

spinazzo

RESTRESSED CONCRETE POLES



Technical Data & Tests

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Spinazzè Group Spa appointed **4Emme Service Spa**, an engineering company specialized in structural tests, to test prestressed concrete poles at Spinazzè headquarters and production base in San Michele di Piave (TV), Italy.

The tests consist in:

- 34 traction tests on prestressed concrete poles
- 13 bending tests on prestressed concrete poles

All tests were conducted on 2009 and 2013. What follows is a summary of the results for commercial use. The complete technical sheets are available for consultation at Spinazzè headquarters in San Michele di Piave.

The following persons were present at the testing site.

For Spinazzè Group:

Robert Spinazzè

For 4 Emme Service:

Dario Altinier

Thomas Pavan

Morris Casagrande

Fabrizio Cisera



1. TESTED PRODUCTS

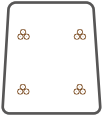
All tests have been conducted on prestressed concrete poles manufactured in Italy by Spinazzè.



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



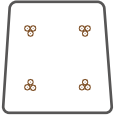
7x7 REINF (11 Kg/m)
4 X 3 CABLE WIRES



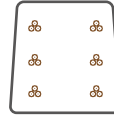
7x8 (12,8 Kg/m)
4 BRAIDS X 3 WIRES



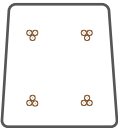
7x8 REINF (12,8 Kg/m)
6 X 3 CABLE WIRES



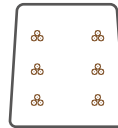
8,5x8,5 (16,4 Kg/m)
4 BRAIDS X 3 WIRES



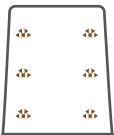
8,5x8,5 REINF (16,4 Kg/m)
6 BRAIDS X 3 WIRES



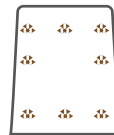
9x9,5 (19 Kg/m)
4 BRAIDS X 3 WIRES



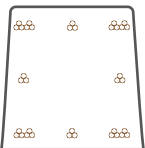
9x9,5 REINF (19 Kg/m)
6 BRAIDS X 3 WIRES



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



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



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

2. 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.

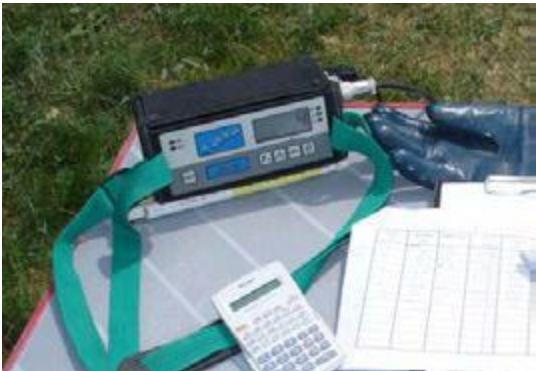
LOAD CELL SPECIFICATIONS

range ± 250 kN

sensitivity 10 daN

accuracy $\pm 0,1$ 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 prestressed concrete 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).



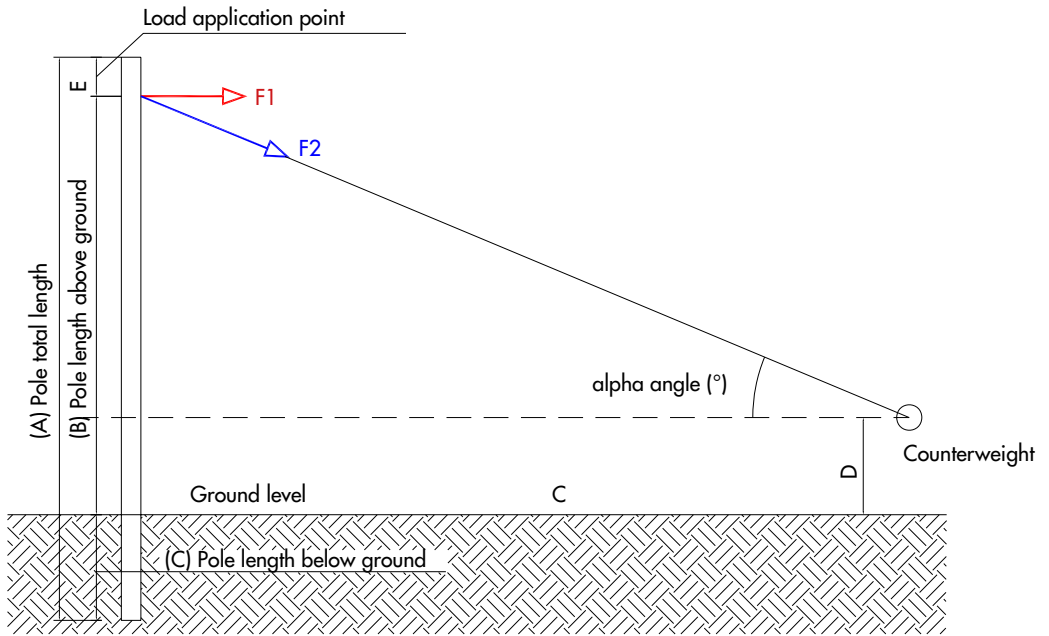
FORCE APPLICATION POINT



COUNTERWEIGHT VEHICLE

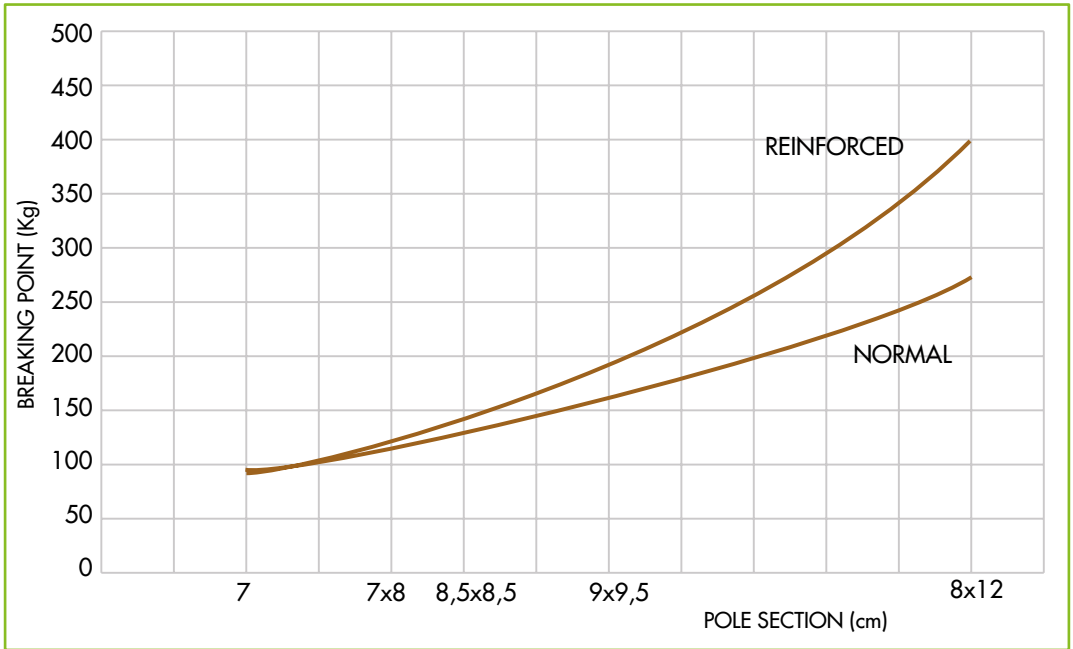
LOAD ARRANGEMENT

Two loading conditions have been set: oblique pulling (1) and perpendicular pulling (2).

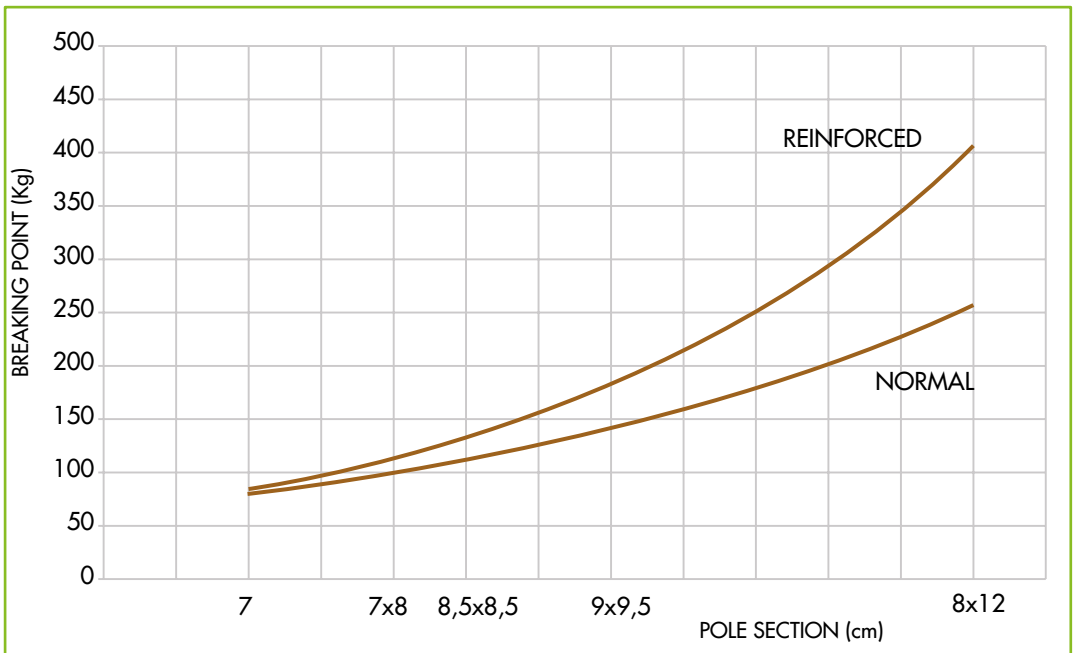


POLE LENGTH: **3.00 m**

HORIZONTAL TRACTION TESTS RESULT



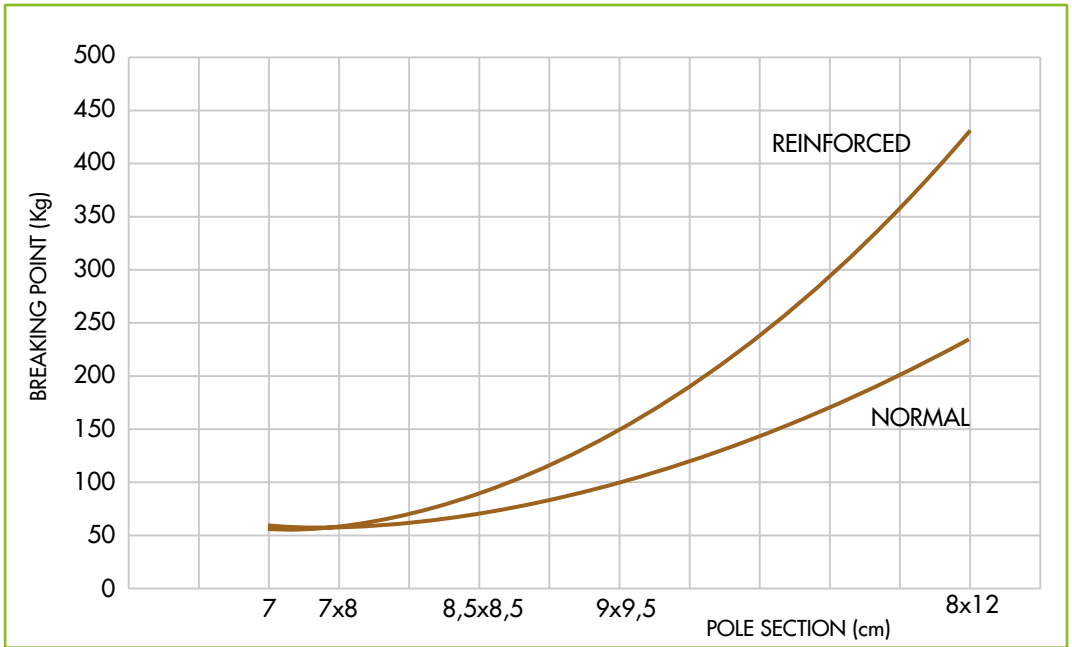
POLE LENGTH: **3.50 m**



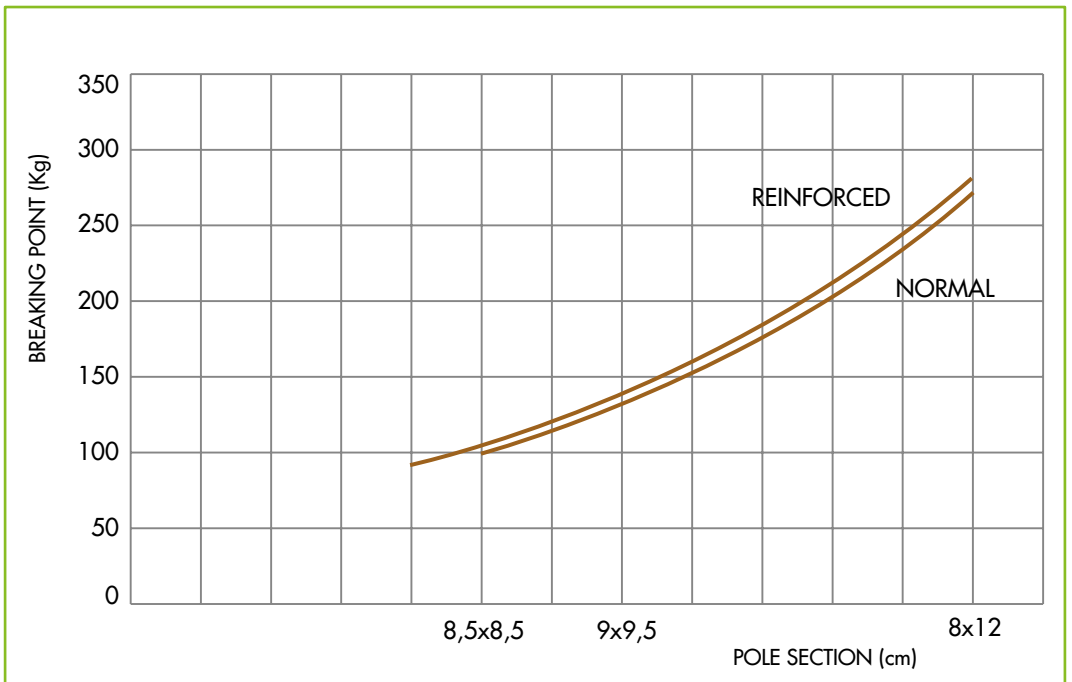
These graphs shows that the breaking point of the poles increases as the pole section increase. On average, reinforced poles requires higher strength in order to be broken. This is most evident from section 8,5 x 8,5 up.

POLE LENGTH: **4.50 m**

HORIZONTAL TRACTION TESTS RESULT



POLE LENGTH: **5.00 m**



For poles shorter than 3,00 m the reinforcement does not show a considerable increase in the performance. For poles longer than 3,00 the reinforcement gives more strength and resistance. The reinforcement gives 10% more resistance on average for the same pole length, for longer poles the resistance increase about 15%.

OBLIQUE TRACTION TEST (alpha 20°)

PRESTRESSED CONCRETE POLES				
Pole Section (cm)	Pole Length (m)	Pole Length Below Ground (cm)	Maximum Force (Kg)	Breaking Point (cm)
7 x 7 R	4.80	80	80	60
7 x 8	5.00	90	90	90
8.5 x 8.5 R	5.50	100	100	80
9 x 9.5 R	5.50	100	120	95
8 x 12 R	6.00	90	140	75
13 x 14	6.00	90	180	35

In the table above we see a few telling examples of test results for the oblique traction test with an angle of 20°.



POLE BREAKING



POLE CRACKING



3. 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 constituted by:

- Personal computer running DasyLab software
- "Midori" potentiometer sensors (5K Ω LP-50 and LP-100 10V DC.)

Technical specifications of the sensors:

Range 50-100 mm

Sensitivity $\pm 0,001$ mm

Linearity 99.6 %

3.1.2 GS03 TESTER

Applied force calculation has been carried on by GS03 equipment which is constituted 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 $\pm 1,5\%$.

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

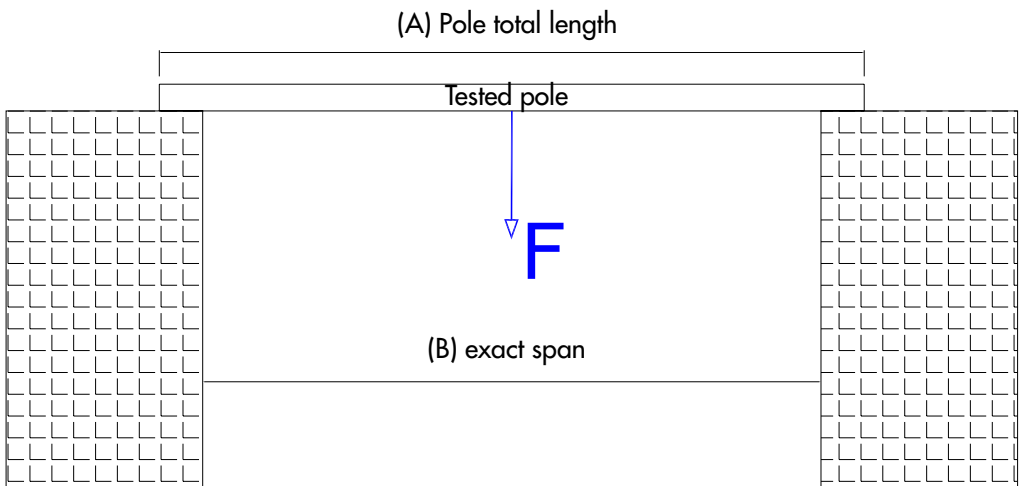


Load Cell

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

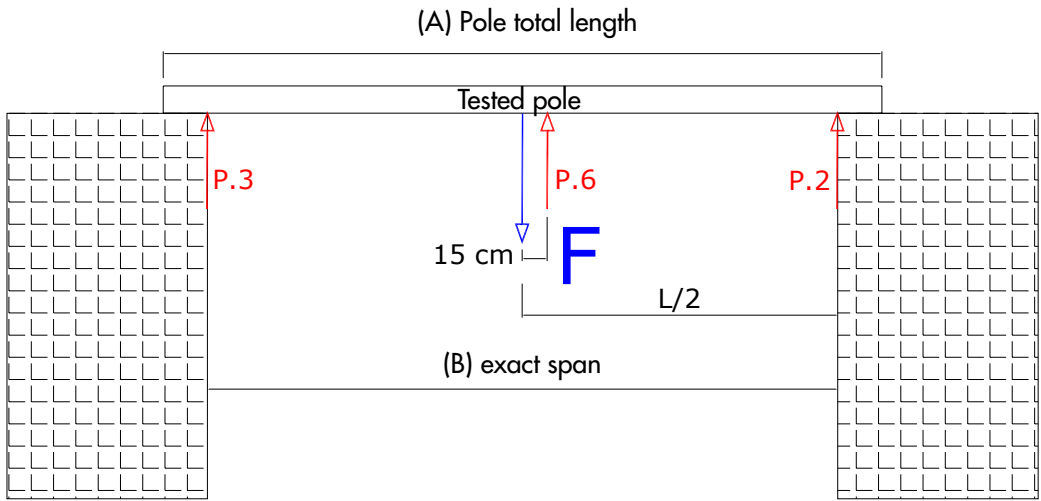
3.2 TESTING PROCEDURE

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

3.3 SENSOR ARRANGEMENT



Sensor arrangement scheme

3.4 LOAD APPLICATION / SUMMARY OF RESULTS

PRESTRESSED CONCRETE POLES		
Pole Section (cm)	Pole Length (m)	Maximum Force (Kg)
7 x 7 R	4.00	210
7 x 8	4.00	225
8.5 x 8.5 R	4.00	290
9 x 9.5 R	4.00	505
8 x 12 R	4.00	620
13 x 14	4.00	1420



Cracks



Pole breakage



Testing area general view



**SCLEROMETRIC
TEST: 400 Kg**

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RESTRESSED CONCRETE POLES

Spinazzè Group Spa
via Garibaldi 39, 31010 Cimadolmo
San Michele di Piave (TV) - Italy
tel +39 0422 743036 - fax +39 0422 743498
info@spinazzegroup.com
www.spinazzegroup.com

