

The Problem

- 2020 renewable targets (BERR, 2008) in combination with saturation of capacity has necessitated a major program of restringing and uprating old high voltage transmission cables (Clark et al., 2006). This program will result in significant increases of loading on transmission pylon foundations systems due to larger cable sizes.
- Studies undertaken by University of Southampton and field tests by National Grid have demonstrated that the design basis for transmission pylon foundations may not be reliable (Lehane, 2008).
- The present failure rate of pylon foundations is extremely low, suggesting that there are additional factors contributing to uplift resistance.

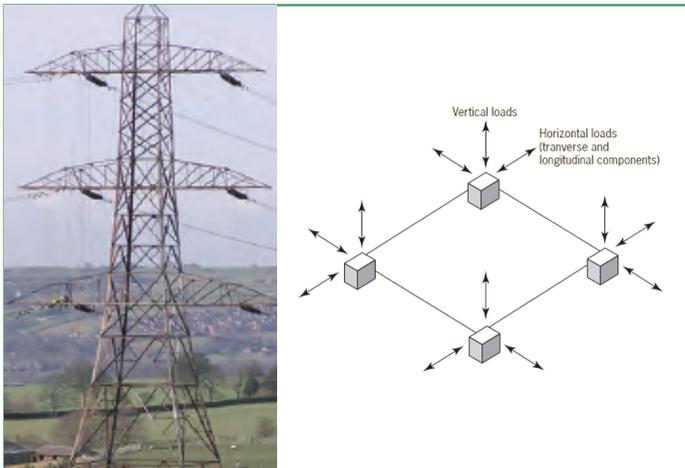


Figure 1 – A typical transmission pylon (left) and typical loads (right)

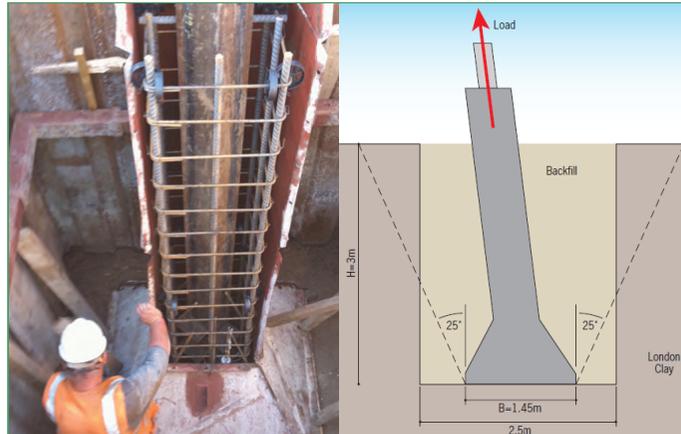


Figure 2 – Foundations tested on site

The Solution

- Investigate pylon foundation capacity by conducting a set of full-scale rapid foundation uplift testing to compare the dynamic response to standard static testing practise.
- Testing was conducted over two weeks in July 2012. Five 10m deep CPTs were used to characterise the site and backfills.
- A set of numerical back-analysis studies were conducted to reproduce the load-displacement behaviour of the tested foundations.

References:

BERR (2008) *UK Renewable Energy Strategy*. Department for Business Enterprise Regulatory Reform, London, UK.
 Clark, M; Richards, D J; and Clutterbuck, D (2006) *Measured dynamic performance of electricity transmission towers following controlled broken-wire events*. International Council on Large Electronic Systems, Paris, France, Paper B2-313.
 Lehane, B M; Gaudin, C; Richards, D J; and Rattley, M J (2008) Rate effects on the vertical uplift capacity of footings founded in clay. *Géotechnique*, 58(1): 13-21.

The Contribution

- The series of field tests on a number of full-scale footings has confirmed that base suction may contribute significantly to footing performance. In the cases where suctions did not develop, the uplift performance of the footings was poor.
- Current testing practice may have led to an undue underestimation of foundation uplift capacity due to the manner of test load application (slow vs rapid). A new load testing protocol has been proposed to National grid.
- With recent developments in data logging and transmission it would be relatively straightforward to fully instrument a pylon. Through such endeavours a better design and testing rationale may be developed..

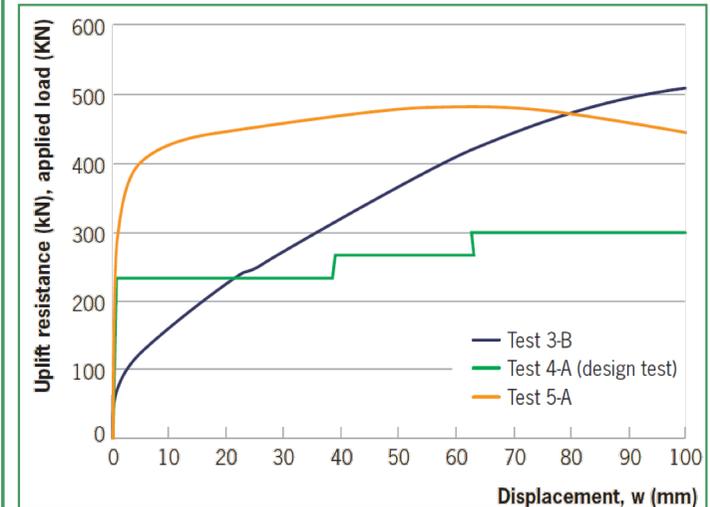


Figure 3 – Test 5-A (suction), Test 3-B (no suction) and Test 4-A (current National Grid testing practice)