

## Serial Report

### History of Cambridge – GIKEN collaboration research (Part2)

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The Cambridge – Giken collaboration research started in 1994, based on the strong awareness of Mr. Akio Kitamura, President of Giken, Ltd., of issues relating to construction. Every summer two students visit Kochi, Japan, to carry out field and model tests using the press-in machines and other facilities of Giken, in order to learn this technology by experience. In some cases, they also conduct model tests or numerical analyses in their own laboratories on their return to Cambridge. In this report, research related to the tests carried out in Kochi from 2004 to 2010 are presented.

[2004-2006]

- Project title : Penetration resistance / Soil plug and bearing capacity
- Outline of tests in Kochi : Cone Penetration Tests (CPTs) and load tests on pressed-in closed-ended tubular piles were conducted at two different sites in Kochi. The closed ended-pile had an outside diameter of 318.5mm and was equipped with a load cell on its base to measure the base resistance. It was found that the load-displacement curves for base resistance and shaft resistance during the load test was well modelled by a parabola considering  $G_0/q_c$ , where  $G_0$  is the small strain shear modulus and  $q_c$  is the cone resistance in CPT. The load test results, together with this parabolic model, as shown in **Fig. 1**, suggested a higher stiffness of the pressed-in piles compared to conventional piling technologies.
- Main students : Melvin Hibberd, Helen Dingle, Andrew Jackson
- Related publications : Dingle, H., 2006. The testing and analysis of jacked foundation piles. M.Eng. Project Report, Cambridge University Department of Engineering, 50p.  
White, D. J. and Deeks, A. D., 2007. Recent research into the behavior of jacked foundation piles. *Advances in Deep Foundations*, pp. 3-26.

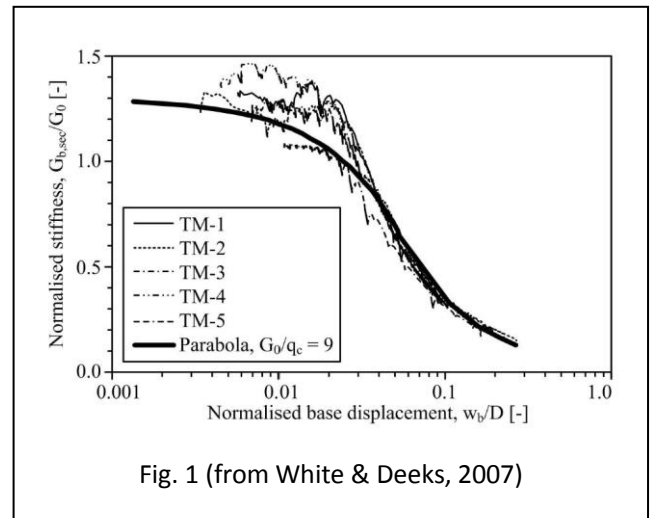


Fig. 1 (from White & Deeks, 2007)

[2006-2007]

- Project title : Mechanism of increase in pull-out resistance
- Outline of tests in Kochi : Three types of piles were used in this project: a U-shaped sheet pile with a width of 400mm (SP-III), a hat-shaped sheet pile with a width of 900mm (25H) and a closed-ended tubular pile with an outside diameter of 318.5mm. The closed-ended pile was equipped with a load cell on its base and several pore water pressure transducers on its shaft. Extraction resistance was investigated with different lengths of curing period. Although set-up was confirmed, the extent of set-up was not clearly linked with the dissipation of excess pore water pressure. In some tests, the peak value of extraction resistance appeared not at the commencement of extraction but when the pile was extracted by a substantial distance (more than 1m), as shown in **Fig. 2**. It was suggested, on the other hand, that the penetration resistance could be well expressed by modifying the UWA-05 pile capacity prediction method.
- Main students : Andrew Jackson, Marcus Gillard

Related publications : Jackson, A., 2007. The setup of jacked piles. M.Eng. Project Report, Cambridge University Department of Engineering, 49p.  
 Jackson, A., M., White, D. J., Bloton, M. D. and Nagayama, T., 2008. Pore pressure effects in sand and silt during pile jacking. Proceedings of the 2<sup>nd</sup> BGA International Conference on Foundations, CD, pp. 575-586.

[2007-2008]

Project title : Penetration resistance and set-up  
 Outline of tests in Kochi : A closed-ended tubular pile with an outside diameter of 318.5mm, instrumented with a load cell on its base and several pore water pressure transducers on its shaft, was pressed-in at 3 different penetration rates (2, 12 and 30 mm/s). After 3 different curing periods (0, 15 and 60 min.), the pile was extracted to confirm the extent of set-up in extraction resistance. The base resistance was reduced at higher penetration rates, while the shaft resistance showed the opposite trend. Set-up in extraction resistance was confirmed. In some tests, peak values in extraction resistance were found not at the commencement of extraction but when the pile was extracted by more than 1 m. This tendency was more apparent for tests with shorter curing periods.

Main students : Marcus Gillard, Paul Shepley

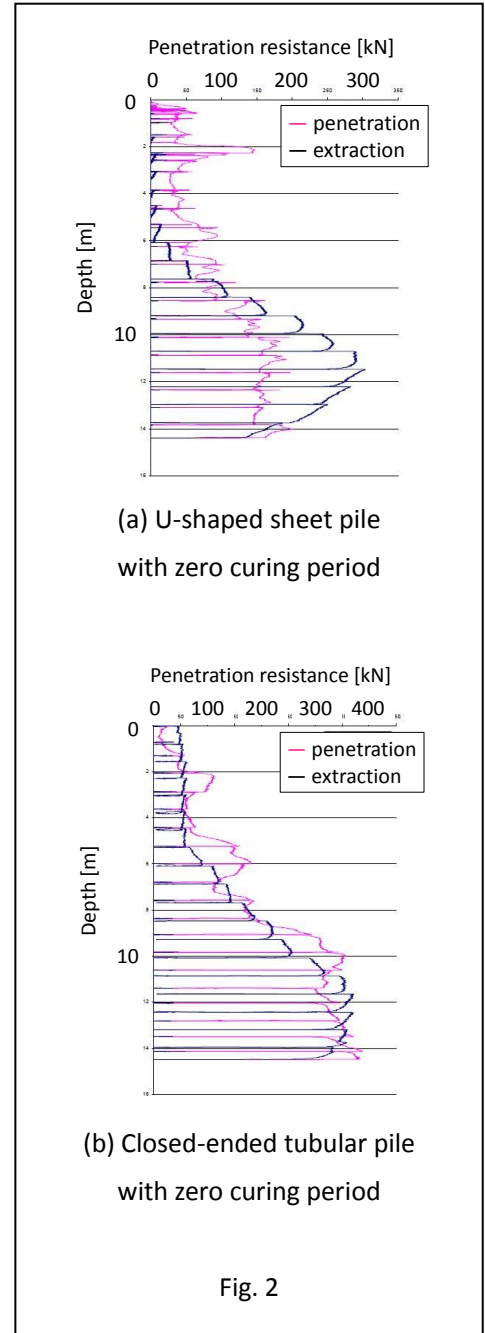
Related publications : Ishihara, Y., Ogawa, N., Horikawa, Y., Kinoshita, S., Nagayama, T., Kitamura, A. and Tagaya, K., 2009. Utilization of pile penetration test data for ground information. Proceedings of the 2<sup>nd</sup> IPA International Workshop in New Orleans, Press-in Engineering 2009, pp. 105-120.

[2008-2009]

Project title : Plugging during press-in  
 Outline of tests in Kochi : A double walled open-ended tubular pile with outside and inside diameters of 318.5 mm and 199.9 mm, as shown in **Fig. 3**, was used in this project. The pile was equipped with 3 earth pressure transducers on its base to measure the base resistance. Four earth pressure transducers and pore water pressure transducers were placed inside the pile. The pile was pressed-in at two different penetration rates (2 and 10 mm/s), followed by load tests with different curing periods (85 minutes, 1 day and 10 days). It was confirmed that the strength of the soil plug was greater if the penetration rate was low. The set-up ratios at 10 days were confirmed to be around 1.5 and 2.5 for base and shaft resistance respectively.

Main students : Paul Shepley, Olusomi Delano

Related publications : Shepley, P., 2009. An investigation into the plugging of open-ended jacked-in tubular piles. M.Eng. Project Report, Cambridge University Department of Engineering, 47p.



[2009-2010]

- Project title : Effect of repeated penetration and extraction
- Outline of tests in Kochi : Two types of piles were used in this project: a U-shaped sheet pile with a width of 400 mm (SP-III) and a closed-ended tubular pile with an outside diameter of 318.5 mm. The closed-ended pile was equipped with a load cell on its base and several pore water pressure transducers on its shaft. The pile was pressed-in monotonically or with repeated penetration and extraction, at different sets of combination of rates and displacements of penetration and extraction. The results showed that shaft resistance was reduced by repeated penetration and extraction, regardless of the ground condition (penetration depth). On the other hand, base resistance was reduced in layers where cohesive soils were dominant. No clear trend was found between the pore water pressure and the penetration resistance in repeated penetration and extraction.
- Main students : Olusomi Delano, Thomas Bond
- Related publications : Delano, O., 2010. The application of surging on jacked-in piles. M.Eng. Project Report, Cambridge University Department of Engineering, 49p.

