GL Garrad Hassan

ETRURIA ENERGY srl, Milano
Piansano Wind Farm, Lazio, Italy

TECHNICAL DUE DILIGENCE, REVIEW OF TURBINE FOUNDATIONS DESIGN

REPORT

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0. Foreword

This document concludes a long process of review, during which GH has asked the Client to perform a supplementary geological investigation and fulfil a List of Additions to the Design.

Both requests have been accepted and fully complied with, as follows:

1. A supplementary geological investigation was carried out in January 2011. The Geologist, Doct. Bernardini, has submitted a supplementary Geological Report, on the basis of which GH and the Authors of the Design, Messrs HYDRO ENGINEERING, have agreed on a final geotechnical model for the wind farm site.
2. A comprehensive document has been issued by Messrs HYDRO ENGINEERING on January 21, 2011, addressing the items of List of Required Additions to Design contained in the Abstract from Report Rev-02 issued by GH in December 2010.

For clarity, key documents of the revision process are part of this document as ANNEXES, as follows:

a. ANNEX 1: Type C Foundation – Independent Calculations Based on Fresh Geotechnical Model
b. ANNEX 2: Type A Foundation, Type B Foundation, Independent Calculations, Structural, Shear
c. ANNEX 3: Abstract from Report, Rev-02
d. ANNEX 4: Report, Rev-01

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1. INTRODUCTION

1.1 How to read this document

This document is 'front-loaded', so to speak. Its salient part is the 'Executive Summary – Recommendations' Chapter (pages 8 and 9), which gives a succinct but comprehensive overview of the due diligence findings. Key issues are then displayed in 'Evaluation Tables' (8 no.), which constitute the bearing structure of this work. Comments and results of independent calculations are given in the 'Remarks' column of the Evaluation Tables. Finally, independent calculations and other detailed ancillary information are given in Annexes and Appendices.

1.2 General

This assessment covers the design for the foundations of the wind turbines in the wind farm developed by ETRURIA ENERGY S.r.l. of Milano, Italy, in areas of the Municipality of Piansano in the Province of Viterbo, Italy. The project comprises No. 21 wind turbines, type VESTAS V90, capacity 2,0 MW. Hub height is 80 m at all sites .

1.3 Authors of Proposed Design

The developer is ETRURIA ENERGY S.r.l., Largo Donegani 2, Milano, Italy. The developer's consultants are:

- Dott. Ing. Mariano Galbo (Hydro Engineering), Via Rossotti 39, Alcamo, Province of Trapani, Sicily - Author of the foundation design (August 2010);
- Dott. Geol. Emma Bernardini, Strada Riello 18/A, 01100 Viterbo - Author of the Geological Investigation (March 2010);

1.4 Authors of Review

- Dott. Ing. Luigi Cesare Speranza, Roma (SCANGEA);
- Dott. Ing. Marco Franceschini, Bologna (SCANGEA);
- Prof. Ing. Claudio Scarponi, Roma (UNIVERSITA' 'LA SAPIENZA', ROMA – SCANGEA).

Profiles of authors of review constitute APPENDIX B to this Report.

1.5 Documentation Reviewed

List of documents reviewed constitutes APPENDIX A to this Report.

1.6 Description of Proposed Design

Proposed design consists of the following foundation types:

a) Type A
Shallow Foundation (square plinth 15x15 m)
N.1 turbine site: P26.

b) Type B
Piled Foundation (hexagonal plinth 10,3 m side – 16 piles – diam:1000mm, length: 22m)
This foundation type is called in the design reports: 'tipologia 6'.
N. 6 turbine sites: P6, P7, P9, P21, P27 and P30.

c) Type C
Piled Foundation (hexagonal plinth 8,0 m side – 12 piles – diam: 800mm, length: 16,18,20,24,26 m)
This foundation type is called in the design reports: 'tipologia 1,2,3,4,5' according to pile length.
N. 3 turbine sites for 'tipologia 1' (pile length 16 m): P17, P18 and P24.

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N. 3 turbine sites for 'tipologia 2' (pile length 18 m): P12, P23 and P25.
N. 1 turbine site for 'tipologia 3' (pile length 20 m): P16.
N. 5 turbine sites for 'tipologia 4' (pile length 24 m): P1, P4, P13, P15 and P29..
N. 2 turbine sites for 'tipologia 5' (pile length 26 m): P5 and P10.
(Total: N. 14 turbine sites)

1.7 Method of Review - Guidelines

This aim of this technical due diligence review is two-fold:

a) to verify the viability of the proposed foundation structures via independent calculations complying with international standards of calculation (Euro-Codes, IEC 61400-1 and Italian NTC-2008);
b) to evaluate the calculations and ancillary documentation of the proposed design so as to assess their compliance with current Italian standards. This in order to foresee potential bottlenecks in the path of approvals from Italian Authorities (Regione, Genio Civile etc.) and ensure that an adequate maintenance plan is drawn up and enforced.

Review criteria have been derived from previous experiences of GL Garrad Hassan, integrated with specific topics which are sensitive for the Italian codes (e.g.: seismic actions, etc.).

1.8 Method of Review – Evaluation Tables

Evaluation of the proposed design is carried out by filling in the following Evaluation Tables:

- **Evaluation Table 1** – GEOLOGICAL INVESTIGATION;
- **Evaluation Table 2** – TURBINE LOADS;
- **Evaluation Table 3** – Type A foundation (shallow) STABILITY;
- **Evaluation Table 4** – Type A foundation (shallow) STRUCTURAL;
- **Evaluation Table 5** – Type B foundation (piled) STABILITY;
- **Evaluation Table 6** – Type B foundation (piled) STRUCTURAL;
- **Evaluation Table 7** – Type C - 1 foundation (piled) STABILITY;
- **Evaluation Table 8** – Type C - 2 foundation (piled) STABILITY.

Tables 7 and 8 evaluate piled foundation Type C, i.e. the deep foundation resting on 800mm piles varying in length from 16 to 26 metres. In order to effect independent calculations, foundation type C has been divided into two sub-types (C-1 and C-2) , as follows:

- Foundation Type C-1
  Piled foundation resting on 800mm piles embedded in lava layer.
  N. 6 Turbine Sites: P12, P16, P17, P18, P24 and P25.

- Foundation Type C-2
  Piled foundation resting on 800mm piles 'floating' in piroclastite layer.
  N. 8 Turbine Sites: P1, P4, P5, P10, P13, P15, P23 and P29.

1.9 Method of Review – Checks in Evaluation Tables

In compliance with points a) and b) of preceding Paragraph 1.7 (Aim of this review), checks in Evaluation Tables are given separately to structure soundness (evaluated with independent calculations) and design documentation quality.

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Checks are given by crossing in the applicable cell in the criteria columns. Colour of crosses in the third column ('Insufficient or Omitted') can be either black or red. Black is given when the issue, though rated insufficiently dealt with, or omitted, is not deemed crucial. Red is given for issues which are deemed to be crucial.

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2. EXECUTIVE SUMMARY

2.1 GEOLOGICAL INVESTIGATION – GEOTECHNICAL MODEL

2.1.1 GEOLOGICAL INVESTIGATION
The original Geological Report by Dr. Emma Bernardini was overall satisfactory, thought affected by the following flaws,:

- CPT (Cone Penetration Tests) have not been performed;
- Soil chemistry analysis is omitted;
- Lab testing results appear somewhat inconsistent in reference to values of parameter (Fi);
- Oedometric test have been conducted up to kPa values which are too low (800 rather than 1600);
- Calculation of Vs30 take the wrong level of reference (ground level as opposed to bottom of foundation level;
- Slope stability check (which ought to be part of the Engineer's Geotechnical part of foundation calculation report) have been carried out only for 3 sites (P10, P13 and P26). Calculations are unclear as to loads from foundation.

A supplementary geological investigation carried out in January 2011 upon request of GH has addressed all of the above shortcomings, with the exception of the soil chemical analysis. On the basis of this supplementary investigation (which has been closely followed by GH during its making), a reasonably accurate geotechnical model has been defined.

Conclusion 1
Geological investigation, completed with additional field and lab activities in January 2011, is now acceptable. The Geologist should produce a Report on Soil Chemistry evaluating potential for chemical aggression to r.c. structures.

2.1.2 GEOTECHNICAL MODEL
Issues regarding geotechnical modelling have been clarified with Engineer Mariano Galbo, who has also satisfactorily addressed items of LIST OF REQUIRED ADDITIONS TO DESIGN contained in the previous version (revision 2) of this Report (HYDRO ENGINEERING document N. U00036/11PIAN210D0129 delivered to GH on January 21, 2011).

Conclusion 2
Geotechnical model, completed as per calculations shown in Annex 1, is now acceptable.

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2. EXECUTIVE SUMMARY
(continued)

2.2 FOUNDATION Type A - SHALLOW
(Evaluation Tables 3 – 4 in following pages)

Foundation design verified via independent calculations is found viable (though under less conservative assumptions with regard to shear tensions, please refer to Annex 2). All issues in previous version of this Report (rev-02) have been addressed in HYDRO ENGINEERING Document of January 21, 2011.

Conclusion 3
Foundation Type A – Shallow is acceptable.

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2. EXECUTIVE SUMMARY
(continued)

2.3 FOUNDATION Type B – PILED (1000 mm Diam x 22 m length – N.16 piles)
(Evaluation Tables 5 – 6 in following pages)

Foundation design verified via independent calculations is found viable (though under less conservative assumptions with regard to shear tensions, please refer to Annex 2). All issues in previous version of this Report (rev-02) have been addressed in HYDRO ENGINEERING Document of January 21, 2011.

Conclusion 4
Foundation Type B is acceptable.

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2. EXECUTIVE SUMMARY

(continued)

2.4 FOUNDATION Type C – PILED (800 mm Diam x variable length – N.12 piles)

(Evaluation Tables 7 – 8 in following pages)

Foundation design verified via independent calculations is found viable on condition that pile length be increased as per Table below (PILE LENGTH INCREMENTS) already given to GH. All other issues in previous version of this Report (rev-02) have been addressed in HYDRO ENGINEERING Document of January 21, 2011.

Conclusion 5

Foundation Type C is acceptable on condition that pile length be increased as per Table in following page.

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Client:	**Garrad Hassan Italia Srl**
Project:	**PIANSANO Wind Farm, ITALY**
Date:	**2011-02-04**
Document:	**Type C Foundation** **800 mm diameter piles (12 no.)** **PILE LENGTH INCREMENTS**

		HYDRO ENGINEERING PROPOSED PROJECT			SCANGEA INDEPENDENT CALCULATIONS					
Progr	Turbine Site N.	Pile Total Length (*) m	Pile Length in Pyroclastite m	Pile Length in Lava m	Pile length in lava required by independe calculations m	Extra length in lava allowed for constr.defect/ lava banks inclination m	Total Length in Lava m	Pile Total Length (*) m	Pile Length Increment m	*REMARKS*
1	**1**	24.0	23.6	0.4	2.9	1.0	3.9	27.5	**3.5**	Specifications for construction control required
2	**4**	24.0	19.0	5.0	5.0	1.0	6.0	25.0	**1.0**	Idem
3	**5**	26.0	24.2	1.8	2.8	1.0	3.8	28.0	**2.0**	Idem
4	**10**	26.0	23.9	2.1	3.1	1.0	4.1	28.0	**2.0**	Idem
5	**12**	18.0	13.5	4.5	4.5	1.0	5.5	19.0	**1.0**	Idem
6	**13**	24.0	24.0	0.0	no lava	not applic	not applic	29.0	**5.0**	No lava found in test borings**
7	**15**	24.0	21.0	3.0	3.0	1.0	4.0	25.0	**1.0**	Idem
8	**16**	20.0	14.4	5.7	5.7	1.0	6.7	21.1	**1.1**	Idem
9	**17**	16.0	6.0	10.0	10.0		10.0	16.0	**0.0**	Idem
10	**18**	16.0	6.0	10.0	10.0		10.0	16.0	**0.0**	Idem
11	**23**	18.0	15.0	3.0	4.0	1.0	5.0	20.0	**2.0**	Idem
12	**24**	16.0	11.1	4.9	4.9	1.0	5.9	17.0	**1.0**	Idem
13	**25**	18.0	11.4	6.7	6.7		6.7	18.1	**0.0**	Idem
14	**29**	24.0	22.0	2.0	3.0	1.0	4.0	26.0	**2.0**	Idem

(*) Pile Length from Bottom of Foundation (-2,50 m from ground level)
(**) No lava found in test borings up 30 m depth. Pile lenght to be increased below explored depth

3. EVALUATION TABLE 1
GEOLOGICAL INVESTIGATION

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	Evaluation Table N. 1 - GEOLOGICAL INVESTIGATION PIANSANO WIND FARM Date: 2011-02-23	***Design Validation***				
		Fully Satisfactory	**Sufficient**	**Insufficient**	**Omitted**	
	ITEMS					*REMARKS*
	Geological Investigation (Geologist)					
1.A.01	EXPLORATION AT EACH TURBINE SITE		**X**			
1.A.02	ADOPTED EXPLORATION METHOD(S)		**X**			Supplemental geological investigation carried out on January 2011
1.A.03	DEPTH OF EXPLORATION (sufficient for characterization within foundation influence zone?)		**X**			
1.A.04	GROUND WATER		**X**			
1.A.05	SOIL CHEMISTRY				**X**	Analysis of soil chemistry to be performed
1.A.06	VERIFICATION OF SHEAR WAVE VELOCITY to verify shear modulus		**X**			
1.A.07	LAB TESTING for evaluation of design parameters		**X**			Supplementary lab testing performed in January 2011

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4. EVALUATION TABLE 2
TURBINE LOADS

	Evaluation Table N. 2 - TURBINE LOADS PIANSANO WIND FARM Date: 2011-02-23 ITEMS	Design Validation Fully Satisfactory | Sufficient | Insufficient | Omitted	REMARKS
	Info from Turbine Manufacturer		
2.A.01	TURBINE SERVICEABILITY LOAD	X	
2.A.02	TURBINE EXTREME LOAD	X	
2.A.03	TURBINE FATIGUE LOAD	X	
2.A.04	TURBINE SEISMIC LOAD	X	

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5. EVALUATION TABLE 3

STABILITY – Foundation Type A - Shallow

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	Evaluation Table N. 3 - STABILITY **PIANSANO WIND FARM Foundation Type A - Shallow** **Date: 2011-02-23** ***Plinth Shape: Square*** ***Size: 15 x 15 m*** ***Turbine Site: P26*** ***ITEMS***	***Structure Validation*** *(via independent calculations)* Fully Satisfactory Sufficient Insufficient	***Design Validation*** Fully Satisfactory Sufficient Insufficient Omitted	*REMARKS*
	GENERAL			All issues clarified with Ing. Galbo during conference calls and meetings.
3.A.01	Clarity - Compliance with Chapt. 10 of NTC-2008		X	
3.A.02	Completeness of Design Documentation		X	
3.A.03	Software Validation		X	
	LOADS EVALUATION			All issues clarified with Ing. Galbo during conference calls and meetings.
3.B.01	STATIC		X	
3.B.02	SEISMIC		X	
3.B.03	COMBINATION STATIC-SEISMIC AS PER IEC 61400-1		X	
	GEOTECHNICAL MODEL			All issues clarified with Ing. Galbo during conference calls and meetings.
3.C.01	Stratigraphy		X	
3.C.02	Ground Water		X	
3.C.03	Characteristic Geotechnical Parameters		X	
3.C.04	Slope Stability		X	
3.C.05	Soil Chemistry			X
3.C.06	Earthworks Specifications		X	

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	Evaluation Table N. 3 - STABILITY PIANSANO WIND FARM Foundation Type A - Shallow Date: 2011-02-23 Plinth Shape: Square Size: 15 x 15 m Turbine Site: P26 ITEMS	Structure Validation (via independent calculations) Fully Satisfactory / Sufficient / Insufficient			Design Validation Fully Satisfactory / Sufficient / Insufficient / Omitted				REMARKS
	STABILITY								
3.D.01	OVERTURNING STABILITY - STATIC		X			X			All issues clarified with Ing. Galbo during conference calls and meetings.
3.D.02	SLIDING RESISTANCE - STATIC		X			X			
3.D.04	OVERTURNING STABILITY - SEISMIC		X			X			
3.D.05	SLIDING RESISTANCE - SEISMIC		X			X			
3.D.06	UPLIFT (none at normal operating loads)								
	BEARING CAPACITY								
3.E.01	STATIC		X			X			All issues clarified with Ing. Galbo during conference calls and meetings.
3.E.02	SEISMIC		X			X			
	SETTLEMENTS								
3.F.01	TOTAL		X			X			All issues clarified with Ing. Galbo during conference calls and meetings.
3.F.02	DIFFERENTIAL		X			X			
	STIFFNESS								
3.G.01	ROTATIONAL		X			X			All issues clarified with Ing. Galbo during conference calls and meetings.

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6. *EVALUATION TABLE 4*

STRUCTURAL – Foundation Type A - Shallow

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	Evaluation Table N. 4 - STRUCTURAL **PIANSANO WIND FARM Foundation Type A - Shallow** **Date: 2011-02-23** ***Plinth Shape: Square*** ***Side Size: 15 x 15 m*** ***Turbine Site: P26*** ***ITEMS***	***Structure Validation*** *(via independent calculations)* Fully Satisfactory | Sufficient | Insufficient			***Design Validation*** Fully Satisfactory | Sufficient | Insufficient | Omitted				*REMARKS*
	GENERAL								All issues clarified with Ing. Galbo during conference calls and meetings.
5.A.01	Clarity - Compliance with Chapt. 10 of NTC-2008					X			
5.A.02	Completeness of Design Documentation								
5.A.03	Software Validation					X			
	REINFORCEMENT: PILE HEADS								
5.B.01	Steel Quantity - Static								Not Applicable
5.B.02	Steel Quantity - Seismic								Not Applicable
	REINFORCEMENT: PLINTH TOP AND BOTTOM MAT								All issues clarified with Ing. Galbo during conference calls and meetings.
5.C.01	Steel Quantity		X			X			
5.C.02	Steel Spacing		X			X			
	REINFORCEMENT: SHEAR								All issues clarified with Ing. Galbo during conference calls and meetings.
5.D.01	Steel Quantity		X			X			
5.D.02	Steel Spacing		X			X			
	REINFORCEMENT: ANCHORING STEEL RING								All issues clarified with Ing. Galbo during conference calls and meetings.
5.E.01	Pull Out								
5.E.02	Contact Pressure		X			X			
5.E.03	Punching Shear		X			X			
	CONCRETE FATIGUE								All issues clarified with Ing. Galbo during conference calls and meetings.
5.F.01			X			X			
	CONCRETE DURABILITY BASED ON SOIL CHEMISTRY			X				X	
5.G.01									

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7. EVALUATION TABLE 5

STABILITY – Foundation Type B - Piled 1000mm – 22 m

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	Evaluation Table N. 5 - STABILITY ***PIANSANO WIND FARM Foundation Type B - Piled*** ***Date: 2011-02-23*** ***Plinth Shape: HEXAGONAL (side: 10,30 m)*** ***Pile Diam.: 1000 mm - Length: 22 m*** ***Number of Piles: 16*** ***Turbine Sites: P6, P7, P9, P21, P27, P30*** ***ITEMS***	***Structure Validation*** (via independent calculations) Fully Satisfactory Sufficient Insufficient			***Design Validation*** Fully Satisfactory Sufficient Insufficient Omitted				*REMARKS*
	GENERAL								All issues clarified with Ing. Galbo during conference calls and meetings.
4.B.01	Clarity - Compliance with Chapt. 10 of NTC-2008					X			
4.B.02	Completeness of Design Documentation					X			
4.B.03	Software Validation					X			
	LOADS EVALUATION								All issues clarified with Ing. Galbo during conference calls and meetings.
4.B.01	STATIC					X			
4.B.02	SEISMIC					X			
4.B.03	COMBINATION STATIC-SEISMIC AS PER IEC 61400-1					X			
4.B.04	Highest Pile Compression Load					X			
4.B.05	Highest Pile Tension Load					X			
	GEOTECHNICAL MODEL								All issues clarified with Ing. Galbo during conference calls and meetings.
4.C.01	Stratigraphy					X			Geotechnical model agreed based on supplemental geological investigatior
4.C.02	Ground Water					X			
4.C.03	Characteristic Geotechnical Parameters for Axial Loads					X			
4.C.04	Characteristic Geotechnical Parameters for Lateral Loads					X			
4.C.05	Characteristic Geotechnical Parameters for Bending Loads					X			
4.C.06	Slope Stability								
4.C.07	Soil Chemistry					X			
4.C.08	Earthworks Specifications					X			

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	Evaluation Table N. 5 - STABILITY ***PIANSANO WIND FARM Foundation Type B - Piled*** ***Date: 2011-02-23*** ***Plinth Shape: HEXAGONAL (side: 10,30 m)*** ***Pile Diam.: 1000 mm - Length: 22 m*** ***Number of Piles: 16*** ***Turbine Sites: P6, P7, P9, P21, P27, P30*** ***ITEMS***	***Structure Validation*** (via independent calculations) Fully Satisfactory Sufficient Insufficient	***Design Validation*** Fully Satisfactory Sufficient Insufficient Omitted	*REMARKS*
	PILE CAPACITY (single pile): AXIAL LOAD			All issues clarified with Ing. Galbo during conference calls and meetings.
4.D.01	Discussion of various calc. methods and explanation of choice	X	X	
4.D.02	Evaluation of Ultimate Axial Resistance of Single Pile	X	X	
4.D.03	Evaluation of Axial Resistance of Single Pile - seismic	X	X	
4.D.04	Evaluation of Down Drag	X	X	
	PILE CAPACITY (single pile): LATERAL LOAD			All issues clarified with Ing. Galbo during conference calls and meetings.
4.E.01	Discussion of various calc. methods and explanation of choice		X	
4.E.02	Evaluation of Lateral Resistance of Single Pile	X	X	
4.E.03	Evaluation of Lateral Resistance of Single Pile - seismic	X	X	
	PILE CAPACITY (single pile): BENDING MOMENT			All issues clarified with Ing. Galbo during conference calls and meetings.
4.F.01	Discussion of various calc. methods and explanation of choice		X	
4.F.02	Evaluation of Bending Resistance of Single Pile	X	X	
4.F.03	Evaluation of Bending Resistance of Single Pile - seismic (cinematic moment)		X	
	SETTLEMENTS			All issues clarified with Ing. Galbo during conference calls and meetings.
4.G.01	Single Pile	X	X	
	STIFFNESS			All issues clarified with Ing. Galbo during conference calls and meetings.
4.H.01		X	X	
	SPECIFICATIONS			All issues clarified with Ing. Galbo during conference calls and meetings.
4.J.01	Integrity Checks during Construction		X	
4.J.02	Load Trials		X	

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8. EVALUATION TABLE 6

STRUCTURAL – Foundation Type B - Piled 1000mm – 22 m

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	Evaluation Table N. 6 - STRUCTURAL PIANSANO WIND FARM Foundation Type B - Piled Date: 2011-02-23 Plinth Shape: HEXAGONAL (side: 10,30 m) Pile Diam.: 1000 mm - Length: 22 m Number of Piles: 16 Turbine Sites: P6, P7, P9, P21, P27, P30 ITEMS	Structure Validation (via independent calculations) Fully Satisfactory / Sufficient / Insufficient			Design Validation Fully Satisfactory / Sufficient / Insufficient / Omitted				REMARKS
	GENERAL								All issues clarified with Ing. Galbo during conference calls and meetings.
5.A.01	Clarity - Compliance with Chapt. 10 of NTC-2008					X			
5.A.02	Completeness of Design Documentation					X			
5.A.03	Software Validation					X			
	REINFORCEMENT: PILE HEADS								All issues clarified with Ing. Galbo during conference calls and meetings.
5.B.01	Steel Quantity - Static		X			X			
5.B.02	Steel Quantity - Seismic		X			X			
	REINFORCEMENT: PLINTH TOP AND BOTTOM MAT								All issues clarified with Ing. Galbo during conference calls and meetings.
5.C.01	Steel Quantity		X			X			
5.C.02	Steel Spacing		X			X			
	REINFORCEMENT: SHEAR								All issues clarified with Ing. Galbo during conference calls and meetings.
5.D.01	Steel Quantity		X			X			
5.D.02	Steel Spacing		X			X			
	REINFORCEMENT: ANCHORING STEEL RING								All issues clarified with Ing. Galbo during conference calls and meetings.
5.E.01	Pull Out								
5.E.02	Contact Pressure		X			X			
5.E.03	Punching Shear		X			X			
5.F.01	CONCRETE FATIGUE		X			X			All issues clarified with Ing. Galbo during conference calls and meetings.
5.G.01	CONCRETE DURABILITY BASED ON SOIL CHEMISTRY			X				X	

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9. EVALUATION TABLE 7

STABILITY – Foundation Type C - Piled 800mm

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	Evaluation Table N. 7 - STABILITY PIANSANO WIND FARM Type C Date: 2011-02-23 **Plinth Shape: HEXAGONAL (side length: 8m)** **Pile Diam.: 800 mm - Pile length: varies** **ITEMS**	Structure Validation (via independent calculations) Fully Satisfactory / Sufficient / Insufficient	Design Validation Fully Satisfactory / Sufficient / Insufficient / Omitted	REMARKS
	GENERAL			All issues clarified with Ing. Galbo during conference calls and meetings.
4.B.01	Clarity - Compliance with Chapt. 10 of NTC-2008		X	
4.B.02	Completeness of Design Documentation		X	
4.B.03	Software Validation		X	
	LOADS EVALUATION			All issues clarified with Ing. Galbo during conference calls and meetings.
4.B.01	STATIC		X	
4.B.02	SEISMIC		X	
4.B.03	COMBINATION STATIC-SEISMIC AS PER IEC 61400-1		X	
4.B.04	Highest Pile Compression Load		X	
4.B.05	Highest Pile Tension Load		X	
	GEOTECHNICAL MODEL			All issues clarified with Ing. Galbo during conference calls and meetings.
4.C.01	Stratigraphy		X	
4.C.02	Ground Water		X	
4.C.03	Characteristic Geotechnical Parameters for Axial Loads		X	
4.C.04	Characteristic Geotechnical Parameters for Lateral Loads		X	
4.C.05	Characteristic Geotechnical Parameters for Bending Loads		X	
4.C.06	Slope Stability			
4.C.07	Soil Chemistry		X	
4.C.08	Earthworks Specifications		X	

REMARKS:
FINAL GEOTECHNICAL MODEL AGREED WITH DESIGNER
BASED ON SUPPLEMENTAL GEOLOGICAL INVESTIGATION CARRIE
OUT IN JANUARY 2011.
PILES MODEL AGREED AS 'SOCKETED' IN LAVA LAYER FOR ALL W
PILE LENGTH TO BE MODIFIED AT ALL WTSs AS PER TABLE IN REF

	Evaluation Table N. 7 - STABILITY PIANSANO WIND FARM Type C Date: 2011-02-23 **Plinth Shape: HEXAGONAL (side length: 8m)** **Pile Diam.: 800 mm - Pile length: varies** **ITEMS**	**Structure Validation** (via independent calculations) Fully Satisfactory / Sufficient / Insufficient	**Design Validation** Fully Satisfactory / Sufficient / Insufficient / Omitted	**REMARKS**
	PILE CAPACITY (single pile): AXIAL LOAD			All issues clarified with Ing. Galbo during conference calls and meetings.
4.D.01	Discussion of various calc. methods and explanation of choice	X	X	
4.D.02	Evaluation of Axial Resistance of Single Pile	X	X	
4.D.03	Evaluation of Axial Resistance of Single Pile - seismic	X	X	
4.D.04	Evaluation of Down Drag	X	X	
	PILE CAPACITY (single pile): LATERAL LOAD			All issues clarified with Ing. Galbo during conference calls and meetings.
4.E.01	Discussion of various calc. methods and explanation of choice	X	X	
4.E.02	Evaluation of Lateral Resistance of Single Pile	X	X	
4.E.03	Evaluation of Lateral Resistance of Single Pile - seismic	X	X	
	PILE CAPACITY (single pile): BENDING MOMENT			All issues clarified with Ing. Galbo during conference calls and meetings.
4.F.01	Discussion of various calc. methods and explanation of choice	X	X	
4.F.02	Evaluation of Bending Resistance of Single Pile	X	X	
4.F.03	Evaluation of Bending Resistance of Single Pile - seismic (cinematic moment)	X	X	
	SETTLEMENTS			All issues clarified with Ing. Galbo during conference calls and meetings.
4.G.01	Single Pile	X	X	
	STIFFNESS			
4.H.01				
	SPECIFICATIONS			All issues clarified with Ing. Galbo during conference calls and meetings.
4.J.01	Integrity Checks during Construction	X	X	
4.J.02	Load Trials	X	X	

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10. *EVALUATION TABLE 8*

STRUCTURAL – Foundation Type C - Piled 800mm

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	Evaluation Table N. 6 - STRUCTURAL PIANSANO WIND FARM Foundation Type C - Piled Date: 2011-02-23 Plinth Shape: HEXAGONAL (side length: 8m) Pile Diam.: 800 mm - Pile length: varies ITEMS	Structure Validation (via independent calculations) Fully Satisfactory / Sufficient / Insufficient			Design Validation Fully Satisfactory / Sufficient / Insufficient / Omitted				REMARKS
	GENERAL								All issues clarified with Ing. Galbo during conference calls and meetings.
5.A.01	Clarity - Compliance with Chapt. 10 of NTC-2008					X			
5.A.02	Completeness of Design Documentation					X			
5.A.03	Software Validation					X			
	REINFORCEMENT: PILE HEADS								All issues clarified with Ing. Galbo during conference calls and meetings.
5.B.01	Steel Quantity - Static		X			X			
5.B.02	Steel Quantity - Seismic		X			X			
	REINFORCEMENT: PLINTH TOP AND BOTTOM MAT								All issues clarified with Ing. Galbo during conference calls and meetings.
5.C.01	Steel Quantity		X			X			
5.C.02	Steel Spacing		X			X			
	REINFORCEMENT: SHEAR								All issues clarified with Ing. Galbo during conference calls and meetings.
5.D.01	Steel Quantity		X			X			
5.D.02	Steel Spacing		X			X			
	REINFORCEMENT: ANCHORING STEEL RING								All issues clarified with Ing. Galbo during conference calls and meetings.
5.E.01	Pull Out								
5.E.02	Contact Pressure		X			X			
5.E.03	Punching Shear		X			X			
5.F.01	CONCRETE FATIGUE		X			X			All issues clarified with Ing. Galbo during conference calls and meetings.
5.G.01	CONCRETE DURABILITY BASED ON SOIL CHEMISTRY			X				X	

11. ANNEXES

v.	Annex 1 – Type C Foundation - Piled (12 No. Piles – 800 mm diameter) Independent Calculations Based on Findings of Supplementary Geological Investigation . ……..	Separate Document
vi.	Annex 2 – Type A Foundation- Shallow , Type B Foundation – Piled Independent Calculations – Structural - Shear……..	Separate Document
vii.	Annex 3 – REPORT Rev-02 (Abstract) …….....	Separate Document
viii.	Annex 4 – REPORT Rev-01 …….. …..	Separate Document

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12. APPENDICES

i. ***APPENDIX A – List of Documents Received and Reviewed***
ii. ***APPENDIX B – References***
iii. ***APPENDIX B – Authors Profiles***

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APPENDIX A
List of Documents Received and Reviewed

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APPENDIX B
REFERENCES

Standards / Norme e Raccomandazioni Generali

1. D.M. 14.01.2008: "Norme Tecniche per le Costruzioni", also referred to as NTC2008
2. Circ. Ministero Infrastrutture e Trasporti 02/02/2009 n. 617 – Istruzioni per l'applicazione delle « Nuove Norme Tecniche per le costruzioni » di cui al DM 14/01/2008.
3. UNI ENV 1997-1 – Eurocodice 7: "Progettazione Geotecnica, Parte 1: Regole Generali. Aprile 1997.
4. EN1998-1 – Eurocode 8: "Design of Structures for Earthquake Resistance; Part 5. Foundation, Retaining Structures and Geothecnical Aspect. December 2003.
5. UNI EN 1992-1-1: 2005: Eurocodice 2 - Progettazione delle strutture di calcestruzzo. Parte 1-1: Regole generali e regole per gli edifici
6. IEC 61400-1

Articles on General Geotechical Topics / Articoli e Pubblicazioni Generali

7. Associazione geotecnica Italiana: "Aspetti geotecnici della progettazione in zona sismica". Linee Guida. Ed. Marzo 2005.
8. Bowles J.E.: Foundation analysis and design. MacGraw Hill Libri Italia Ed., Milano, 1991.
9. Cestari F.: Prove geotecniche in sito; Geo-Graph Ed., Segrate, 1990.
10. Fardis – Carvalho – Elnashai – Faccioli – Pinto: Designers' guide to EN 1998-1 and EN 1998-5. Thomas Telford Editor, 2005
11. Bond – A. Harris "Decoding EC7" Taylor e Francis Edition, 2009.
12. Eucentre Pavia – Corso breve in geotecnica sismica – Pavia, Dicembre 2008.
13. Maugeri – Castelli "Analisi, modellazione e miglioramento sismico delle fondazioni di edifici esistenti", Rivista Italiana di Geotecnica, Ottobre – Dicembre 2006.
14. MIR 2008 – Opere geotecniche in condizioni sismiche.- Torino 2008

Articles on Bearing Capacity of Foundations in Static and Seismic Condition /
Articoli sulla capacità portante delle fondazioni in campo statico e sismico.

15. Brinch – Hansen: "A revised and extended formula for bearing capacity". Danish Geoth. Inst. Bull., 28, 1970.
16. Vesic: "Bearing capacity of shallow foundation" in Foundation Engineering Handbook. 1975
17. R.Richards – D.Elms – M.Budhu: "Seismic bearing capacity and settlement of foundation", Jour. Geoth. Engng. ASCE, Vol. 119, No.4, pp.662-674, 1993.
18. Franceschini – Carbonella Confronto tra metodi di calcolo della capacità portante di fondazioni superficiali in terreni sabbiosi in zona sismica. – INARCOS n.666 – Gennaio - Febbraio 2006.
19. S.Sarma – S. Iossifelis: "Seismic bearing capacity factor of shallow strip footings"; Geotechnique 40,No.2, pp.265-273, 1990.
20. R.Paolucci – A.Pecker: "Seismic bearing capacity of shallow strip foundation on dry soil", Soil and Foundation, Vol. 37, No.3, pp.95-105, 1997
21. M.Maugeri – D.Novità: "Numerical model for the evalutation of the soil inertia effects on bearing capacity" Proc. Int. Conf. On Soil Dynamics and Earthquake Eng. 2004.
22. J.Kumar – Mohan Rao: "Seismic bearing capacity factors for spread foundations"; Geotechnique 52.No.2, pp.79-88, 2002.
23. D.Choudhury – K.Subba Rao: "Seismic bearing capacity of shallow strip foundation" Geoth and Geol. Engng. No.23, pp.403-418, 2005

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24. G.Cortellazzo – A.Mazzuccato: "Eurocodice 7: fondazioni superficiali" RIG, n.2/3, pp.42-51, 1997
25. J.Kumar – Mohan Rao: "Seismic bearing capacity factors for spread foundations" Discussion; Geotechnique 52.No.2.
26. J.Kumar – Mohan Rao: "Seismic bearing capacity of foundations on slopes"; Geotechnique 53.No.3, pp.347-361, 2003.
27. Pecker: "Analytical formulae for the seismic bearing capacity of shallow strip foundation"; Proc. Of the 14th Int. Conf. on Soil Mech. And Found. Eng., Balkema, Hamburg, pp. 262-268.
28. Franceschini M, 2009 - Corso breve "Le fondazioni superficiali con le NT2008- teoria ed esempi pratici di progettazione"- Ordine dei geologi della regione Veneto- 04 Settembre 2009.
29. Franceschini M, 2010 – Corso breve "Le fondazioni superficiali – teoria ed applicazioni alla luce delle NTC 2008" – Ordine dei geologi regione Emilia – Romagna, 22 gennaio 2010

Articles on Determination of Coefficient of Subgrade Reaction /

Articoli sulla determinazione del valore del coefficiente di sottofondo

30. Geotechnet. – innovative Design Tools in Geotechnical - Final Report

31. Geotechnet. – innovative Design Tools in Geotechnical - Final Report – background document
32. Francesco Castelli, Michele Maugeri ANIDIS - SSN: Commentario al D.M. 16.1.1996; Cap. 3 - FONDAZIONI (par. B.10)
33. Plaxis Bullettin n.16
34. Jamshid Sadrekarimi - Comparative Study of Methods of Determination of Coefficient of Subgrade Reaction EJGE Vol. 14, Bund. E
35. Riccardo Berardi – Aspetti connessi al calcolo elastico dei cedimenti.

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APPENDIX D
Authors Profiles

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Dott. Ing. LUIGI CESARE SPERANZA

Career Outline

A baby-boomer from Rome, after receiving his Master's Degree in Civil Engineering (Structural) at the University of Rome "La Sapienza", Luigi served in the military as an Officer of the Italian Navy, thus following both traditions in his family: the Navy and engineering.

A stint as a researcher / assistant professor at "La Sapienza", Department of Mechanics of Materials, made him consider an academic career. The quest for adventure, however, prevailed and lead him to Africa, where he established his own firms in 1977 (Hidroad, a civil engineering contractor, and Italbeton, a water well drilling contractor).

Hidroad built airports (Sokoto International, Benin City Domestic, Abuja Control Tower), hospitals (Kwara State Rural Hospitals), industrial buildings, roads and telephone lines. Clients included the Nigerian Government and multinationals such as SIEMENS, AGIP, IMPRESIT. Italbeton designed and constructed water wells and water distribution systems in sub-Saharan Nigeria, pioneering the application of photovoltaic technology to ground water pumping. Clients included ELF AQUITAINE and DANIDA.

In the late 1980's the decline in the African economies lead LCS to return to Italy. He revived his ties with the University of Rome 'La Sapienza' (project SPIRITUS) and established an engineering firm specialized in design and construction of foundations and sub-surface infrastructures (telephone lines, power lines). Clients included TELECOM ITALIA, ALCATEL, SIRTI, SIELTE, TERNA, NEXANS, PRYSMIAN as well as large construction companies.

In his current capacity as a Director of IFME (the UNESCO-affiliated International Federation of Municipal Engineering), Luigi keeps researching and disseminating information on sustainable development, renewable energy and international co-operation.

Education and Academic Experience

- UNIVERSITA' "LA SAPIENZA", Rome, 1972.
  Master's Degree in Civil Engineering ("INGEGNERIA CIVILE INDIRIZZO B: STRUTTURE").
- UNIVERSITA' "LA SAPIENZA", Rome.
  Assistant Professor of Mechanics of Materials ("Assistente Volontario di Tecnica delle Costruzioni"):
  - Cattedra di Tecnica delle Costruzioni I (Prof. Remo Calzona), 1972
  - Cattedra di Tecnica delle Costruzioni II (Prof. Arrigo Carè), 1973

Professional Affiliations

- IFME (International Federation of Municipal Engineering), Paris.
  Member of the Board since 2005. Secretary-General from 2005 to 2006.

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Prof. Ing. CLAUDIO SCARPONI

Career Outline

A late baby-boomer, CS was born in Rome in 1953, the third son of an Army Officer and a Literature Teacher. He received his Master's Degree in Mechanical Engineering at the University of Rome "La Sapienza" in 1978. A couple of more years spent at 'La Sapienza' attending courses in aerospace technology revealed his call for an academic career.

A stint as a research engineer with the 'Centro Sperimentale Metallurgico (Centre for Experimental Research in Metallurgy) of the Italian state-owned IRI-FINSIDER industrial conglomerate ushered his taking the position of Structural Engineer in the Renewable Energies Department of AERITALIA (a subsidiary of IRI-FINSIDER).

His first assignments consisted in design and construction of wind generators components made of isotropic and anisotropic materials. Duties included component design, production process design and control, testing, installation, commissioning. In 1981 Claudio was put in charge for the design and development of wind turbine blades in composite-materials. In this capacity, CS represented Aeritalia in ENEA's (Italian National Board for Alternative Energies) research program 'Progetto Finalizzato Energetica 2 – Materiali e Tecnologie per Pale di Generatori di Grande Capacità' (Energy Project 2 – Materials and Technologies for Large Wind Turbine Rotors). He also represented his firm in UNIPLAST (Italian National Committee for Unification of Standards for Plastic Materials).

A position as Manager of the Aerospace Department Labs of 'La Sapienza', University of Rome, ushered his way into Academia (1996).

Since 2002 he is Full Professor of 'Tecnologia delle Costruzioni Aerospaziali' (Aerospace Structures Technology).

His co-operation with SCANGEA started in the late 1990's (Project SPIRITUS – integrated system of solar photovoltaic technology and IT) and continued with consulting for photovoltaic and wind projects.

He is currently involved in the creation of PRIE – Piano Regolatore per l'Installazione di Impianti Eolici – (Standards for the Design of Wind Parks) in the 'Murgia Tarantina' area of the Puglia Region in Italy-

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Dott. Ing. Marco FRANCESCHINI

Career Outline

Marco was born in Bologna in 1964. His vocation for the construction industry lead him to study surveying and then to continue his studies at the University of Bologna, where he received his Degree in Civil Engineering (Structural) in 1990. Ever since he has never severed contact with the University of Bologna, where he is a regular visiting lecturer. He splits his existence between his profession of structure designer, specialised in geotechnical sciences and foundations, the university and his hobbies (golf, tennis and rock music). His co-operation with SCANGEA started in 2005, with design of towers for high-voltage power lines.

Professional Affiliations

- AGI (Associazione Geotecnica Italiana)
  Member since 2000

Recent articles on calculation techniques for foundations in seismic condition

- *Atti del XXII convegno Nazionale di geotecnica* - Palermo 22-24 settembre 2004 pagg. 365-372
  Articolo presentato: "*Studio per una corretta analisi dei recenti fenomeni di dissesto degli edifici a Bologna dovuti a crisi del sistema di fondazioni*".
- Rivista: Inarcos - Numero: 641 Luglio Agosto 2003
  Articolo presentato: "*Progetto, realizzazione e collaudo di micropali valvolati di grande portata. L'esempio di fondazioni per un grande capannone*".
- Rivista: Inarcos - Numero: 654 Novembre 2004
  Articolo presentato: "*Una torre per telecomunicazioni a Modena. Progetto e realizzazione di una torre in cemento armato a Modena*".
- Rivista: Inarcos - Numero: 666 Gennaio/Febbraio 2006
  Articolo presentato: "*Confronto tra i metodi di calcolo delle capacità portanti di fondazioni superficiali in terreni sabbiosi in zona sismica*".

Recent Lectures

- Lezione. 04 Settembre 2009. "*Le fondazioni superficiali in condizioni statiche e in condizioni sismiche*" - Teoria, procedure ed esempi applicativi alla luce delle Norme Tecniche per le Costruzioni (D.M. 14/01/2008). Organizzazione a cura dell'Ordine Regionale e dei Geologi del Veneto. Mestre / (5 ore).
- Lezione. 08 Giugno 2009. "*Le fondazioni con le NT2008: teoria ed esempio pratico di progettazione*", Ordine Ingegneri di Bologna / (2 ore).
- Lezione. 07 Maggio 2009. "*Le fondazioni con le nuove normative: esempio pratico di progettazione*". Università degli studi di Bologna / (3 ore).
- Luglio 2007. "*Fondazioni superficiali in campo statico e sismico sulla base delle n.t.2008 (in bozza) e del comportamento sismico dei terreni*". Università degli studi di Bologna / (3 ore).
- Giugno 2007. "*Fondazioni superficiali in campo statico e sismico sulla base delle n.t.2008 (in bozza) e del comportamento sismico dei terreni*". Università degli studi di Bologna / (3 ore).

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