchina, presa visione del presente verbale, a conferma delle dichiarazioni rese, dei lavori eseguiti e delle indicazioni di cui sopra, riceve in consegna la macchina e copia del presente verbale, da utilizzare per la compilazione del registro di controllo e per gli adempimenti di legge.

Firma del delegato dal cliente

in data: 14-05-2021

Fabrizio Di Bitonto

mi sento sollevato.

Verbale di Esecuzione Lavori

CLIENTE ROSETTI MARINO SPA

RIF. INT. Intervento 2021/2731 **TIPOLOGIA** MRT Controllo magneto-induttivo su funi

CANTIERE YARD PIOMBONI VIA DEL MARCHESATO, 37 - 48122 - MARINA DI RAVENNA (RA)

MACCHINA Argano fisso zavorrato Brissonneau&Lotz Marine Verricello 7t matricola: I02920053 cod. cliente: Ver. N.5 - I 1986 005/2

Data esecuzione lavori **12/05/2021**

Delegato dal Cliente (nome e cognome) **Fabrizio Di Bitonto**

DICHIARAZIONE DI CORRETTA ESECUZIONE

Eseguito controllo magneto-induttivo (MRT) sulla fune di ormeggio (diametro nominale 24 mm).

LAVORAZIONE ESEGUITA

Da Preventivo

NOTE

Al presente verbale seguirà invio della documentazione tecnica relativa ai controlli CND eseguiti con metodo MRT-MIT secondo i criteri di accettabilità/scarto indicati nella normativa internazionale numero ISO 4309:2017 e nella normativa nazionale in vigore numero UNI ISO 4309:2019.

CONCLUSIONI

Si dichiara la corretta esecuzione di quanto riportato nel presente verbale.

Firma preposto Imola Gru

Cristian Zuccherini

Il referente, delegato dal cliente a prendere in consegna la macchina, presa visione del presente verbale, a conferma delle dichiarazioni rese, dei lavori eseguiti e delle indicazioni di cui sopra, riceve in consegna la macchina e copia del presente verbale, da utilizzare per la compilazione del registro di controllo e per gli adempimenti di legge.

Firma del delegato dal cliente

in data: 14-05-2021

Fabrizio Di Bitonto

Marine & Offshore

Certificate number: 00005RAV21

The continuation sheet(s) form(s) part of the attestation.

www veristar com

CERTIFICATE
FOR
WINCH

Applicant : Rosetti Marino SPA (Ravenna - ITA)

Product description : **Winch WWL:7 ton**
Quantity : 5 pcs

Particulars of products as declared by the applicant :

Supplier	: Rosetti Marino SPA (Ravenna - ITA)
Type or Model	: 5 off- Winches WWL: 7 ton
Declared as intended for	: Jacket S34 (119B20)
Winch Identification	: item 1-60511484868
	: item 2-60511484870
	: item 3- 60511485058
	: item 4-60511484869
	: item 5-60511484871
Maximum Pull Load	: 7.7 ton for each Drum
Maximum Drum Brake Test load	: 10.5 ton

Technical specifications : UM_10292049_IT_R00_manuale 7 t
Rosetti dwg. 7WCH-MT-DD-001 rev.00

Scope of intervention : See continuation sheet(s)

Enclosures / Remarks : Manufacturer data book filed in VPM.
See continuation sheet.

This certificate attests that the products tests / checks described in the continuation sheet(s) were carried out under the attendance / by Bureau Veritas Marine & Offshore with no remark in view of the relevant part of the above referenced technical specifications as declared by the applicant.

Marking : N.A.
Last attendance date : 10 May 2021
Surveyor : Ivano Felice Maurizio DEL GAUDIO

Issuance date : 19 May 2021
Office : BV VENEZIA



This certificate is issued within the scope of the General Conditions of Bureau Veritas Marine & Offshore available on the internet site www veristar com. Any person not a party to the contract pursuant to which this document is delivered may not assert a claim against Bureau Veritas Marine & Offshore for any liability arising out of errors or omissions which may be contained in said document, or for errors of judgment, fault or negligence committed by personnel of the Society or of its Agents in establishment or issuance of this document, and in connection with any activities for which it may provide.

Continuation sheet of Certificate N°: 00005RAV21

The continuation sheet(s) form(s) part of the certificate.

SCOPE OF INTERVENTION

Scope of Inspection:

-Check test preparation as indicated on Rosetti Pulling and Braking Test Schemes.

- Witness of pulling and brake testing.

-Visual examination of winches before and after the load testing.

Results:

1) ***Test sequence:***

- ***Step 1- Preliminary and set-up check.***
- ***Step 2-Dynamic test of winches /drum and brake).***
- ***Step 3-Pulling test of Drums (110% WWL): satisfactory after 10 seconds holding time.***
- ***Step 4-Brake test of Drums (150% WWL): satisfactory after 10 seconds holding time.***
- ***Step 5 –Visual Check of final condition after load test: satisfactory.***

2) ***Review of Magnetic Inductive control for existent wire ropes No.(2021/2720-2021/2727-2021/2729-2021/2730-2021/2731).***

3) ***Review of test report No. 2021 CS 01 1664 (proof load test of Snatch blocks and breaking load test of existent wire ropes).***

4) ***Review of load cell calibration certificate No.3544/21.***

Conclusion:

No reportable defects or deformations could be observed.

Winches found in compliance with client requirements.

Bureau Veritas Surveyor: Mr. Ivano Del Gaudio

Bureau Veritas ITALY

MOORING ROPES
WINCH 7 TON
(4 pcs L=100m)

SIRTEF s.r.l.

20080 Calvignasco (MI) - Zona Industriale
Via dei Lavoratori, 1
Tel. 02.90.05.92.73 (6 linee ric. aut.) - Telefax 02.90.05.92.58
Cap.Soc. € 119.000,00 i.v. - Sede Legale Calvignasco
Reg. Impr. Trib. Milano n. 05942780965
C.C.I.A.A. Milano n. 1860385- Cod. Fisc. e Part. IVA 05942780965

Filiale di Roma: Via Libero Leonardi, 4 - 00173 ROMA - Tel. 06266098 - Fax. 062677606
Filiale di Udine: Via G. D'Annunzio, 9/8 - Loc. Crosada - 33050 S.Maria La Longa (UD)
Tel. 0432.685022 - Fax. 0432685033
Sito Web: www.sirtef.it

Spett.
ROSETTI MARINO S.p.A.

Via Trieste, 230
48100 RAVENNA (RA)

Calvignasco, 06/03/2020

Documento di trasporto Num. / Document Num. 650/BM

Ordine Num. / Purchase Order Num. 1720000617

DICHIARAZIONE CE DI CONFORMITA' / CE DECLARATION OF CONFORMITY Num. 1.638/1

In accordo alla direttiva macchine 2006/42/CE Allegato II punto A / According to machinery directive 2006/42/CE Enclosure II part A

OGGETTO / SUBJECT	FUNE POLYPROPILENE 8 LIGNOLI D.60 mm.
QUANTITA' / QUANTITY	MT 400,0000
MATERIALE CORPO / BODY MATERIAL	
MATERIALE PERNO / PIN MATERIAL	
MATERIALE / MATERIAL	POLYDACRON 2
DIAMETRO PERNO / PIN DIAMETER	mm.
APERTURA / OPENING	mm.
LUNGHEZZA /LENGTH	mm. 100.000,0000
CARICO DI LAVORO / SAFE WORKING LOAD	t. 8,9700
CARICO DI PROVA / PROOF LOAD TEST	
COEFFICIENTE DI SICUREZZA / SAFETY FACTOR	7,0000
CARICO DI ROTTURA MINIMO / MINIMUM BREAKING LOAD	t. 78,5000
MARCATURA / MARKING	
NORMA RIFERIMENTO / STANDARD	
PRODUTTORE / MANUFACTURER	
NOTE / REMARKS	FUNE POLYDACRON 2nd 8 STRANDS ROPE D.60 MM. - MBL 78,5t CON GASSE ALLE ESTREMITA'/SOFT EYES AT BOTH ENDS 4 bobine L=100 mt./cad. / 4 reels L=100 mtrs./each

Si dichiara che il materiale descritto risponde ed e' conforme alla vigente Direttiva Comunitaria Macchine 2006/42/CE. Si segnala inoltre che non ne è consentito un utilizzo diverso da quello indicato nelle istruzioni di assemblaggio ed utilizzo consultabili al sito internet www.sirtef.it . Il fascicolo tecnico è disponibile presso la nostra sede.

We declare under our sole responsibility that the product to which this declaration relates is in conformity with the regulation of 2006/42/CE. It is a precondition to put it into service that the instructions for use has been read and understood. Instructions for use available on our site www.sirtef.it for your convenience. The relevant technical documentation is available upon request.

SIRTEF s.r.l.
General Manager
Dott. M. Martucci

SHACKLES

italmet

CERTIFICATO DI CONFORMITÀ DIRETTIVA 2006/42/CE
CERTIFICATE OF CONFORMITY TO DIRECTIVE 2006/42/CE

No. 107/2011

Cliente / *Custumer:*	ROSETTI MARINO SPA - RAVENNA
Ordine No./*Order no.:*	RE NS. DDT N. 802 DEL 30/03/2011
	Caratteristiche *Characteristics*
Codice Materiale / Code:	GODSWL9.5
Tipo: *Type:*	Grillo ad omega in acciaio ad E.R. perno passante dado e coppiglia wll 9.5 ton Safety bow pin shackle, wll 9.5 ton
Quantità / quantity:	10 pezzi / pieces
Materiale: *Material:*	Acciaio alta resistenza, temperato e rinvenuto *High tensile steel, quenched and tempered*
Finitura: *Finished:*	Staffa: zincata Perno: verniciato *Body: galvanized Pin: painted rustproof*
Norme di riferimento: *Standard:*	EN 13889 and meets performance requirement of US. FED. SPEC. RR-C-271

Analisi chimica*
Chemical analisys

	C	Mn	Si	P	S	Cr	Ni
Staffa *Body*	0.45	0.6	0.23	0.019	0.019	0.07	0.06
Perno *Pin*	0.40	0.59	0.3	0.019	0.01	0.93	0.05

Caratteristiche meccaniche*
Mecanichal Characteristics

	Snervamento *Yeld point*	**Resistenza** *Tensile*	**Allungamento** *Elongation*	**Strizione** *Shrinkage*
Staffa *Body*	490 N/mmq	742 N/mmq	22%	43%
Perno *Pin*	1010 N/mmq	1120 N/mmq	14%	55%

***valori medi**

Test di rottura/*Braking load test*

Misura *Size*	1.1/8"	**Minimo carico di rottura** *Minimum breaking load*	47,5 Ton	**CMU**** *WLL***	9.5 Ton
Marcatura di identificazione *Id remaks*	1.1/8 " WLL 9.5 T CE			**Lotto:** *Lote:*	ti4
Prove di collaudo/Carried *out test*	esame visivo				*visual test*

** **in tiro verticale/***in line pul*

DICHIARAZIONE "CE" DI CONFORMITÀ: Il costruttore Italmet S.r.l., Via delle Industrie, 81 – Ravenna ai sensi della Direttiva 2006/42/CE, dichiara che l'accessorio di sollevamento descritto nel campo "Descrizione" è conforme ai punti 4.1.1 – 4.1.2.3 – 4.1.2.4 – 4.1.2.5 – 4.3 – 4.4 dell'Allegato I.
Il marchio "CE" è posto sull'accessorio. Il fascicolo tecnico è a disposizione presso la sede operativa (Allegato VII).
L'accessorio è esclusivamente idoneo per essere montato su una attrezzatura di sollevamento in accordo alla Direttiva Macchine 2006/42/CE.
Persona autorizzata a costituire la documentazione tecnica: Gianni Rigoni c/o Italmet S.r.l.
According to the Enclosure I (points 4.1.1 – 4.1.2.3 – 4.1.2.4 – 4.1.2.5 4.3 – 4.4) of the Commission of The European Communities 2006/42/CE.

italmet
Legale Rappresentante / Mandatario

DISTINTA CELLE ADOS PER TARATURA

Item Description	Model	Serial Number	Taratura	Position	Card N°
CELLE DI CARICO A TRAZIONE & DISPLAY	TCC 10 -	S/N 2011**2690** + 2011**1702**	**Tiro in 6°**	Verr. N. 4	C1/059
CELLE DI CARICO A TRAZIONE & DISPLAY	TCC 10	S/N 2011**2691** + 2011**1703**	**Tiro in 8°**	Verr. N. 3	C1/060
CELLE DI CARICO A TRAZIONE & DISPLAY	TCC 10	S/N 2011**2692** + 2011**1704**	**Tiro in 8°**	Verr. N. 2	C1/061
CELLE DI CARICO A TRAZIONE & DISPLAY	TCC 10	S/N 2011**2693** + 2011**1705**	**Tiro in 8°**	Verr. N. 5	C1/062
CELLE DI CARICO A TRAZIONE & DISPLAY	TCC 10	S/N 2011**2694** + 2011**1706**	**Tiro in 8°**	Verr. N. 1	C1/063
CELLE DI CARICO A TRAZIONE & DISPLAY	TCC 25T	S/N 2011**2703** + 2011**1238**	**Tiro in 4°**		C1/064
CELLE DI CARICO A TRAZIONE & DISPLAY	TCC 25T	S/N 2011**2704** + 2011**1239**	**Tiro in 4°**		C1/065

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PRECISION EXISTS

1970-2020 FIFTY YEARS OF PRECISION

CURVA DI TARATURA
Calibration curve

RMA N°	2021044
CLIENTE / Customer	ROSETTI MARINO
CELLA / Load cell mod.	TCC 25
N.° SERIE / Serial number	20112704
STRUMENTO / Instrument mod.	A100E2
N.° SERIE / Serial number	20111239
BANCO DI PROVA CAMPIONE / Reference Testing machine	GPR 06

carico load Kg	lettura indication Kg	curva teorica reference Kg	errore error Kg	errore error %FS
0	0	0	0	0,00
5000	20000	20000	0	0,00
10000	39950	40000	-50	-0,05
15000	59900	60000	-100	-0,10
20000	79950	80000	-50	-0,05
25000	100000	100000	0	0,00
0	0	0	0	0,00

NOTE / Notes:

DATA/date : 27/04/21 TECNICO / operator: File:Cer-TCC-RMA2021044

LA CATENA DI RIFERIBILITA' METROLOGICA HA INIZIO DA CAMPIONI CERTIFICATI PRESSO CENTRI LAT
The traceability chain begin from first line standards certify by calibration service

Ados s.r.l. | Via Lazio, 25 | 20090 Buccinasco (MI) Italy | T. +39 02.45700120 | F. +39 02.48840833
P.IVA 01070150154 | Cap. Soc. € 36.400,00 I.V. | R.E.A. Milano 851258 | codice SDI: SUBM70N
info@ados.it | **www.ados.it**

ados
PRECISION EXISTS

1970-2020 FIFTY YEARS OF PRECISION

CURVA DI TARATURA
Calibration curve

RMA N°	2021044
CLIENTE / Customer	ROSETTI MARINO
CELLA / Load cell mod.	TCC 25
N.° SERIE / Serial number	20112703
STRUMENTO / Instrument mod.	A100E2
N.° SERIE / Serial number	20111238
BANCO DI PROVA CAMPIONE / Reference Testing machine	GPR 06

carico load Kg	lettura indication Kg	curva teorica reference Kg	errore error Kg	errore error %FS
0	0	0	0	0,00
5000	20000	20000	0	0,00
10000	39950	40000	-50	-0,05
15000	59900	60000	-100	-0,10
20000	79950	80000	-50	-0,05
25000	100000	100000	0	0,00
0	0	0	0	0,00

NOTE / Notes:

DATA/date : 27/04/21 TECNICO / operator: File:Cer-TCC-RMA2021044

LA CATENA DI RIFERIBILITA' METROLOGICA HA INIZIO DA CAMPIONI CERTIFICATI PRESSO CENTRI LAT
The traceability chain begin from first line standards certify by calibration service

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PRECISION EXISTS

1970-2020 FIFTY YEARS OF PRECISION

CURVA DI TARATURA
Calibration curve

RMA N°	2021044
CLIENTE / Customer	ROSETTI MARINO
CELLA / Load cell mod.	TCC 10
N.° SERIE / Serial number	20112690
STRUMENTO / Instrument mod.	A100E2
N.° SERIE / Serial number	20111702
BANCO DI PROVA CAMPIONE / Reference Testing machine	GPR 06

carico load Kg	lettura indication Kg	curva teorica reference Kg	errore error Kg	errore error %FS
0	0	0	0	0,00
2000	12000	12000	0	0,00
4000	23950	24000	-50	-0,08
6000	35950	36000	-50	-0,08
8000	47950	48000	-50	-0,08
10000	60000	60000	0	0,00
0	0	0	0	0,00

NOTE / Notes:

DATA/date : 27/04/21 TECNICO / operator: File:Cer-TCC-RMA2021044

LA CATENA DI RIFERIBILITA' METROLOGICA HA INIZIO DA CAMPIONI CERTIFICATI PRESSO CENTRI LAT
The traceability chain begin from first line standards certify by calibration service

Ados s.r.l. | Via Lazio, 25 | 20090 Buccinasco (MI) Italy | T. +39 02.45700120 | F. +39 02.48840833
P.IVA 01070150154 | Cap. Soc. € 36.400,00 I.V. | R.E.A. Milano 851258 | codice SDI: SUBM70N
info@ados.it | **www.ados.it**

ados
PRECISION EXISTS

1970-2020 FIFTY YEARS OF PRECISION

CURVA DI TARATURA
Calibration curve

RMA N°	2021044
CLIENTE / Customer	ROSETTI MARINO
CELLA / Load cell mod.	TCC 10
N.° SERIE / Serial number	20112694
STRUMENTO / Instrument mod.	A100E2
N.° SERIE / Serial number	20111706
BANCO DI PROVA CAMPIONE / Reference Testing machine	GPR 06

carico load Kg	lettura indication Kg	curva teorica reference Kg	errore error Kg	errore error %FS
0	0	0	0	0,00
2000	15950	16000	-50	-0,06
4000	31900	32000	-100	-0,13
6000	47900	48000	-100	-0,13
8000	63900	64000	-100	-0,13
10000	80000	80000	0	0,00
0	0	0	0	0,00

NOTE / Notes:

DATA/date : 27/04/21 TECNICO / operator: File:Cer-TCC-RMA2021044

LA CATENA DI RIFERIBILITA' METROLOGICA HA INIZIO DA CAMPIONI CERTIFICATI PRESSO CENTRI LAT
The traceability chain begin from first line standards certify by calibration service

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P.IVA 01070150154 | Cap. Soc. € 36.400,00 I.V. | R.E.A. Milano 851258 | codice SDI: SUBM70N
info@ados.it | **www.ados.it**

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PRECISION EXISTS

1970-2020 FIFTY YEARS OF PRECISION

CURVA DI TARATURA
Calibration curve

RMA N°	2021044
CLIENTE / Customer	ROSETTI MARINO
CELLA / Load cell mod.	TCC 10
N.° SERIE / Serial number	20112692
STRUMENTO / Instrument mod.	A100E2
N.° SERIE / Serial number	20111704
BANCO DI PROVA CAMPIONE / Reference Testing machine	GPR 06

carico load Kg	lettura indication Kg	curva teorica reference Kg	errore error Kg	errore error %FS
0	0	0	0	0,00
2000	15950	16000	-50	-0,06
4000	31900	32000	-100	-0,13
6000	47900	48000	-100	-0,13
8000	63900	64000	-100	-0,13
10000	80000	80000	0	0,00
0	0	0	0	0,00

NOTE / Notes:

DATA/date : 27/04/21 TECNICO / operator: File:Cer-TCC-RMA2021044

LA CATENA DI RIFERIBILITA' METROLOGICA HA INIZIO DA CAMPIONI CERTIFICATI PRESSO CENTRI LAT
The traceability chain begin from first line standards certify by calibration service

Ados s.r.l. | Via Lazio, 25 | 20090 Buccinasco (MI) Italy | T. +39 02.45700120 | F. +39 02.48840833
P.IVA 01070150154 | Cap. Soc. € 36.400,00 I.V. | R.E.A. Milano 851258 | codice SDI: SUBM70N
info@ados.it | **www.ados.it**

ados
PRECISION EXISTS

1970-2020 FIFTY YEARS OF PRECISION

CURVA DI TARATURA
Calibration curve

RMA N°	2021044
CLIENTE / Customer	ROSETTI MARINO
CELLA / Load cell mod.	TCC 10
N.° SERIE / Serial number	20112693
STRUMENTO / Instrument mod.	A100E2
N.° SERIE / Serial number	20111704
BANCO DI PROVA CAMPIONE / Reference Testing machine	GPR 06

carico load Kg	lettura indication Kg	curva teorica reference Kg	errore error Kg	errore error %FS
0	0	0	0	0,00
2000	15950	16000	-50	-0,06
4000	31900	32000	-100	-0,13
6000	47900	48000	-100	-0,13
8000	63950	64000	-50	-0,06
10000	80000	80000	0	0,00
0	0	0	0	0,00

NOTE / Notes:

DATA/date : 27/04/21 TECNICO / operator: File:Cer-TCC-RMA2021044

LA CATENA DI RIFERIBILITA' METROLOGICA HA INIZIO DA CAMPIONI CERTIFICATI PRESSO CENTRI LAT
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P.IVA 01070150154 | Cap. Soc. € 36.400,00 I.V. | R.E.A. Milano 851258 | codice SDI: SUBM70N
info@ados.it | **www.ados.it**

INDUSTRIA FILATI SINTETICI S.p.A.

IFIS S.p.a. Cap. Soc. €2.292.000 I.v.
Cod Fic. 00708630637 - P. IVA IT.01247801218
Sede Legale: Via P. Iannielio, 28 - 80027 FRATTAMAGGIORE (NA) ITALIA
Stabilimento Zona Industriale ASL sud - 81025 MARCIANISE (CE) ITALIA
Tel.+39.0823.584511 - Fax.+39.0823.512024
www.ifisspa.com e-mail: info@ifisspa.com

CERTIFIED QUALITY MANAGEMENT SYSTEM ISO 9001:2000 SINCERT DNV

CERTIFICATO DI FABBRICA *143/2011*
TEST CERTIFICATE

Commessa interna N. *Work order N.*	339
Ordine cliente N. *Customer order n.*	**353 DEL 10/03/11**
Committente *Purchaser*	**NEPTUNE SRL – RAVENA -ITALIA**
Riferimento ddt N. *Rif document N.*	390 DEL 16/03/2011
Destinazione *Intended for*	FONDO MAGAZZINO

Si certifica che i cavi in fibra, le cui caratteristiche sono di seguito indicate, sono stati sottoposti agli accertamenti ed alle prove di collaudo previste dai regolamenti con esito positivo ed in conformità al

This is to certify that the fibre ropes, particulars of which are given below, have been tested as per rules with satisfactory results in accordance to

ISO RULES

Tipo cavo *Mooring rope type*	STAR50		
Materiale impiegato *Material (type of fibre)*	50% POLIPROP.50% POLYESTERE HT		
Lunghezza (m) *Length*	400	**Diametro (mm)** *Diameter*	76
Massa lineare (g/m) *Linear mass*	3150	**Numero dei legnoli** *Number of strands*	12
Senso di avvolgimento *Lay*	S/Z	**Numero e tipi del filo** *Numbe and type of yarn*	
Colore *Color*	BIANCO	**Peso specifico** *Specific weight*	1,10
Punto di fusione *Melting point*	260°	**Stabilizzazione UVA** *UV light resistence*	YES
Prova su N. fili *Test on wires No*		**Carico di rottura medio sui fili** *Average breaking load on wire*	
Coefficiente cordatura *Realization factor*		**Norme** *Norme*	
Carico di rottura richiesto kN. *Breaking strenght reiquered kN.*	1315	**Carico di rottura calcolato kN.** *Breaking strength calculated kN.*	1315
Marche apposte *Stamping*	2454	**Data produzione** *production data*	MARZO
Rilasciato a *Issued at*	MARCIANISE	**Il** *On*	16/03/2011

IFIS SPA

Mod 3.8 ed. 0

Remarks : product is in accordance with OCIMF Mooring equipment Guidelines.
The material covered by this delivery is produced in accordance with IFIS's manufacturing specifications currently in force for this product grade. IFIS certifies that the material supplied meets the requirements for this grade and conforms to the product description, and that it has been tested in accordance with the internal control routines used in our company.

INDUSTRIA FILATI SINTETICI S.p.A.

IFIS S.p.a. Cap. Soc. €2.292.000 I.v.
Cod Fic. 00708630637 - P. IVA IT.01247801218
Sede Legale: Via P. Iannielio, 28 - 80027 FRATTAMAGGIORE (NA) ITALIA
Stabilimento Zona Industriale ASL sud - 81025 MARCIANISE (CE) ITALIA
Tel.+39.0823.584511 - Fax.+39.0823.512024
www.ifisspa.com e-mail: info@ifisspa.com

CERTIFIED QUALITY MANAGEMENT SYSTEM ISO 9001:2000 SINCERT DNV

CERTIFICATO DI FABBRICA *142/2011*
TEST CERTIFICATE

Commessa interna N. *Work order N.*	339
Ordine cliente N. *Customer order n.*	**353 DEL 10/03/11**
Committente *Purchaser*	**NEPTUNE SRL – RAVENA -ITALIA**
Riferimento ddt N. *Rif document N.*	390 DEL 16/03/2011
Destinazione *Intended for*	FONDO MAGAZZINO

Si certifica che i cavi in fibra, le cui caratteristiche sono di seguito indicate, sono stati sottoposti agli accertamenti ed alle prove di collaudo previste dai regolamenti con esito positivo ed in conformità al

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Tipo cavo *Mooring rope type*	STAR50		
Materiale impiegato *Material (type of fibre)*	50% POLIPROP.50% POLYESTERE HT		
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Massa lineare (g/m) *Linear mass*	3150	**Numero dei legnoli** *Number of strands*	12
Senso di avvolgimento *Lay*	S/Z	**Numero e tipi del filo** *Numbe and type of yarn*	
Colore *Color*	BIANCO	**Peso specifico** *Specific weight*	1,10
Punto di fusione *Melting point*	260°	**Stabilizzazione UVA** *UV light resistence*	YES
Prova su N. fili *Test on wires No*		**Carico di rottura medio sui fili** *Average breaking load on wire*	
Coefficiente cordatura *Realization factor*		**Norme** *Norme*	
Carico di rottura richiesto kN. *Breaking strenght reiquered kN.*	1315	**Carico di rottura calcolato kN.** *Breaking strength calculated kN.*	1315
Marche apposte *Stamping*	2453	**Data produzione** *production data*	MARZO
Rilasciato a *Issued at*	MARCIANISE	**Il** *On*	16/03/2011

Mod 3.8 ed. 0

IFIS SPA

Remarks : product is in accordance with OCIMF Mooring equipment Guidelines.
The material covered by this delivery is produced in accordance with IFIS's manufacturing specifications currently in force for this product grade. IFIS certifies that the material supplied meets the requirements for this grade and conforms to the product description, and that it has been tested in accordance with the internal control routines used in our company.

ATTACHMENT G – LOADOUT ORGANIZATION CHART

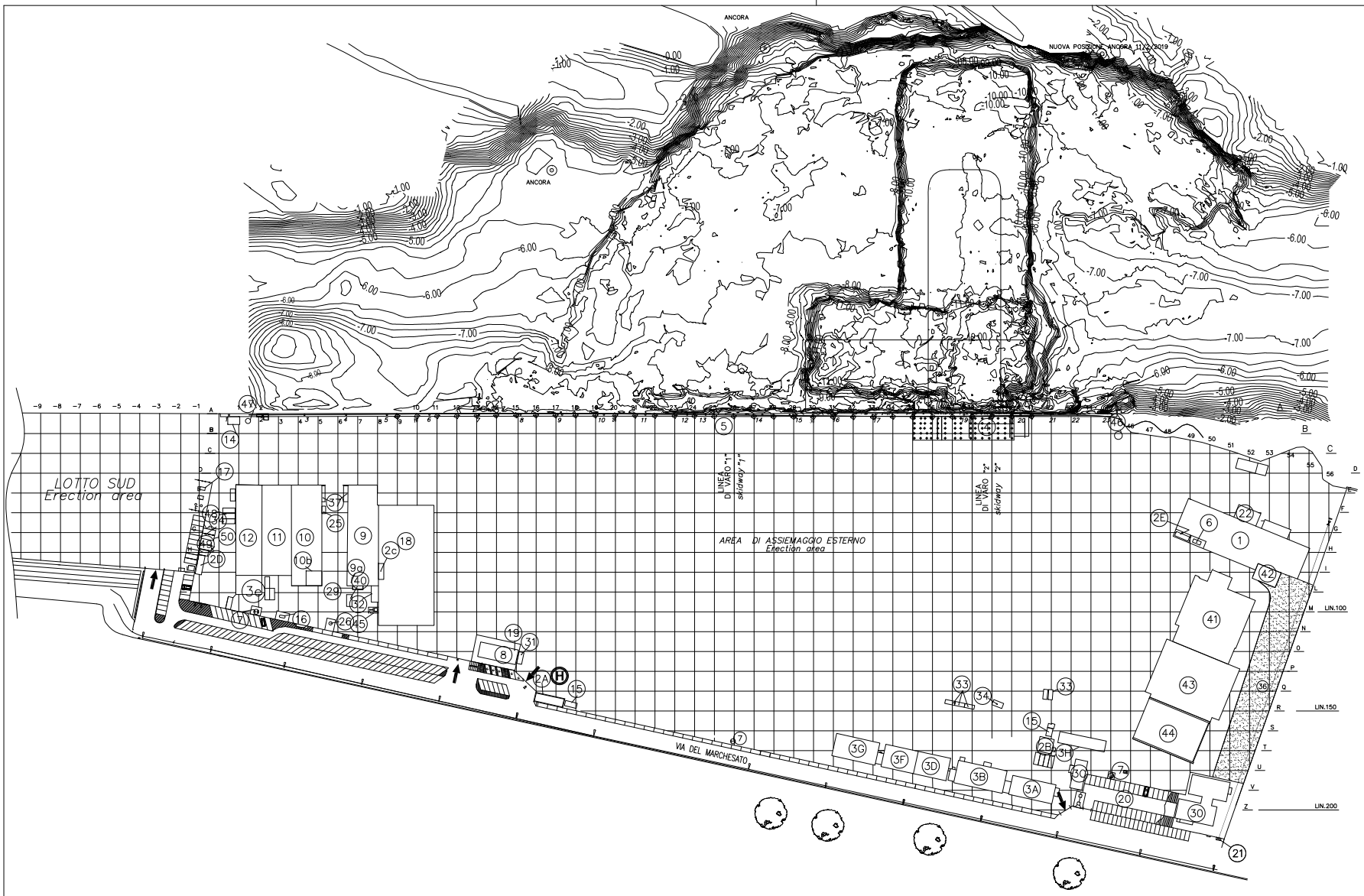
HOLD

ATTACHMENT H – SPMT METHOD STATEMENT

HOLD

ATTACHMENT I – HYDROGRAPHICAL SURVEY

Software: Auto–CAD r2000 File: CADdraw.dwg



Quote batimetriche riferite al L.M.M.
riferimento CS RMN2–mareometro di Marina di Ravenna

ROSETTI MARINO RAVENNA ITALY

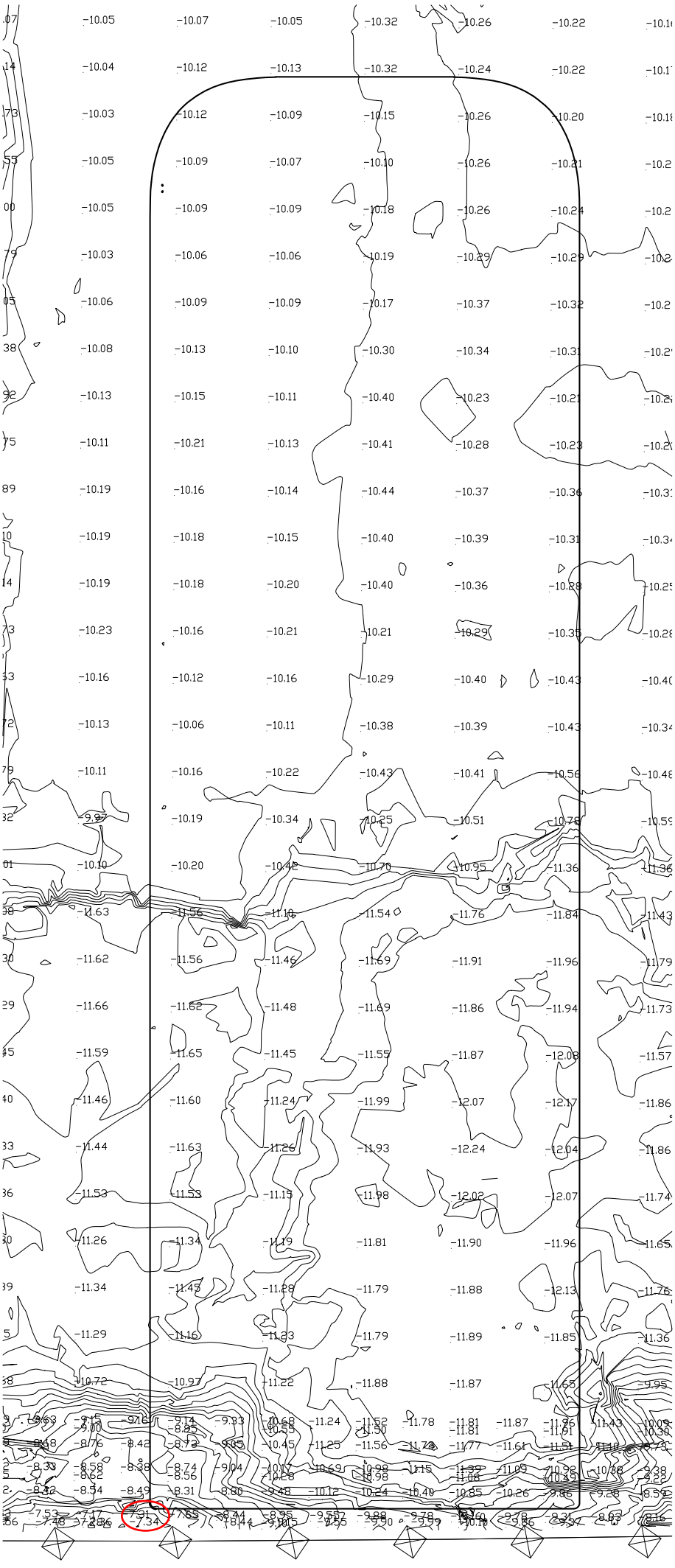
REV. REV.	DATA DATE	DESCRIZIONE / DESCRIPTION	DISEGN. DRAWN.	CONTR. CHECK.	APPROV. APPROV.	Q. A APPROV.
3						
2						
1						
0	18/03/19	EMISSIONE	MTM			

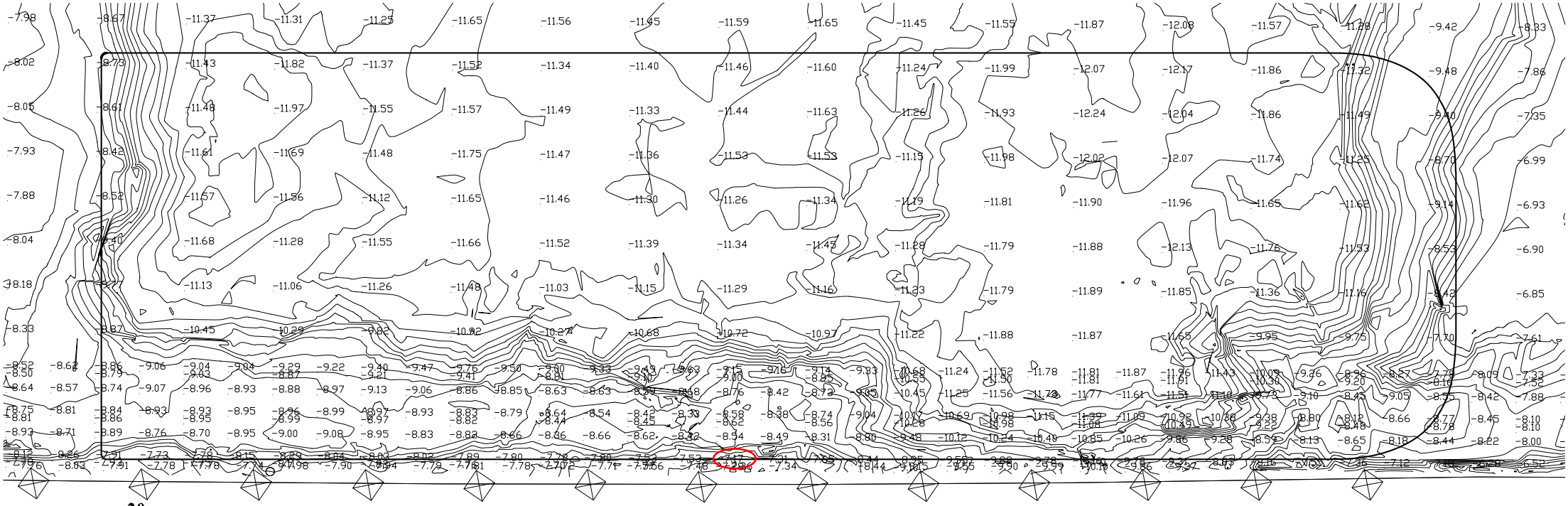
CANTIERE PIOMBONE
Via del Marchesato 37
Marina di Ravenna

PLANIMETRIA GENERALE/GENERAL LAY–OUT
BATIMETRIA STATO DI FATTO AL 28.02.2019
BATHIMETRY AS–BUILT AL 28.02.2019

DIS. N° / DWG Nr 79004.855
SCALA / SCALE 1:2000
FOGLIO SHEET 1 DI OF 1

Stampa: _ Foglio: A3


-10.05 -10.07 -10.05 -10.32 -10.26 -10.22
-10.04 -10.12 -10.13 -10.32 -10.24 -10.22
-10.03 -10.12 -10.09 -10.15 -10.26 -10.20
-10.05 -10.09 -10.07 -10.10 -10.26 -10.21
-10.05 -10.09 -10.09 -10.18 -10.26 -10.24
-10.03 -10.06 -10.06 -10.19 -10.29 -10.29
-10.06 -10.09 -10.09 -10.17 -10.37 -10.32
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-10.19 -10.16 -10.14 -10.44 -10.37 -10.36
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-10.23 -10.16 -10.21 -10.21 -10.29 -10.35
-10.16 -10.12 -10.16 -10.29 -10.40 -10.43
-10.13 -10.06 -10.11 -10.38 -10.39 -10.43
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-9.97 -10.19 -10.34 -10.25 -10.51 -10.78
-10.10 -10.20 -10.42 -10.70 -10.95 -11.36
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-11.62 -11.56 -11.46 -11.69 -11.91 -11.96
-11.66 -11.62 -11.48 -11.69 -11.86 -11.94
-11.59 -11.65 -11.45 -11.55 -11.87 -12.08
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-11.53 -11.53 -11.15 -11.98 -12.02 -12.07
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-11.34 -11.45 -11.28 -11.79 -11.88 -12.13
-11.29 -11.16 -11.23 -11.79 -11.89 -11.85
-10.72 -10.97 -11.22 -11.88 -11.87 -11.65
-9.63 -9.15 -9.16 -9.14 -9.33 -10.68 -11.24 -11.52 -11.78 -11.81 -11.87 -11.26 -11.43
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-8.30 -8.58 -8.38 -8.74 -9.04 -10.17 -10.69 -10.98 -11.15 -11.32 -11.09 -10.92
-8.32 -8.54 -8.49 -8.31 -8.80 -9.48 -10.12 -10.24 -10.48 -10.85 -10.26 -9.86
-7.53 -7.54 -7.63 -8.44 -8.95 -9.55 -9.89 -9.78 -9.60 -9.26 -8.95 -8.76
-7.54



30

SIDE SCAN SONAR
MORPHOLOGICAL SURVEYS

Morphological survey for the verification of the seabed in front of ROSETTI YARD inside the Piomboni area (Port of Ravenna)

Rif. C2124

CONFORMITY CERTIFICATE OF THE AREA

Client:

ROSETTI MARINO

Index of revision

Rev.	Date	Description	Issue	Verified	Approved
0	21/05/2021	Emissione	S. Mancini	I. Malavolti	F. Morello
1					
2					
3					

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3.0 DEFINITION....7
4.0 CONFORMITY DECLARATION OF SEABED AREA....8

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ANNEX 2-B	*Digital*	Sistema di posizionamento RTK Trimble R20-2
ANNEX 2-C	*Digital*	Sistema di posizionamento Hemisphere Vector V102
ANNEX 2-D	*Digital*	Sistema Side Scan Sonar Edgetech 4125P
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ANNEX 7-B	*Digital*	PDS Lite View Software Manual

1.0 SCOP OF WORK

Subsea Fenix Srl from Ravenna have been completed morphological surveys in front of the Rosetti Marino Yard in the area known as the Piomboni inside Ravenna Harbor.

The entire work was carried out with the aim of mapping the seabed surface and identifying the presence of any targets / anomalies such as wrecks or debris, that could be dangerous or an obstacle to the clear navigation and safe approach to the Rosetti jetty. The focus of the survey must guarantee the following information:

- Mapping the morphology of the seabed;
- Target identification;
- Sizing and positioning of any target identified;
- Bathymetric and Morphological data merging;



Image 1 – Rosetti Marino "Piomboni" Yard

The service offered by Subsea Fenix srl included the supply of equipment, operators and everything necessary to perform the required survey, including data processing and their cartographic representation.

2.0 SCOP OF DOCUMNT

To complete the scope of work, this declaration was drawn up and delivered. The document hold the conclusions reached from the analysis of the onsite collected data.

The annex of this document was written to describe i the methods of execution of surveys and data processing, the list and characteristics of the instrumentation used and the personnel employed.

The conclusions was obtained by the analysis of the data acquired and mapped. All the info and the data used to determinate this conclusion was summarized in all the document and map annex to this document.

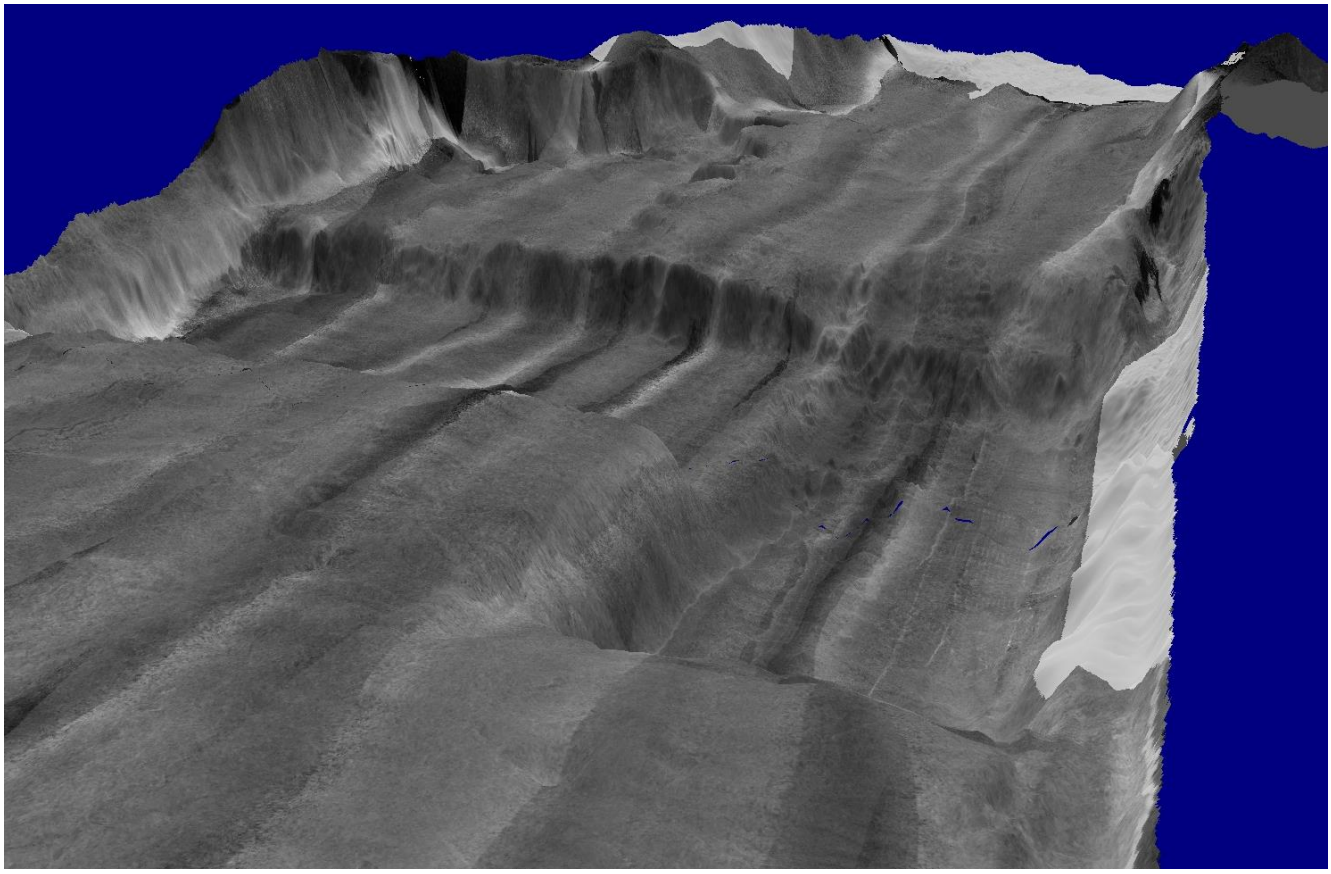


Image 2 – 3D Image of photomosaic

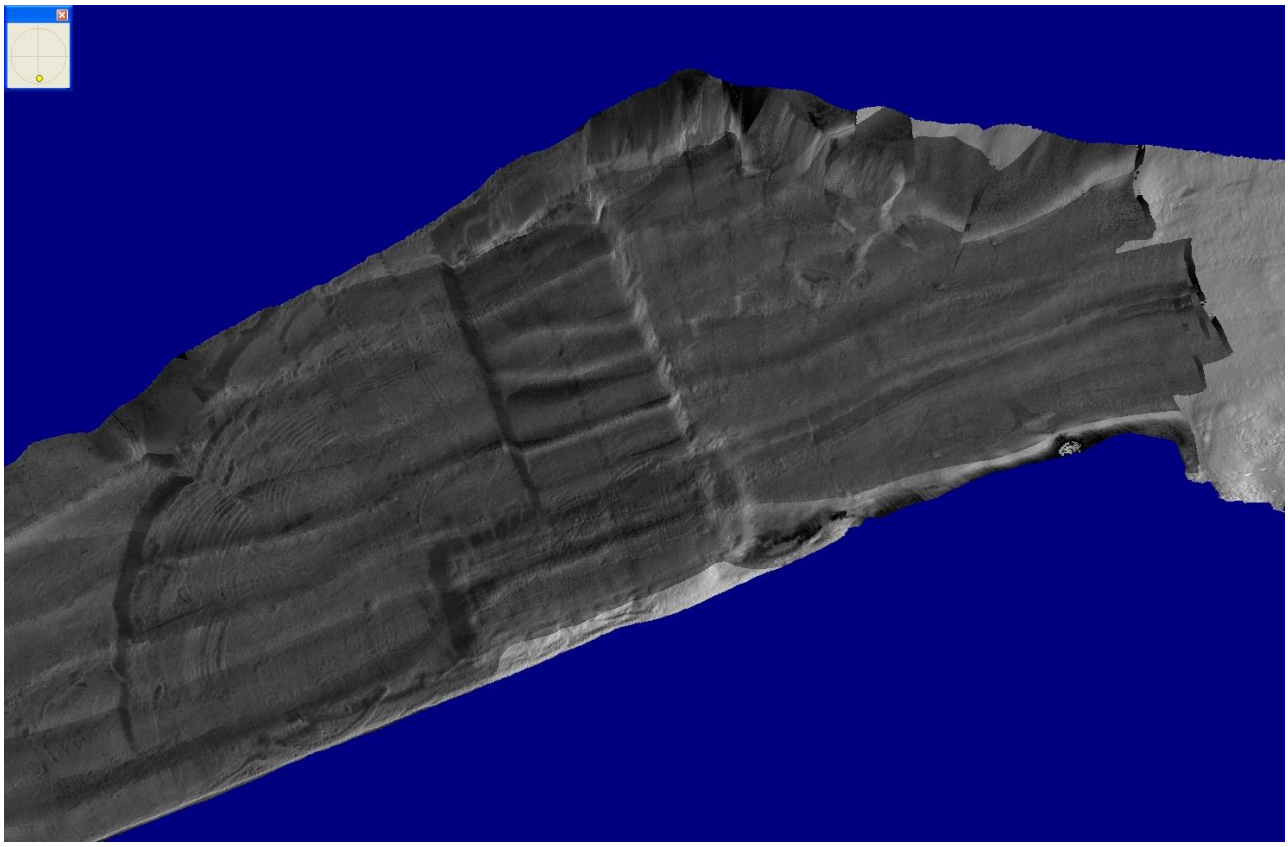


Image 3 – 2D Image of photomosaic

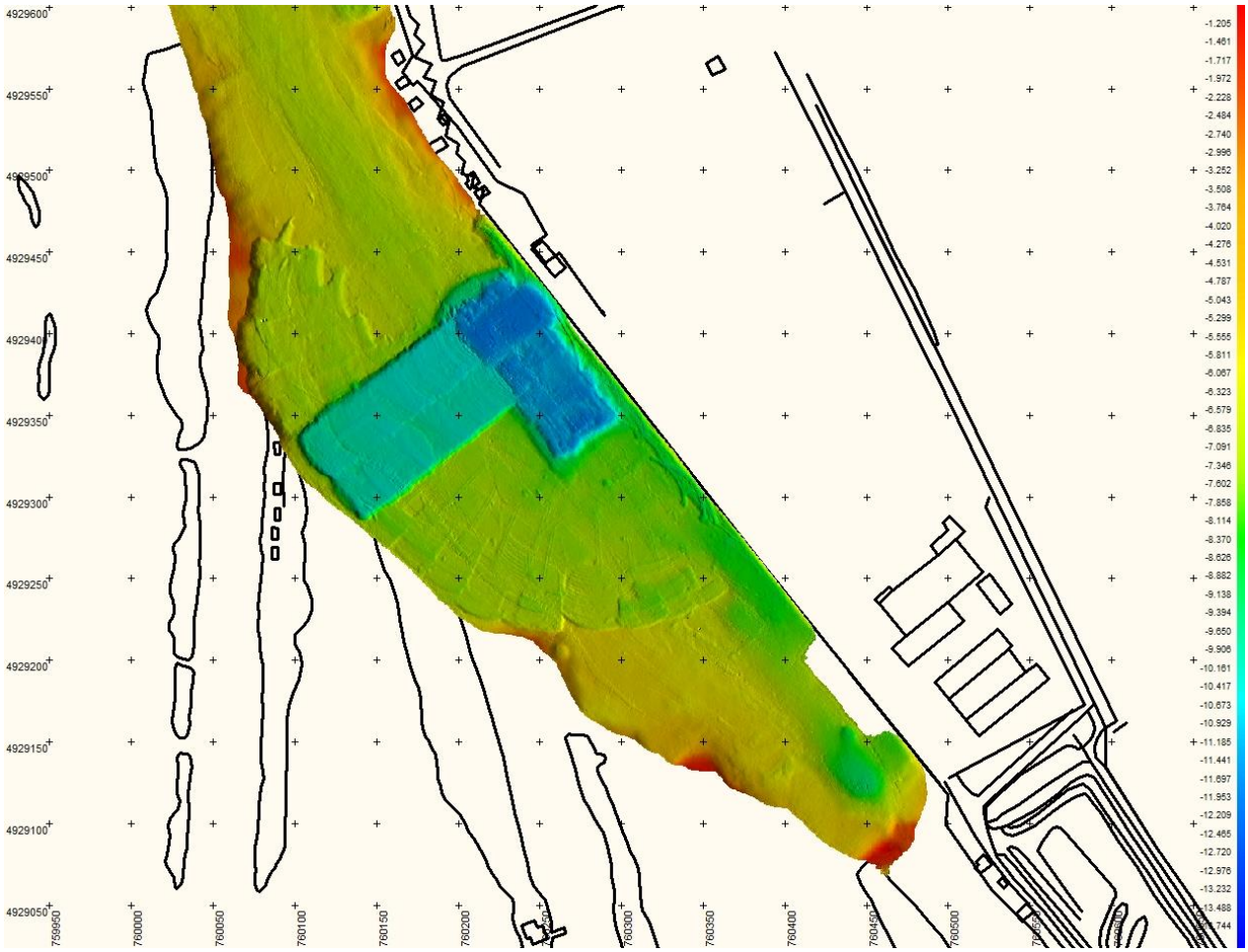


Image 4 – DTM Image

3.0 DEFINITION

- **Client** **Rosetti Marino Srl;**
- **Contractor** Subsea Fenix Srl;
- **Executor** Subsea Fenix Srl;

4.0 CONFORMITY DECLARATION OF SEABED AREA

On 14th May 2021 Subsea Fenix Srl has performed a detailed morphological survey of the Seabad Morphological survey for the verification of the seabed in front of ROSETTI YARD inside the Piomboni area (Port of Ravenna)

The entire work was carried out with the aim of mapping the seabed surface and identifying the presence of any targets / anomalies such as wrecks or debris, that could be dangerous or an obstacle to the clear navigation and safe approach to the Rosetti jetty.

The survey inspection was execute by using a very High Fr3equacy Side Scan Sonar 1250 kHz) system combined with appropriate positioning system and software capable to recording, validate and analyse the acquired data. By making a series of dockside parallel line, spaced 25m, we obtained 100% of coverage of the seabed and 200% of data overlap.

The summary results obtained with the survey, did not report inside the on the seabed any targets, anomalies such as wrecks or debris, that could be dangerous or an obstacle to the clear navigation and safe approach to the Rosetti jetty.

ATTACHMENT L – TIDE TABLE

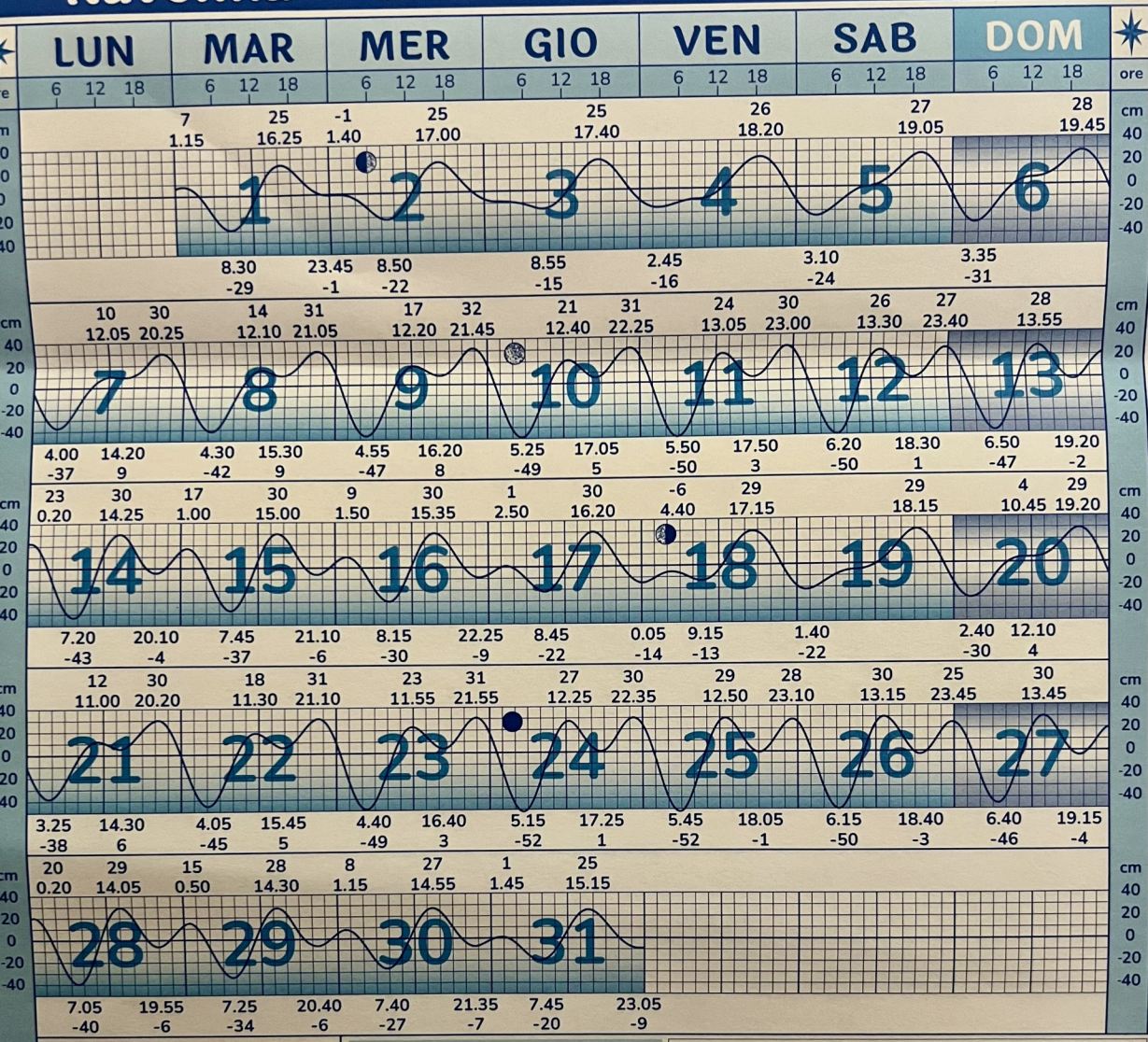
LUGLIO 2025

Ora Legale

• Ravenna •

Previsioni di marea nell'Adriatico settentrionale

RAVENNA PORTO - Lat. 44° 29' 31" Nord - Long. 12° 17' 33" Est • VALORI ASTRONOMICI



ANTICIPI E RITARDI DELLE MAREE - APPROSSIMATI - NEI PORTI IN MINUTI E CON AMPIEZZA RELATIVA

ANTICIPI		RITARDI	
Trieste	55'(100%)	Cesenatico	5'(70%)
Grado	45'(100%)	Rimini	10'(70%)
Lignano	35'(100%)	Riccione	15'(70%)



IL SOLE:

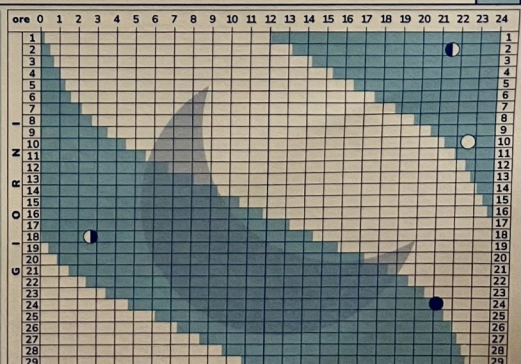
gg.	leva	tram.
1	05.29	20.59
4	05.31	20.59
7	05.33	20.58
10	05.35	20.57
13	05.37	20.55
16	05.40	20.53
19	05.43	20.51
22	05.46	20.48



LA LUNA:

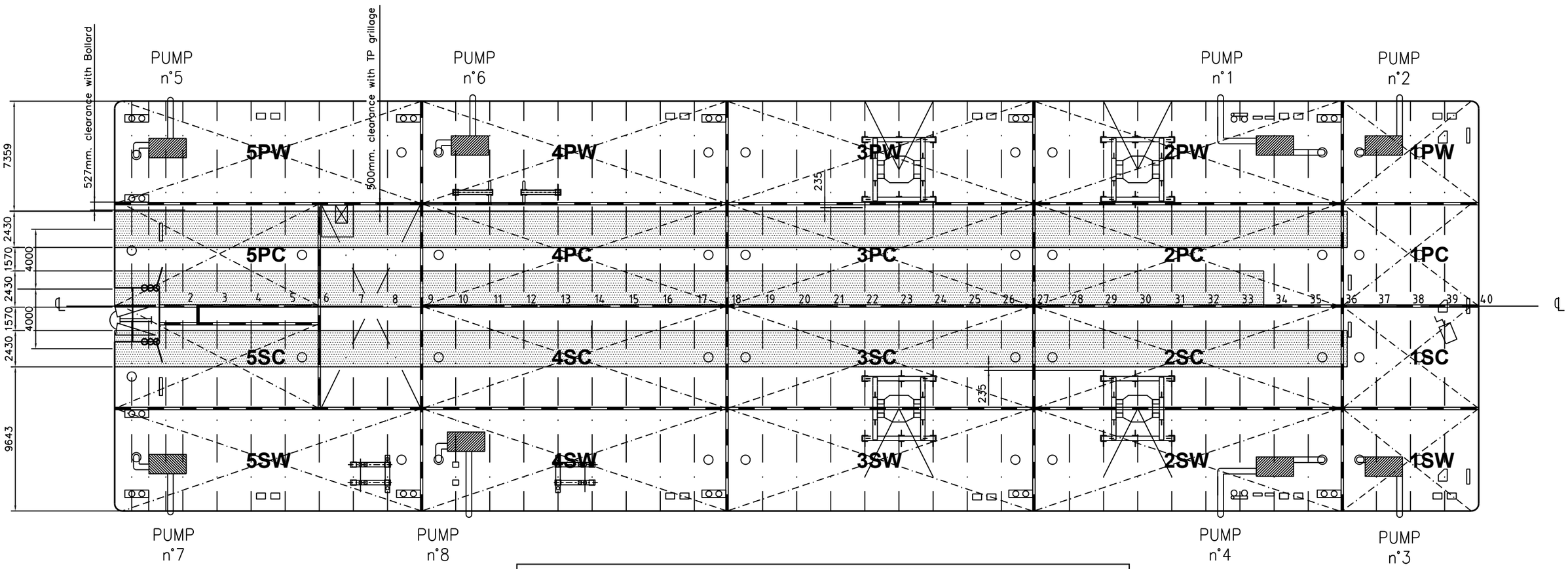
sorge ▬▬ tramonta

Nel grafico è evidenziato il tempo in cui la Luna è visibile nell'arco delle 24 ore. La Luna ed il Sole sono gli astri che principalmente esercitano una attrazione in grado di



ATTACHMENT M – PORTABLE BALLASTING PUMPS & GENERAL ARRANGEMENT ON BARGE

This document undergoes an issuance cycle within EDMS Fusionlive". Its distribution is electronically controlled. Once printed shall be considered as "NOT CONTROLLED" copy



PORTABLE BALLAST PUMP TABLE

PUMP N.	CAPACITY [M3/H]	BARGE TANK	BALLAST ARRANGEMENT	NOTE
1	300	2PW	IN & OUT	LOAD TRANSFER AND TIDE
2	300	1PW	OUT	LOAD TRANSFER
3	300	1SW	OUT	LOAD TRANSFER
4	300	2SW	IN & OUT	LOAD TRANSFER AND TIDE
5	300	5PW	IN & OUT	LOAD TRANSFER
6	300	4PW	IN & OUT	LOAD TRANSFER AND TIDE
7	300	5SW	IN & OUT	LOAD TRANSFER
8	300	4SW	IN & OUT	LOAD TRANSFER AND TIDE

ATTACHMENT N – BALLAST SEQUENCE

This document undergoes an issuance cycle within EDMS Fusionlive". Its distribution is electronically controlled. Once printed shall be considered as "NOT CONTROLLED" copy

ATTACHMENT O – SAFETY CHECKLIST

This document undergoes an issuance cycle within EDMS Fusionlive". Its distribution is electronically controlled. Once printed shall be considered as "NOT CONTROLLED" copy

ROSETTI MARINO SPA

CW - BLPH loadout

SAFETY CHECK LIST

Date: _____

LOAD OUT OPERATION

Location: Marina di Ravenna (RA)

N°	TOPIC	CHECKED
	MOORING ARRANGEMENT	
1	Check winch engines and trial start	
2	Check lubricant levels	
3	Inspect and grease-up wire ropes and block sheaves	
4	Control positions and elevations of quay fenders	
	BARGE BALLASTING	
5	Instruct ballast superintendent to perform all checks on ballast pumps	
6	Ballast the barge according to the pattern defined for the initial phase	
7	Check and report ballast tank levels by manual sounding	
	BARGE TRIM AND ALIGNMENT	
8	Check position of all targets on barge	
9	Check position and readings of survey instrument	
10	Check and report the barge trim and alignment	

	SPMT	
11	Travel path inspected /cleaned	
12	Check plate covering holes in the ground	
13	No loose or not secured material, loose items survey with MWS	
14	Correct configuration of SPMT trailers as per attached drawings	
15	Functioning of every SPMT trailer	
16	Functioning of radio communications between SPMT trailer operator and lifting supervisor	
17	Briefing with personnel involved in the operation	
18	Area to be used cordoned off and access forbidden to unauthorized personnel	
	TIDE READINGS	
19	Check that the tide reading instrument is in place and perfectly working	
	WEATHER FORECAST	
20	In the week before load-out require every day official weather forecast and report to load-out Manager	
	COMMUNICATION EQUIPMENTS	
21	Available communication equipments and spare units and batteries	
	CONTINGENCY	

22	Cutting equipment	
23	Contingency plans (ballasting pumps, power supply, trailers, mooring winch and mooring lines) in place	
	APPROVAL	
24	Check warranty surveyor approval before topside lift off	
25	After load out and before removal of SPMT, check if necessary additional steelwork (shims).	