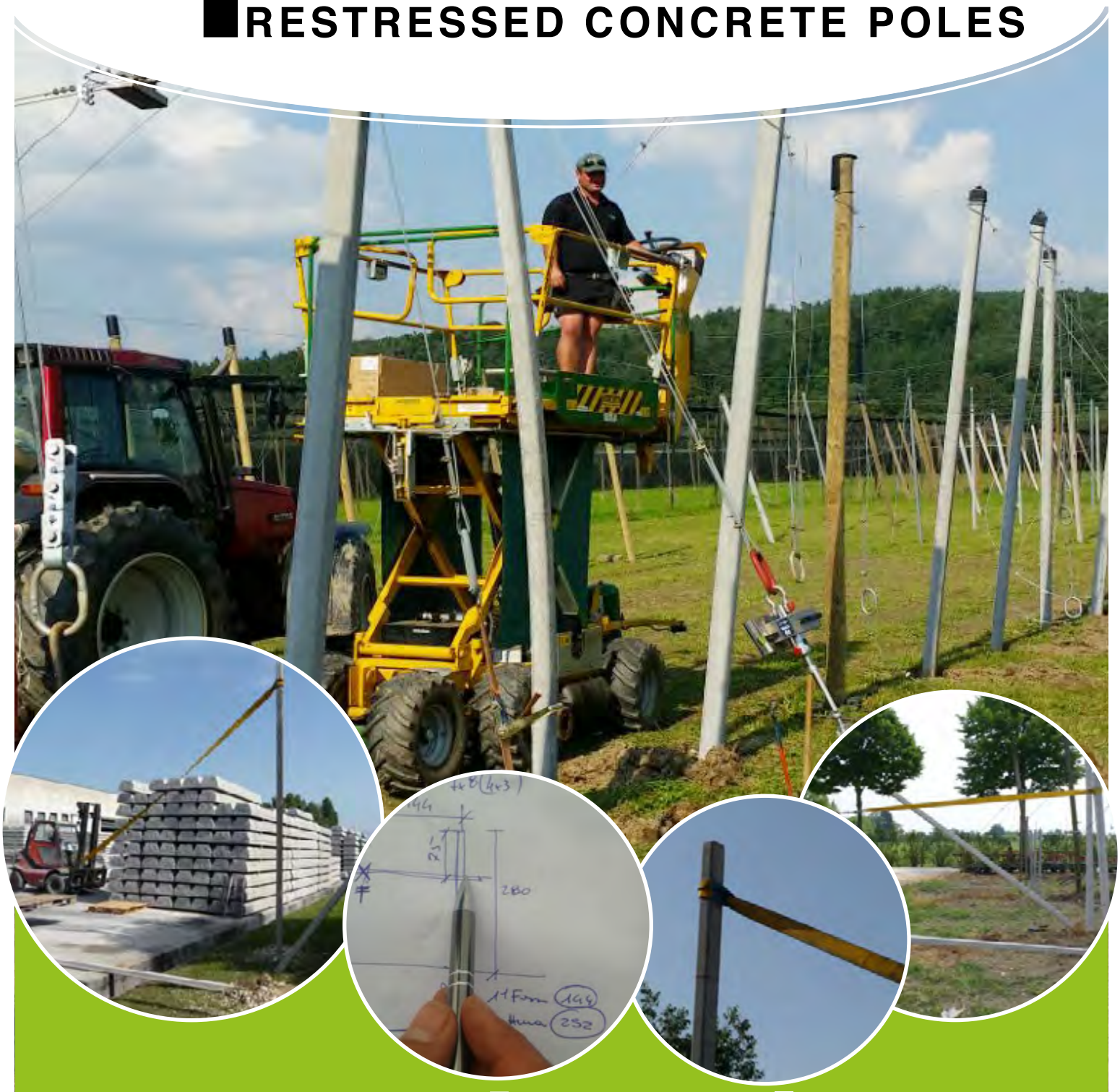
spinazzè

PRESTRESSED CONCRETE POLES



Technical Data&Tests

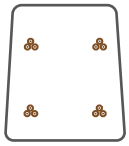
www.spinazzegroup.com info@spinazzegroup.com

1. TESTED PRODUCTS

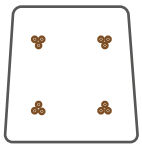
All tests have been conducted on prestressed concrete poles and on steel poles.

Concrete Poles

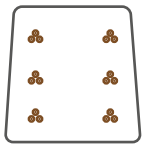
7x7
4 BRAIDS X 2 WIRES
(11 Kg/m)



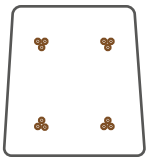
7x8
4 BRAIDS X 3 WIRES
(12,8 Kg/m)



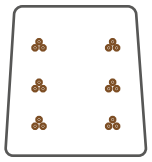
8,5x8,5
4 BRAIDS X 3 WIRES
(16,4 Kg/m)



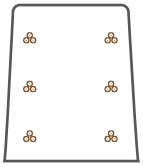
8,5x8,5 REINF
6 BRAIDS X 3 WIRES
(16,4 Kg/m)



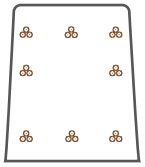
9x9,5
4 BRAIDS X 3 WIRES
(19 Kg/m)



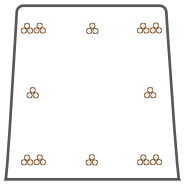
9x9,5 REINF
6 BRAIDS X 3 WIRES
(19 Kg/m)



8X12
6 BRAIDS X 3 WIRES
(24 Kg/m)



8x12 REINF
8 BRAIDS X 3 WIRES
(24 Kg/m)



13x14
12 BRAIDS X 3 WIRES
(46 Kg/m)

Steel Poles

WEATHERING STEEL POLE (COR-TEN)
THIKNESS: 150 - 180 mm
LENGTH: 2.50 - 2.80 m
PROFILE: U
WEIGHT: 2,05 Kg/m

2. TEST 2174/TV - LOADING, CRUSHING, BENDING TEST

2.1 EQUIPMENT DESCRIPTION: UAD3 AND LOAD CELL

A load cell is used in order to detect the applied force. The load cell is connected to the UAD3 unit shows the applied force in kN.

LOAD CELL SPECIFICATIONS
range ± 250 kN
sensitivity 10 daN
accuracy ± 0,1 kN

All instruments are periodically tested at EMME Service S.p.a. Calibration Laboratory as provided by the Quality Control Manual.


UAD-3 UNIT


LOAD CELL

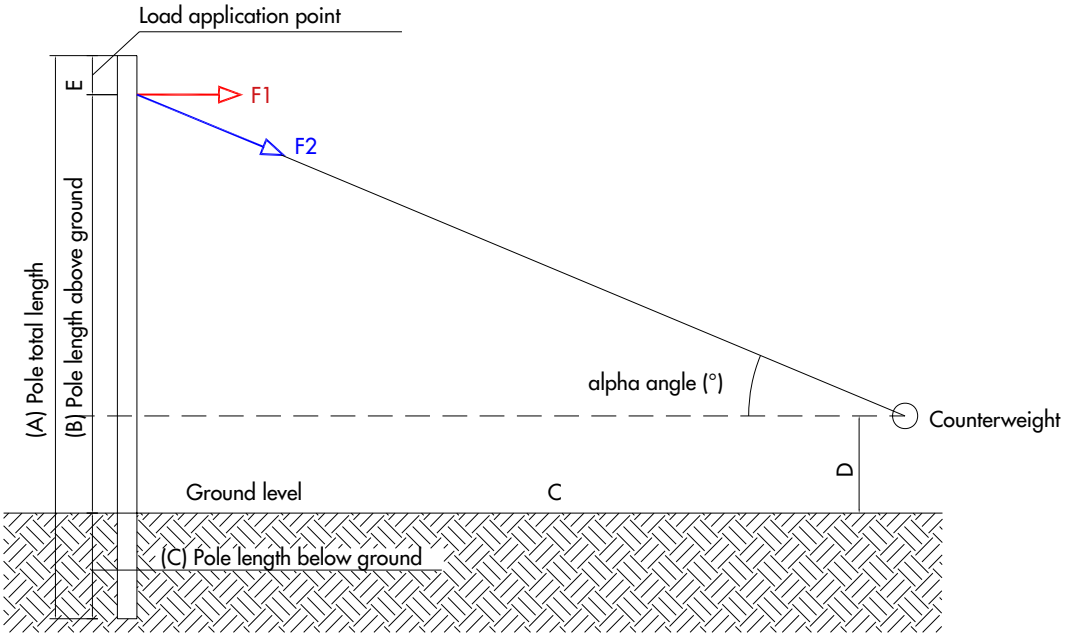
2.2 TEST METHOD

All tests have been carried on simulating the actual use of concrete and steel products. The poles have been hammered into the ground at different depth between 70 and 115 cm. Each pole was subjected to a force applied to its free end by means of elastic bands and chains counterbalanced on the ground by a vehicle. The tested products have been brought to breaking point (cement poles) and to bending / torsion (steel poles).


FORCE APPLICATION POINT


COUNTERWEIGHT VEHICLE

Two loading conditions have been set: perpendicular pulling and oblique pulling.



LOAD ARRANGEMENT

OBLIQUE FORCE APPLICATION

HORIZONTAL FORCE APPLICATION

2.3 RESULTS

PRESTRESSED CONCRETE POLES													
Pole (N°)	Section (cm)	Scaffolding	Weight (KN/m)	A (m)	B (m)	C (m)	E (m)	(°)	F (KN)	F1 (KN)	F2 (KN)	F3 (KN)	K (m)
1	13 x 14	12 trecce 3x2.25 mm	0.45	8.50	7.60	0.90	0.25	--	--	0.90	--	0.80	0.45
2	13 x 14	12 trecce 3x2.25 mm	0.45	6.00	5.15	0.85	0.25	20	1.80	--	1.69	1.00	0.35
3	8 x 12	6 trecce 3x2.25 mm	0.25	6.00	5.15	0.85	0.25	20	0.90	--	0.84	0.80	0.45
4	7 x 8	4 trecce 3x2.25 mm	0.128	5.00	4.10	0.90	0.25	20	0.90	--	0.84	0.70	0.50
5	8 x 12	6 trecce 3x2.25 mm	0.25	7.00	6.15	0.85	0.25	20	1.00	--	0.94	0.70	0.45
6	8.5 x 8.5	4 trecce 3x2.25 mm	0.165	5.60	4.60	1.00	0.25	20	0.80	--	0.75	0.70	0.60
7	8.5 x 8.5	6 trecce 3x2.25 mm	0.165	6.00	5.10	0.90	0.25	20	0.80	--	0.75	0.70	0.40
8	8 x 12	6 trecce 3x2.25 mm	0.25	5.70	4.85	0.85	0.25	20	1.50	--	1.41	1.20	0.35
9	8.5 x 8.5	6 trecce 3x2.25 mm	0.165	5.50	4.60	0.90	0.25	20	1.10	--	1.03	0.90	0.70
10	9 x 9.5	6 trecce 3x2.25 mm	0.20	5.50	4.55	0.95	0.25	20	1.20	--	1.13	1.00	0.40
11	8.5 x 8.5	4 trecce 3x2.25 mm	0.165	5.50	4.70	0.80	0.25	20	0.90	--	0.84	0.80	0.77
12	7 x 7	4 trecce 3x2.25 mm	0.11	4.80	4.00	0.80	0.25	20	0.80	--	0.75	0.70	0.60
13	8.5 x 8.5	4 trecce 3x2.25 mm	0.165	4.70	3.95	0.75	0.25	20	1.00	--	0.94	0.80	0.60
14	8 x 12	6 trecce 3x2.25 mm	0.25	3.30	2.50	0.80	0.25	20	Pole pulled out				
15	9 x 9.5	6 trecce 3x2.25 mm	0.20	2.80	2.10	0.70	0.25	--	--	2.10	--	1.50	0.50
16	9 x 9.5	4 trecce 3x2.25 mm	0.20	2.80	2.10	0.70	0.25	--	--	1.70	--	1.60	0.50
17	8.5 x 8.5	4 trecce 3x2.25 mm	0.165	2.80	2.05	0.75	0.25	--	--	2.30	--	1.20	0.35
18	7 x 7	4 trecce 3x2.25 mm	0.11	2.80	2.05	0.75	0.25	--	--	1.00	--	1.20	0.30
19	8 x 12	8 trecce 3x2.25 mm	0.25	4.50	3.60	0.90	0.25	--	--	3.10	--	2.20	0.55
20	8.5 x 8.5	6 trecce 3x2.25 mm	0.165	4.70	3.90	0.80	0.25	--	--	1.30	--	1.00	0.50
21	9 x 9.5	6 trecce 3x2.25 mm	0.20	4.60	3.80	0.80	0.25	--	--	1.60	--	1.30	0.68
22	9 x 9.5	6 trecce 3x2.25 mm	0.20	4.00	3.25	0.75	0.25	--	--	1.50	--	1.30	0.80
23	7 x 8	4 trecce 3x2.25 mm	0.128	4.20	3.35	0.85	0.25	--	--	1.10	--	0.90	0.70

A = Pole total length
B = Pole length above ground
C = Pole length below ground
E = Force application point (taken from the pole's free end)
a = Force inclination angle
K1 = Bending / torsion point (taken from the pole's ground end)

F = Maximum oblique force at breaking point
F1 = Equivalent horizontal force at breaking point
F2 = Applied horizontal froce at breaking point
F3 = Cracks begin to appear
K = Breaking point
(*) = Windbraced pole at 2.30 m from ground level

PRESTRESSED CONCRETE POLES													
Pole (N°)	Section (cm)	Scaffolding	Weight (KN/m)	A (m)	B (m)	C (m)	E (m)	(°)	F (KN)	F1 (KN)	F2 (KN)	F3 (KN)	K (m)
24	8.5 x 8.5	4 trecce 3x2.25 mm	0.165	4.00	3.25	0.75	0.25	--	--	1.20	--	1.10	0.60
25	7 x 7	4 trecce 3x2.25 mm	0.11	4.50	3.75	0.75	0.25	--	--	1.00	--	0.80	0.70
26	9 x 9.5	6 trecce 3x2.25 mm	0.20	5.50	4.35	1.15	0.25	25	1.00	0.90	--	0.80	1.00
27	9 x 9.5	6 trecce 3x2.25 mm	0.20	5.50	4.40	1.10	0.25	25	1.20	1.09	--	1.00	0.95
28	8.5 x 8.5	6 trecce 3x2.25 mm	0.165	5.50	4.45	1.05	0.25	25	0.80	0.73	--	0.70	0.80
29	8.5 x 8.5	6 trecce 3x2.25 mm	0.165	5.50	4.35	1.15	0.25	25	1.00	0.90	--	0.80	1.00
30	7 x 8	4 trecce 3x2.25 mm	0.128	5.00	3.90	1.10	0.25	25	0.70	0.63	--	0.60	1.05
31 (*)	8 x 12	8 trecce 3x2.25 mm	0.25	6.00	4.85	1.15	0.25	30	3.80	3.29	--	3.00	2.30
32	8 x 12	8 trecce 3x2.25 mm	0.25	6.00	5.10	0.90	0.25	30	1.40	1.21	--	1.30	0.75
33	13 x 14	12 trecce 3x2.25 mm	0.45	8.00	6.80	1.20	0.25	30	1.60	1.38	--	1.50	1.00
34	13 x 14	12 trecce 3x2.25 mm	0.45	8.00	6.95	1.05	0.25	30	2.60	2.25	--	2.20	0.95

WEATHERING STEEL POLES (COR-TEN)													
Pole (N°)	Section (cm)	Metal Sheet Thickness	Weight (KN/m)	A (m)	B (m)	C (m)	E (m)	(°)	F (KN)	F1 (KN)	F2 (KN)	F3 (KN)	K (m)
35	U	15	0.017	2.50	1.80	0.70	0.25	--	--	0.50	--	---	0.70
36	U	15	0.017	2.50	1.80	0.70	0.25	--	--	0.90	--	--	0.70
37	U	18	0.018	2.80	2.10	0.70	0.25	--	--	1.00	--	--	0.70
38	U	18	0.018	2.80	2.05	0.75	0.25	--	--	0.60	--	--	0.60
39	U	18	0.018	2.80	2.05	0.75	0.25	--	--	0.60	--	--	0.7

A = Pole total length
B = Pole length above ground
C = Pole length below ground
E = Force application point (taken from the pole's free end)
a = Force inclination angle
K1 = Bending / torsion point (taken from the pole's ground end)

F = Maximum oblique force at breaking point
F1 = Equivalent horizontal force at breaking point
F2 = Applied horizontal froce at breaking point
F3 = Cracks begin to appear
K = Breaking point
(*) = Windbraced pole at 2.30 m from ground level

POLE BREAKING

POLE CRACKING

POLE BENDING AND TORSION

3. 2175/TV TEST - LOADING TEST

3.1 EQUIPMENT DESCRIPTION

3.1.1 DATA SHUTTLE EXPRESS UNIT AND POTENTIOMETER SENSORS

Potentiometer sensors connected to a data processing station have been used for measuring structural failure. Data Shuttle Express SN187 is constitued by:
- Personal computer running DasyLab software
- "Midori" potentiometer sensors (5KΩ LP-50 and LP-100 10V DC.)

Technical specifications of the sensors:
Range 50-100 mm
Sensitivity ± 0,001 mm
Linearity 99.6 %

3.1.2 GS03 TESTER

Applied force calculation has been carried on by GS03 equipment which is constitued by:
- force measuring unite GS03
- bidirectional load cell TCQ200kN
- personal computer
- hydraulic control unit and jacks


Data Shuttle Control Unit


Potentiometer Sensor

3.1.3 LOAD CELL

The load cell, connected to the computer's alphanumeric display, is used to measure the applied force. The cell was installed directly onto the hydraulic jacks' stem.
The measuring chain tool-cable-unit has a maximum error ratio of ±1,5%.

Load cell specifications:
- Range ± 250 kN
- Sensitivity 10 daN
- Linearity 99.4 %

3.1.4 HYDRAULIC JACK

An Hydraulic Jack "B1" with 70,49 cm2 section has been used for load application.

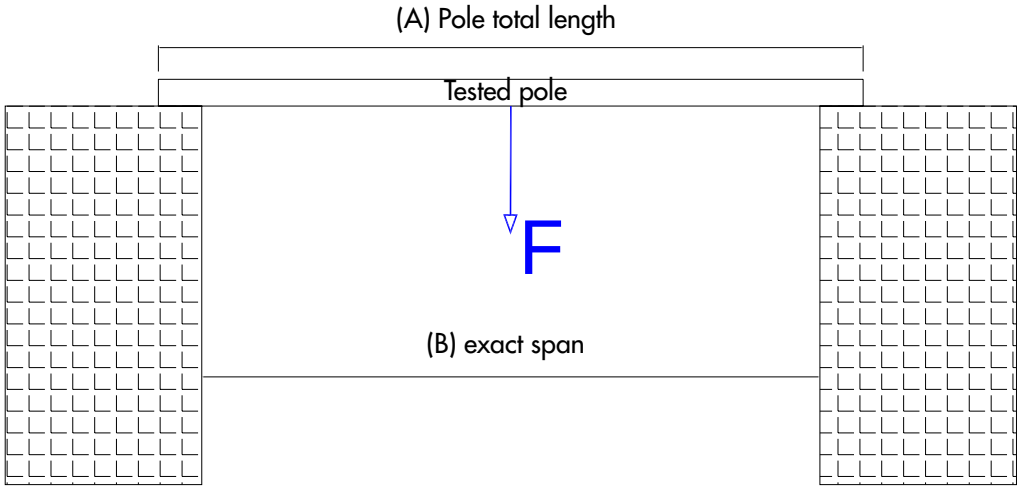
Hydraulic Jack B1

Load Cell

All equipment is periodically tested at EMME Service S.p.a. Calibration Laboratory as provided by the Quality Control Manual.

3.2 TESTING PROCEDURE

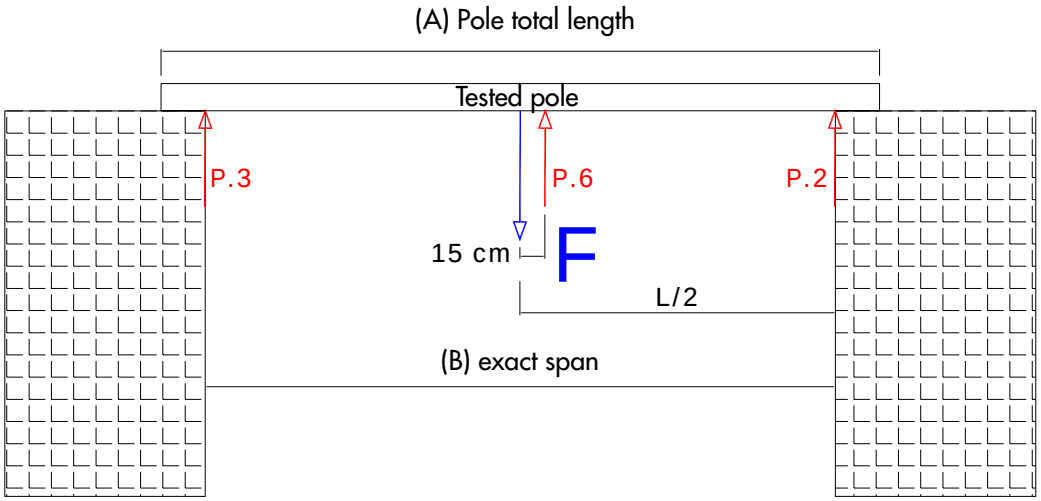
All tests have been conducted on prestressed concrete poles (described at 2.) applying a force on the middle point by means of a hydraulic jack counterweighted on the ground by a mechanical wedge. During tests the load application has been conducted gradually, monitoring force and failures step by step from the appearance of cracks to the final breaking of the element.



Load arrangement scheme

Testing area general view

3.3 SENSOR ARRANGEMENT



Sensor arrangement scheme

3.4 RESULTS

Pole (N°)	Section (cm)	Scaffolding	Weight (KN/m)	A (m)	B (m)	F (KN)	F1 (KN)	Cracking (mm)			Breakage (mm)		
								P.2	P.6	P.3	P.2	P.6	P.3
1	9 x 9.5	4 trecce 3x2.25 mm	0.20	4.00	3.80	2.80	2.00	4.97	46.10	5.24	14.17	134.70	15.12
2	8.5 x 8.5	4 trecce 3x2.25 mm	0.165	4.00	3.80	2.70	2.00	8.92	78.00	9.14	14.31	127.62	15.16
3	9 x 9.5	6 trecce 3x2.25 mm	0.20	4.00	3.80	3.35	2.00	3.35	29.64	3.72	11.92	110.40	13.69
4	8.5 x 8.5	6 trecce 3x2.25 mm	0.165	4.00	3.80	2.90	2.00	6.70	63.90	6.70	13.48	134.01	15.05
5	13 x 14	12 trecce 3x2.25 mm	0.45	4.00	3.80	14.20	7.00	2.58	15.63	2.79	10.74	82.51	11.30
6	8 x 12	8 trecce 3x2.25 mm	0.25	4.00	3.80	6.20	5.50	5.00	46.91	6.49	6.21	59.61	8.00
7	7 x 8	4 trecce 3x2.25 mm	0.128	4.00	3.80	2.25	1.50	9.97	88.63	10.23	19.82	169.42	20.89
8	7 x 7	4 trecce 3x2.25 mm	0.11	4.00	3.80	2.10	1.20	7.90	63.57	8.65	17.72	139.60	19.03
9	7 x 7	4 trecce 2x2.25 mm	0.11	4.00	3.80	1.35	1.00	7.50	68.43	8.44	15.68	142.58	17.31
10	9 x 9.5	4 trecce 3x2.25 mm	0.20	2.80	2.60	3.00	1.50	1.50	8.32	3.50	7.31	50.53	10.45
11	9 x 9.5	6 trecce 3x2.25 mm	0.20	2.80	2.60	5.05	3.50	3.13	17.53	2.85	8.05	49.80	8.78
12	7 x 7	4 trecce 3x2.25 mm	0.11	2.80	2.60	2.90	2.00	7.41	33.36	6.98	13.87	75.55	14.86
13	8.5 x 8.5	6 trecce 3x2.25 mm	0.165	2.80	2.60	5.10	3.50	3.86	22.34	4.55	8.30	51.85	9.14

A= pole total length
B= Exact opening between supports
F= Applied force at breaking point
F1= Applied force when cracks appear

Failure observed at the appearance of cracks
Failure observed at the object's breakage

Cracks

Pole breakage

All tests were conducted by engineering firm 4Emme Service Spa.

spinazzè
RESTRESSED CONCRETE POLES

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