Bearing capacity of thin-walled shallow foundations: an experimental and artificial intelligence-based study

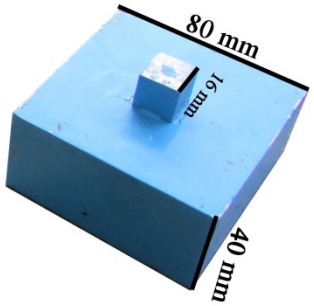
Cite this as: Hossein Rezaei, Ramli Nazir, Ehsan Momeni, 2016. Bearing Capacity of Thin-walled Shallow foundations: an Experimental and Artificial Intelligence-based Study. *Journal of Zhejiang University-SCIENCE A (Applied Physics & Engineering)*, 17(4):273-285. http://dx.doi.org/10.1631/jzus.A1500033

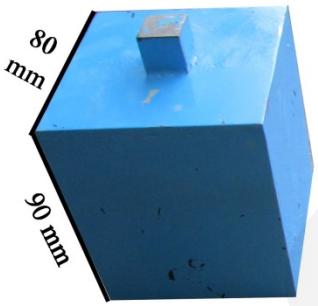
Artificial Intelligence-based Predictive Model of Bearing Capacity

Thin-wall spread foundations can be used in coastal projects where the soil strength is relatively low. Developing a predictive model of bearing capacity for this kind of foundation is of interest due to the fact that the famous bearing capacity equations are proposed for conventional footings.

For developing a predictive model, a relatively large dataset comprising 145 recorded cases of related footing load tests was compiled from the literature. The dataset includes bearing capacity, *Qu*, friction angle, unit weight of sand, footing width and footing wall to width ratio, L_w/B. Apart from *Qu*, other parameters were set as model inputs. To enhance the diversity of the data, four more related laboratory footing load tests were conducted on Johor Bahru sand and results were added to the dataset

Thin-wall spread foundation





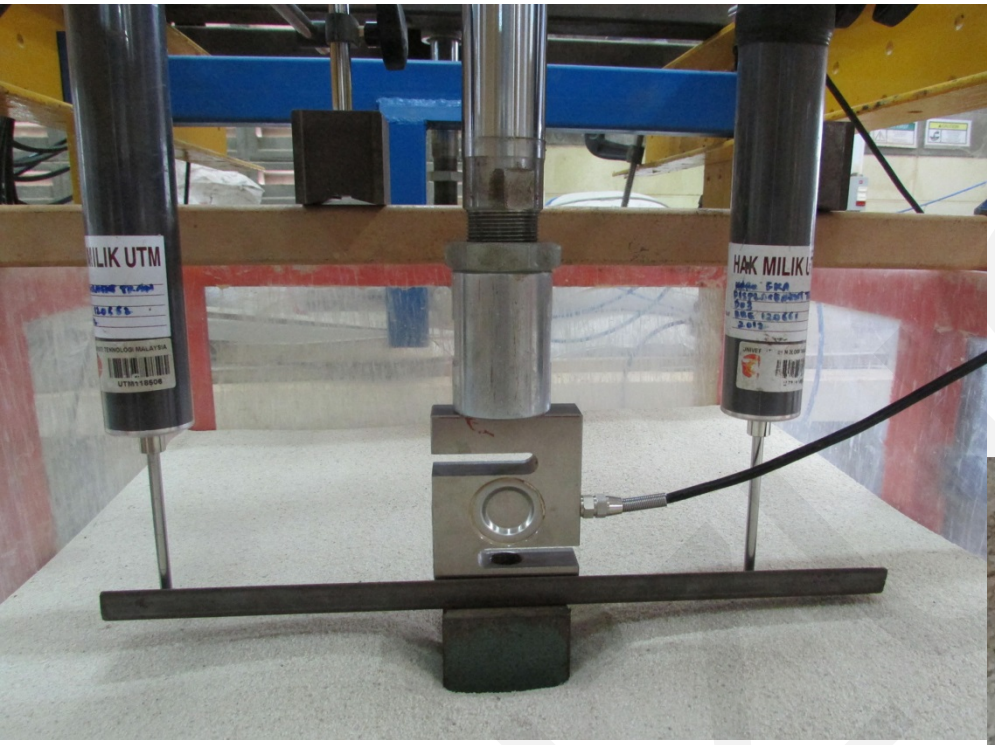
Four laboratory tests were conducted to enhance the diversity of the dataset (tests were conducted on loose and dense sands)

a) IBS footing with shorter wall

b) IBS footing with longer wall

Mobile Sand pluviator was used for constructing the sand at desirable relative densities

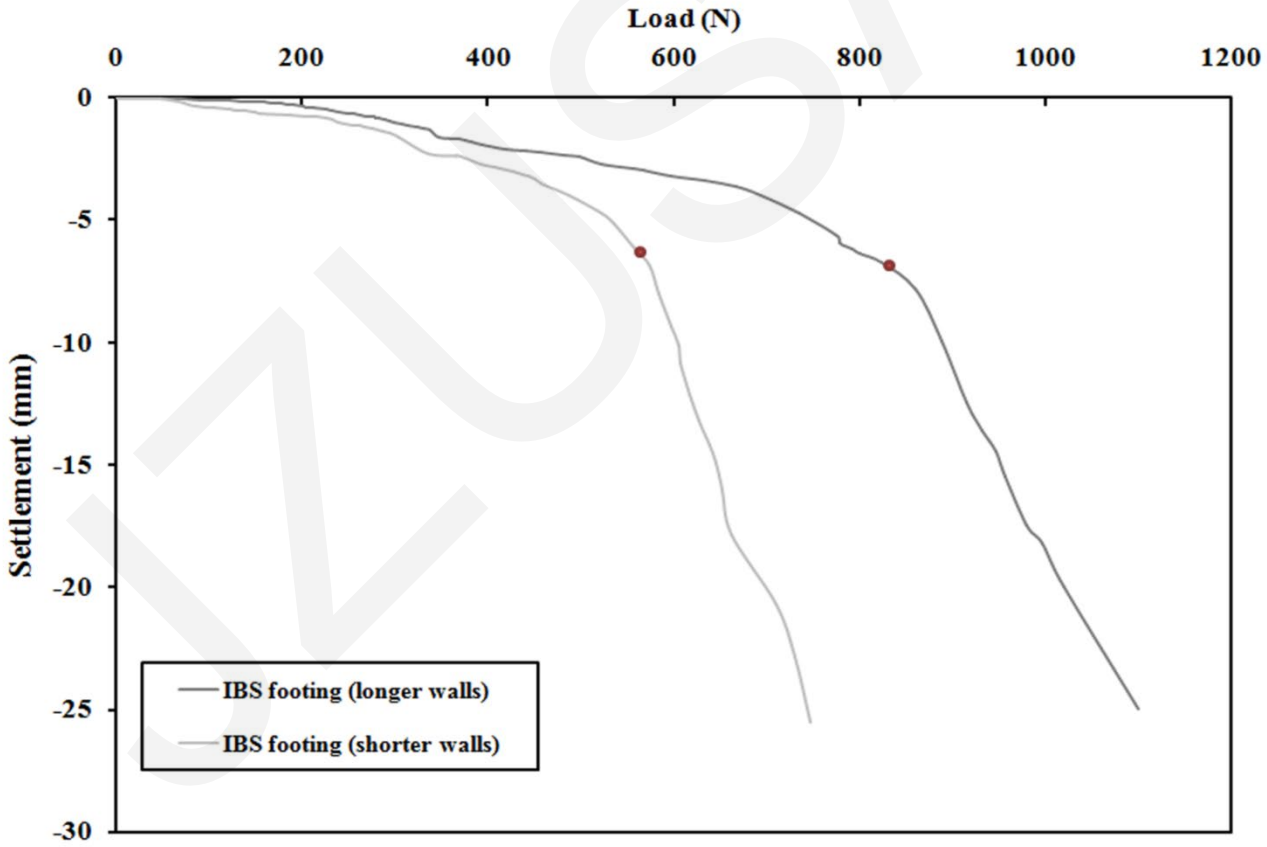
Footing load tests



Soil failure after loading

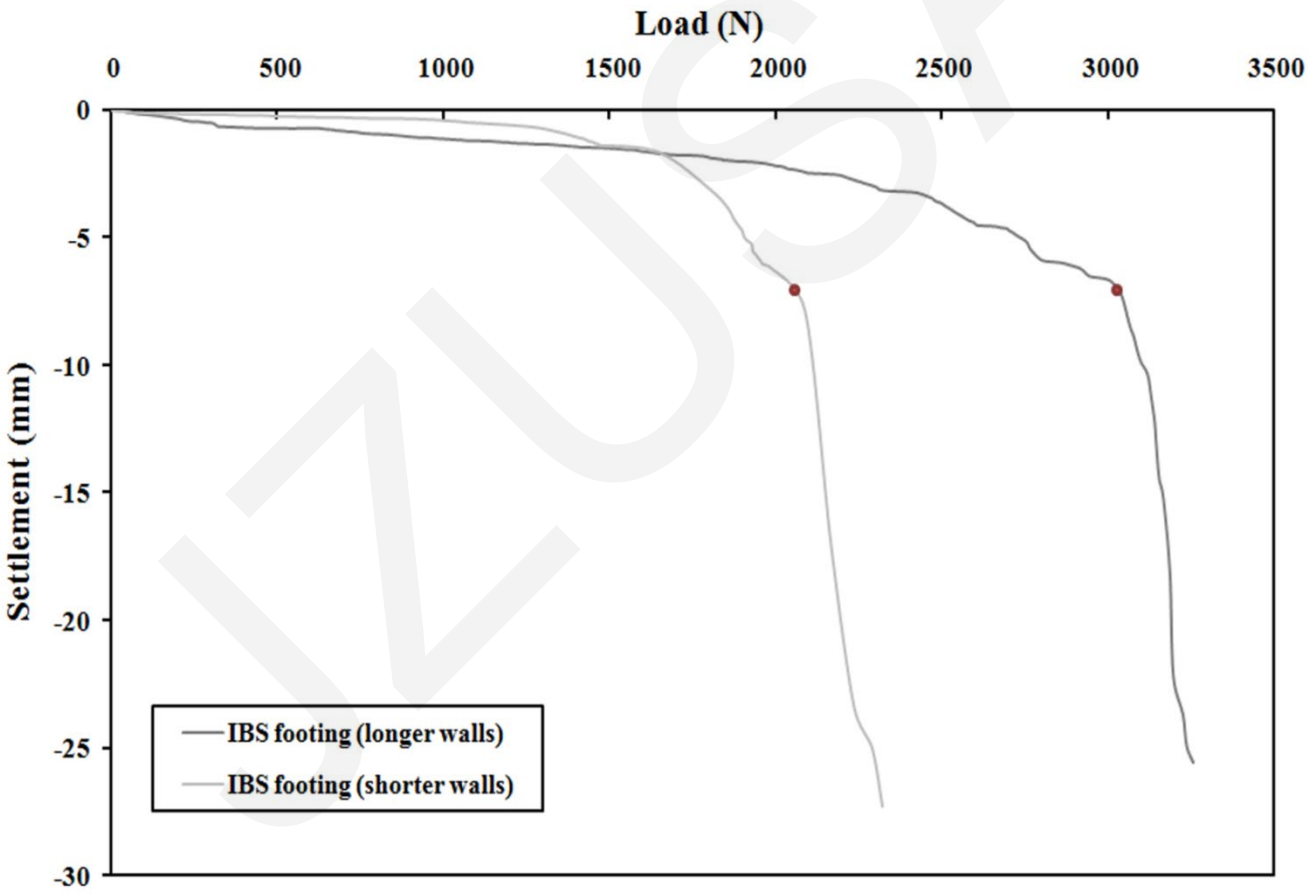
Laboratory test results

- The effect of wall length on the bearing capacity of footing in loose sand



Laboratory test results

- The effect of wall length on the bearing capacity of footing in dense sand

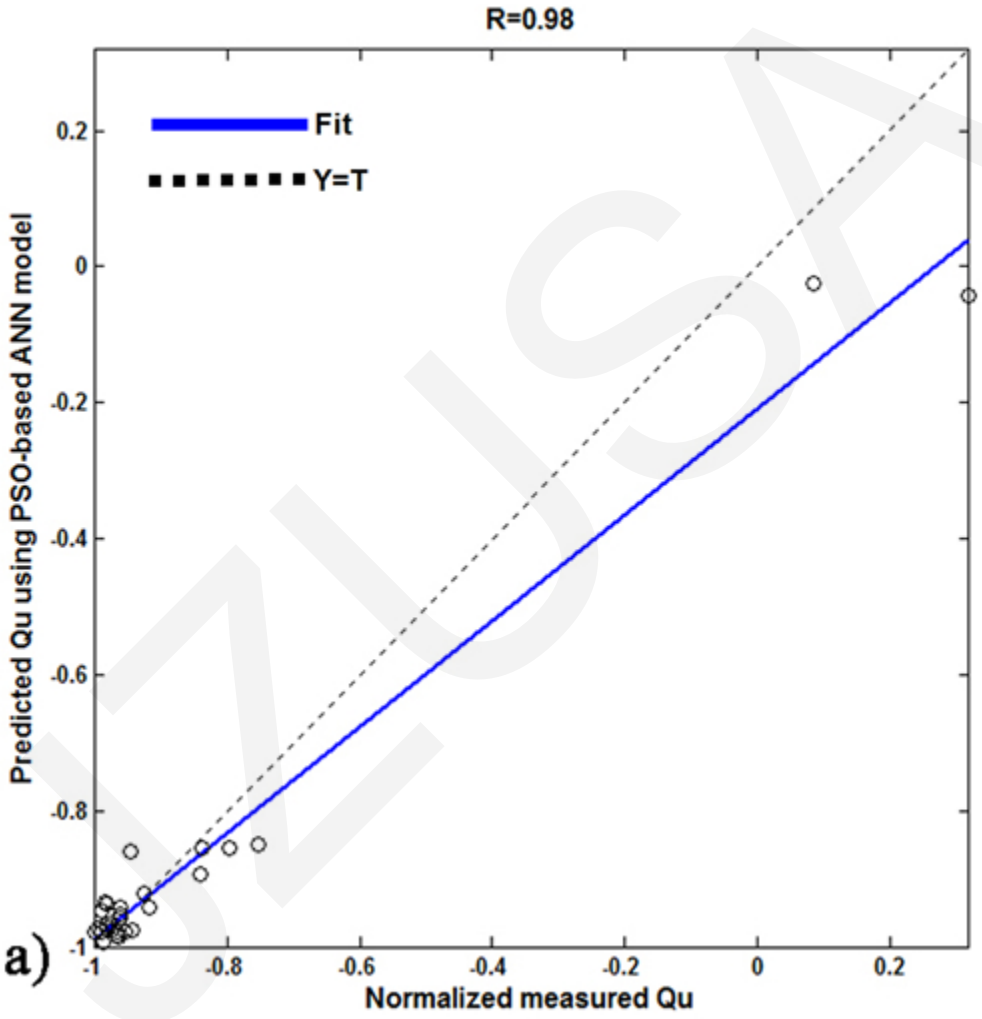


Range of Data used in this study (149 sets of data)

Model paramters	Dimension	Min	Max	Average
B	Mm	36.55	144	71.16
L_w/B	-	0	2	0.9
ϕ	-	29.23	44.75	38
γ	kN/m^3	10.34	18.20	15.5
Qu	kPa	17.10	8005	607

The dataset was used for developing an artificial intelligence-based predictive model of bearing capacity for thin-walled spread foundation

The prediction performance of the proposed predictive model



Conclusions

- The close agreement between the measured and predicted bearing capacities using the PSO-based ANN model revealed the applicability of hybrid ANNs, as a feasible, practical and quick tool in predicting the bearing capacity of thin-wall spread foundations in cohesionless soils.

In particular, the laboratory tests confirmed the beneficial effect of wall length on the bearing capacity. It was found that a 1.5 times bearing capacity improvement is expected when L_w/B is increased from 0.5 to 1.12.

Lorestan University

UTM UNIVERSITI TEKNOLOGI MALAYSIA