



High Pressure Menard Pressuremeter Tests (MPT) in London Thanet Sands

Catherine Jacquard
Michel Rispal & Jean-Yves de Lamballerie

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The project

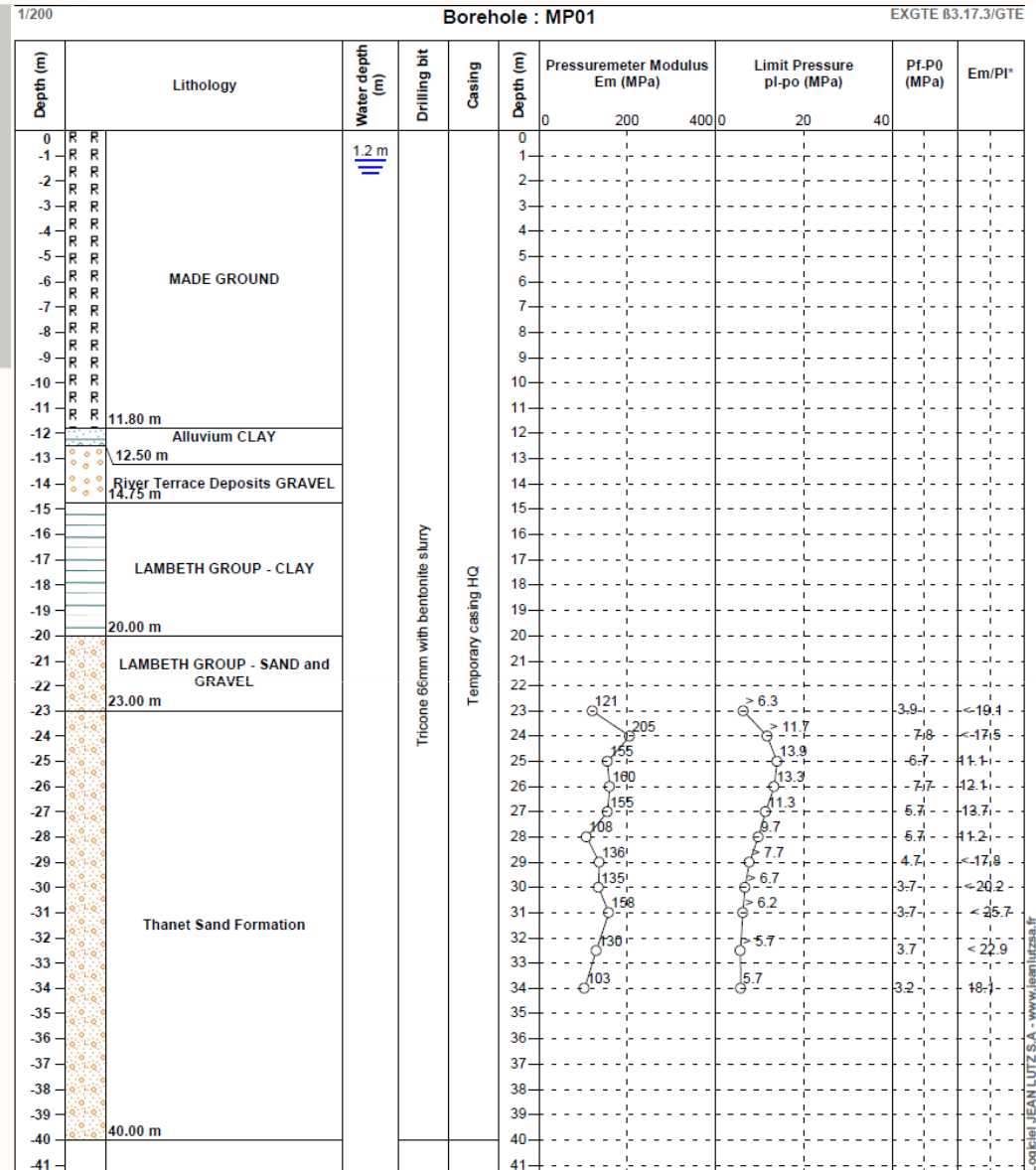
- ✓ Stratford, North-East of London



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Geological log

- ✓ Made ground (12m)
- ✓ Alluvial deposits (15m)
- ✓ Lambeth group clay (20m)
- ✓ Lambeth group sand and gravel (23m)
- ✓ Thanet sands (40m)



MPT High pressure equipment

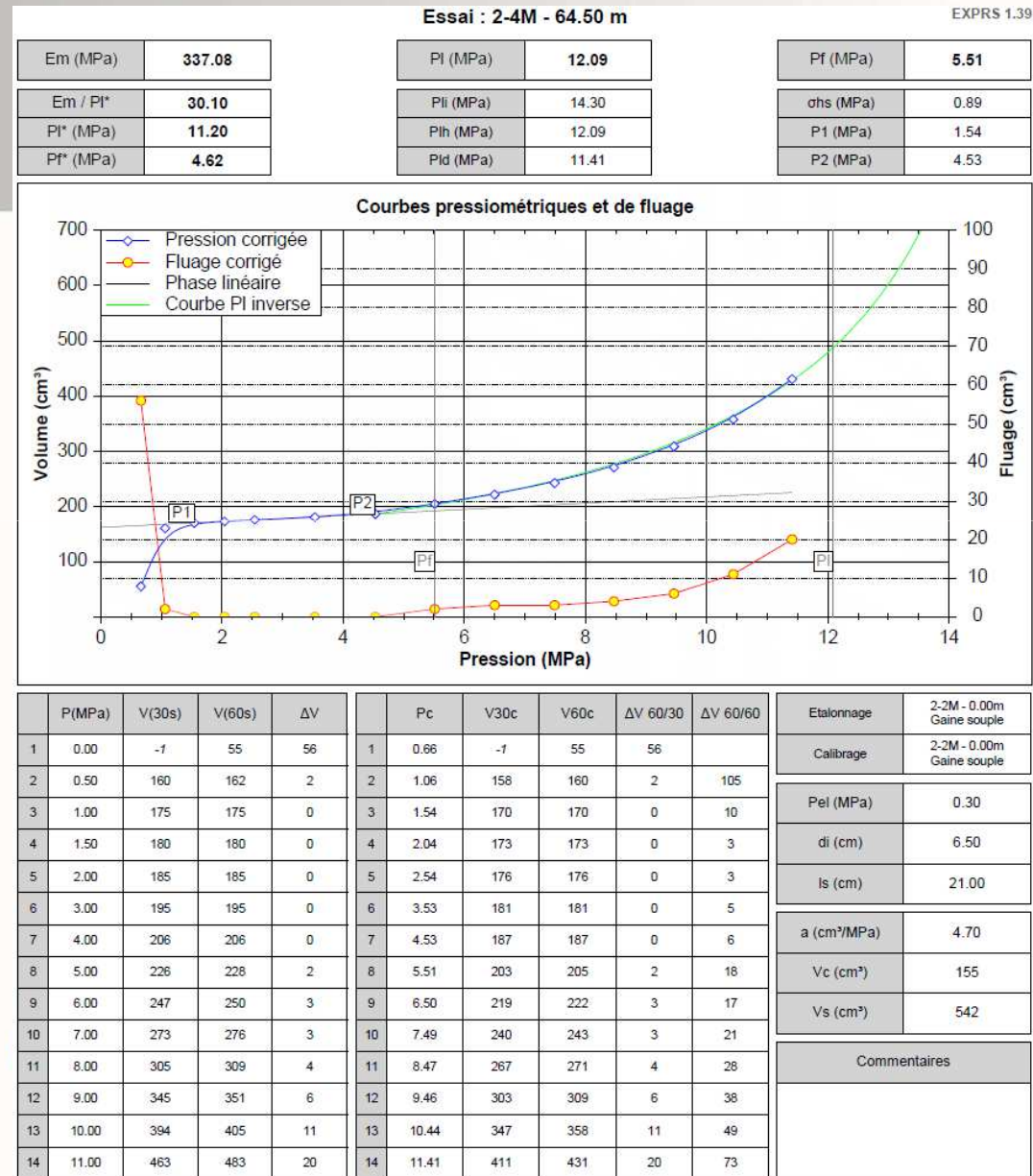
- ✓ Pressure-volume controller FONDASOL allowing measures up to 15MPa pressures



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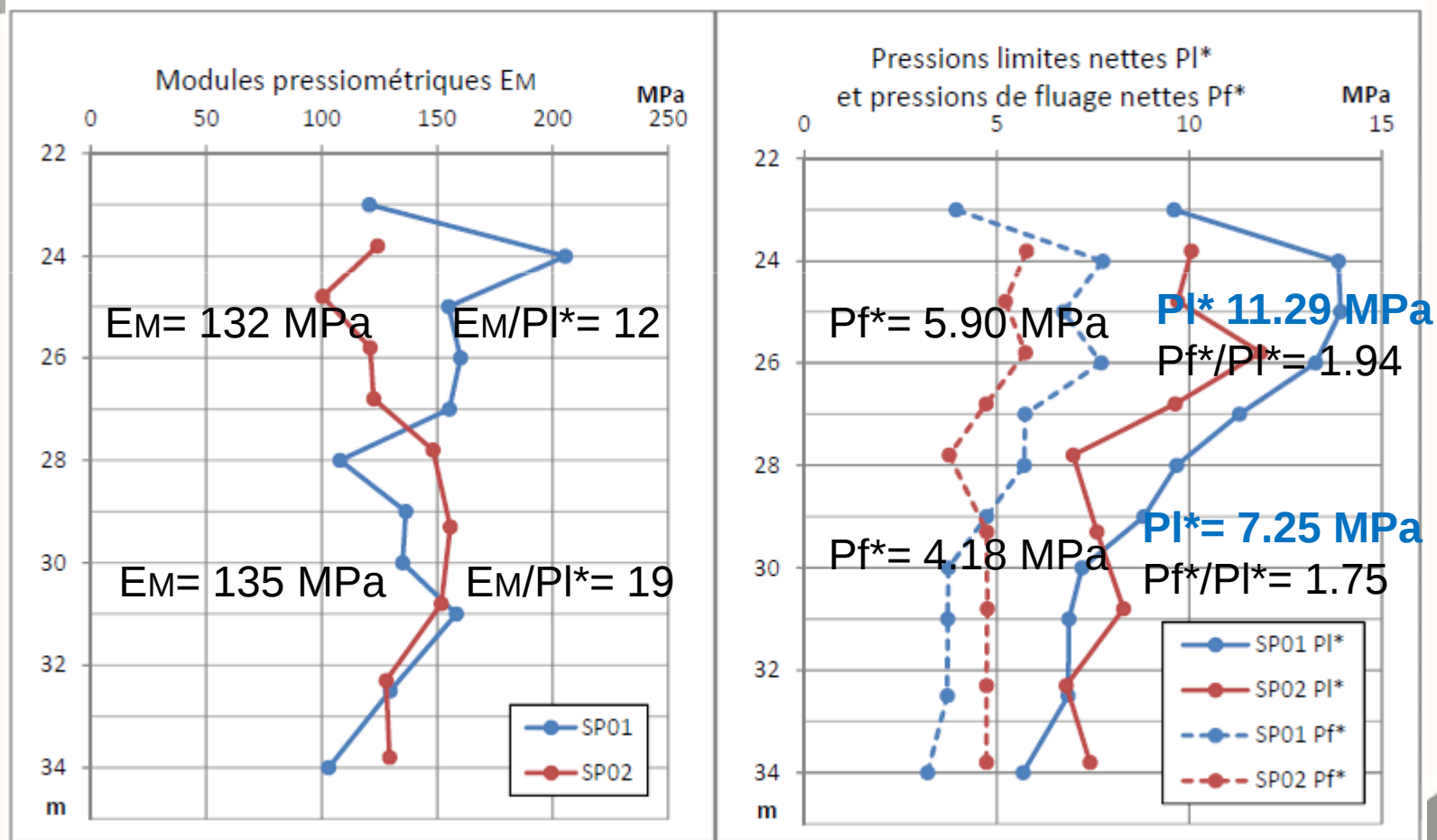
An example of MPT curve

- ✓ 64.5m below GL
- ✓ Creep pressure:
 $P_f = 5.5 \text{ MPa}$
- ✓ Limit pressure
 $P_l = 12.1 \text{ MPa}$
- ✓ Pressuremeter modulus
 $E_M = 337 \text{ MPa}$



Analysis of the results

- ✓ Pressuremeter logs enable to characterize two families in Thanet sands:



Comparison with SPT and fines content

- SPT doesn't show any modification of resistance with depth

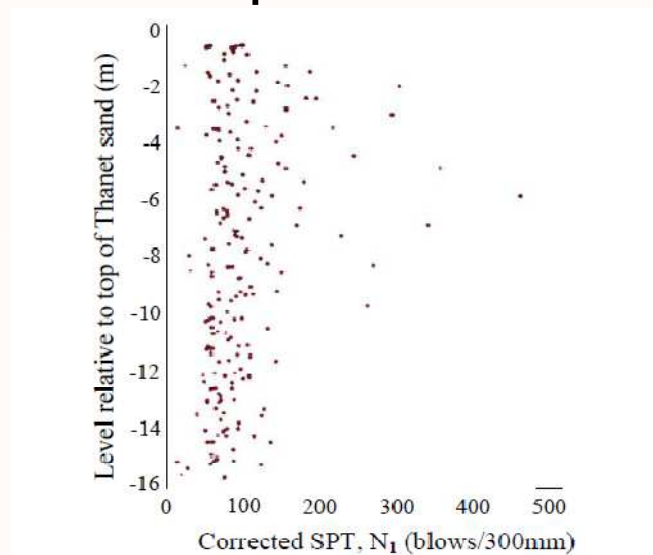
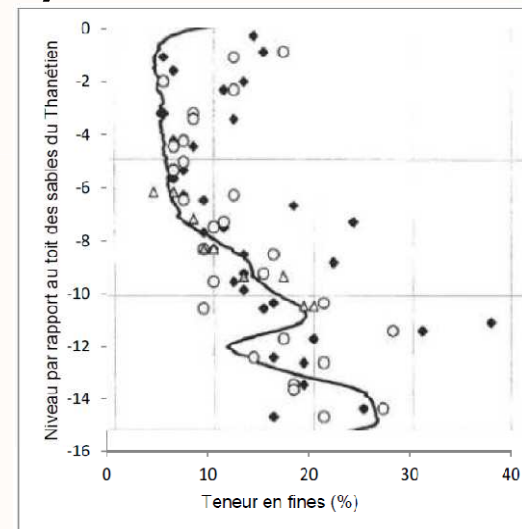


Figure 4-2 Corrected SPT "N" values (after Nicholson et al., 2002)

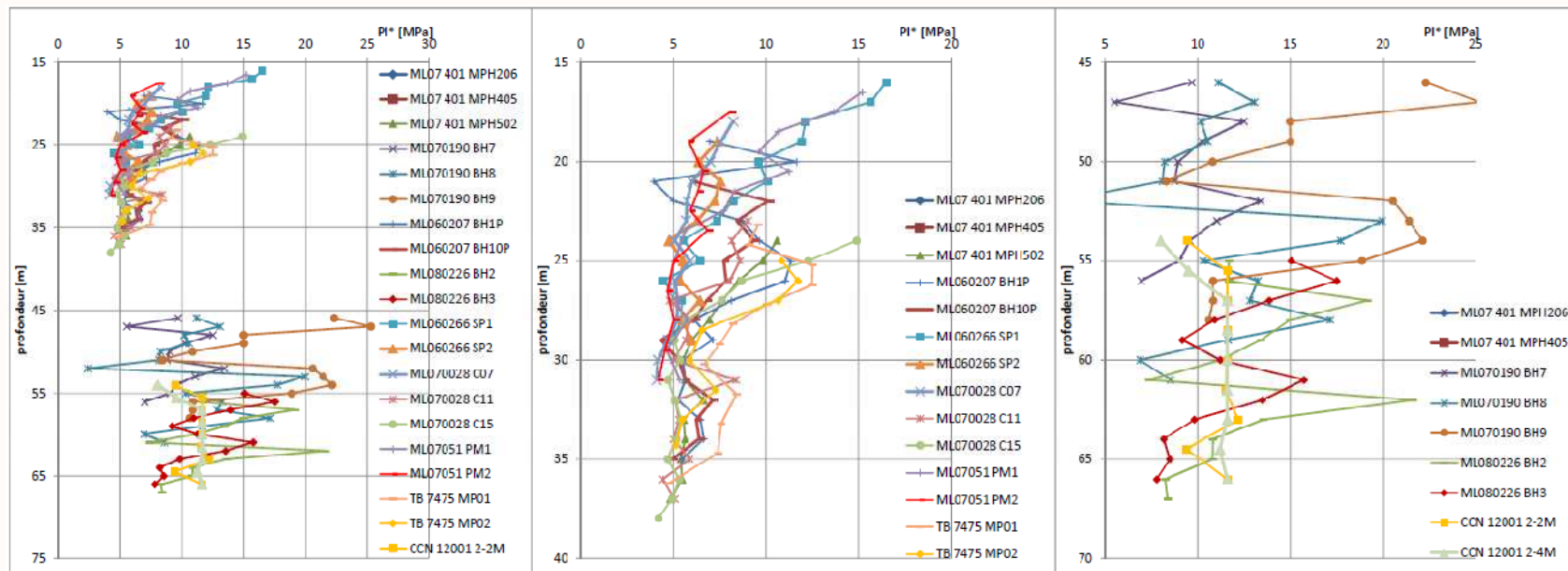
- Sieve analysis shows an increase in fine content at bottom of the Thanet sands layer



(From K.Ventouras : Engineering behaviour of Thanet sands, October 2005)

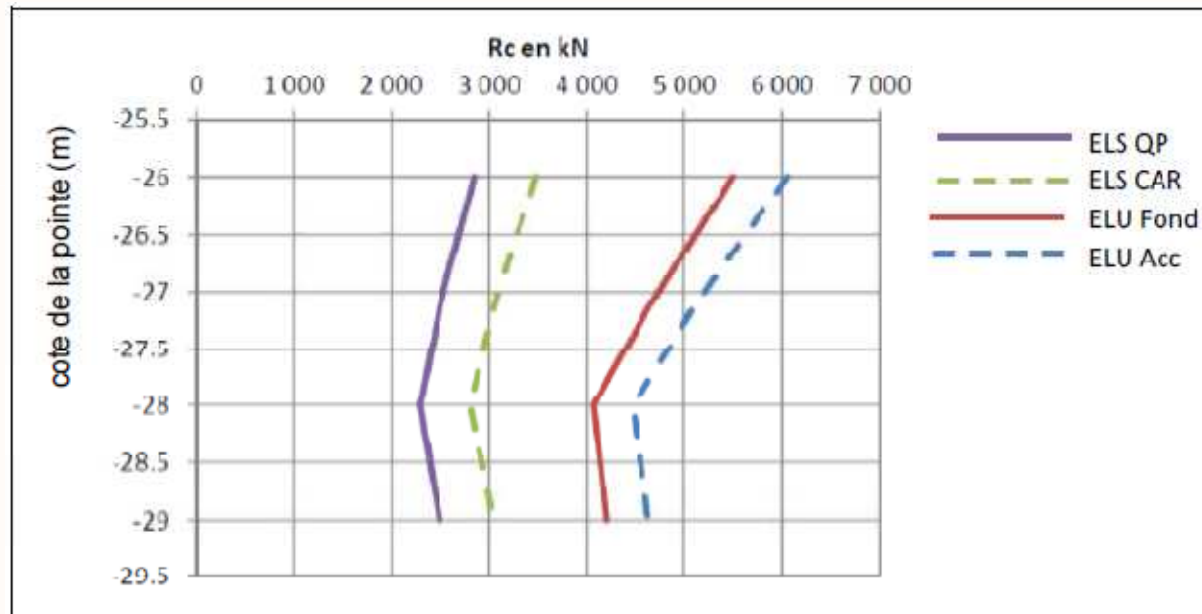
Comparison with other MPT investigations in the Thanet sands

- ✓ 8 sites between 2006 and 2014
 - Between 45 to 70m below GL: $PI^* = 12.1$ MPa (83 tests)
 - Between 15 to 40 m below GL: $PI^* = 7$ MPa (169 tests)
- ✓ PI^* values tend to decrease with depth when layer is between 15 to 40m below GL



Bearing capacity of bored piles

- ✓ Bored pile, 0.8 m in diameter
- ✓ According to French application document of EC7



Bearing capacity of bored piles

$$q_{su} = 90 \text{ kPa}$$

$$q_{pu} = k_p \cdot P_{le}^*$$

✓ SP01: At 25m: $P_{le}^* = 13.8 \text{ MPa}$ and $k_p = 1.04$

At 28m: $P_{le}^* = 9.9 \text{ MPa}$ and $k_p = 1.1$

10% decrease of bearing capacity at ELS

✓ If MPT limited to 5 MPa, $P_{le}^* = 5 \text{ MPa}$

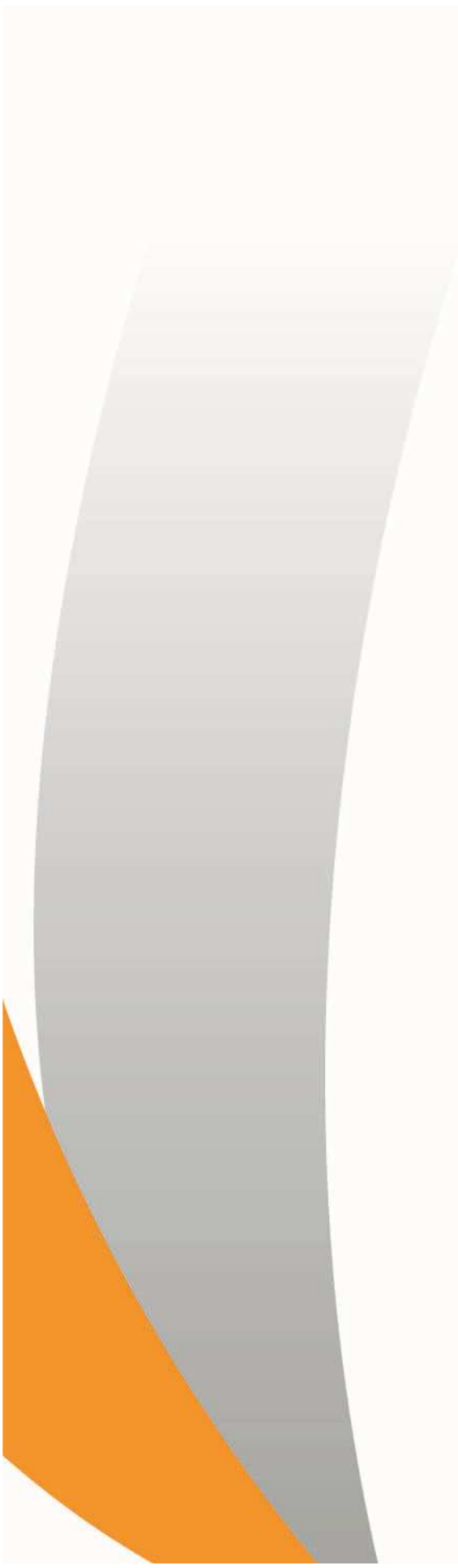
25% decrease of bearing capacity at ELS between 25 and 28m

45 to 53% decrease compared to tests carried to high pressure (12 MPa)

		Tous sondages	SP01	SP02	$P_{le}^* = 5 \text{ MPa}$
		Traction	compression	compression	compression
Pieu 25m	ELU sismique	280 kN	6 055 kN	4 828 kN	2 444 kN
	ELU fondamental	255 kN	5 505 kN	4 389 kN	2 222 kN
	ELS caractéristique	187 kN	3 444 kN	2 762 kN	1 437 kN
	ELS quasi-permanent	137 kN	2 817 kN	2 260 kN	1 176 kN
Pieu 28m	ELU sismique	639 kN	4 733 kN	3 840 kN	2 800 kN
	ELU fondamental	699 kN	5 206 kN	4 224 kN	3 080 kN
	ELS caractéristique	467 kN	3 091 kN	2 545 kN	1 910 kN
	ELS quasi-permanent	343 kN	2 529 kN	2 082 kN	1 562 kN

Conclusions

- ✓ The HP probe used enables to measure higher Limit Pressures with no extrapolation
- ✓ It allows to characterize mechanically Thanet sands whereas SPT could not make any distinction without sieving analysis
- ✓ The measurement of a 'real' limit pressure enables to optimize largely the design of foundations, compared to the design with results of standard tests stopped at 5 MPa (specification of NFP 94-110-1)



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