Serial Report

History of Cambridge – GIKEN collaboration research

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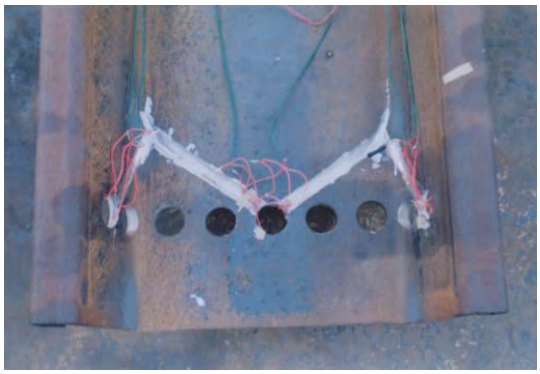
The Cambridge – GIKEN collaboration research started in 1994, based on the strong awareness of Mr. Akio Kitamura, President of GIKEN LTD., of issues relating to construction. Every summer two students visit Kochi, Japan, to carry out field and model tests using the press-in machines and other facilities 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 1994 to 2003 are presented.

■ [1995-1996]

Project title	:	Effect of water jetting
Outline of tests in Kochi	:	Field tests were conducted using a press-in machine to investigate the effect of water jetting on reducing press-in time in dense sand. U-shaped sheet piles with a width of 400mm (SP-III) were used. The size of the water-jetting nozzle was varied between 6.5 and 8.5mm, with a flowrate of about 320ℓ/min. Two different nozzle shapes (directions of jetting) were also examined. The effect of these parameters on press-in time was analyzed, and the mechanisms were discussed qualitatively.
Main students	:	Matthew Carter, Fiona Gooch
Related publications	:	None

■ [1997-1998]

Project title	:	Investigation into pressure bulbs
Outline of tests in Kochi	:	The resistance on the base of the sheet pile during press-in was obtained by measuring the strain due to the hoop stress around the holes in the base of the sheet pile, as shown in **Picture 1**. The unit base resistance in dense sand was approximately constant at 35MPa, beyond a penetration depth of 3m, of the same order of magnitude as the crushing strength of coarse sand.
Main students	:	David White, Peter Kirkham, Naomi Lyons
Related publications	:	White, D. J., 1998. Deep penetration in sand. M.Eng. Project Report, Cambridge University Department of Engineering, 51p.



Picture 1

■ [1998-1999]

Project title	:	Press-in force and pile type / Press-in speed
Outline of tests in Kochi	:	The press-in force during press-in was compared using U-shaped sheet piles, H-shaped sheet piles and open ended tubular piles. Two press-in rates were adopted. An attempt to estimate the press-in force based on CPT data was discussed, and the necessity of considering the effect of soil plug in the pan of the sheet pile was pointed out.
Main students	:	Peter Kirkham, Haramrita Sidhu
Related publications	:	None

■ **[1999-2000]**

Project title : Measurement of soil plug strength

Outline of tests in Kochi : The phenomenon of plugging was investigated using a split tubular pile. The pile was pressed-in, extracted and separated into two, as shown in **Picture 2**, so that the inner soil column could be directly observed. The creation, dissolution and re-creation of the soil plug during press-in was confirmed, and the mechanism of the creation of soil plug was discussed.

Main students : Haramrita Sidhu, Timothy Finlay

Related publications : White, D. J., Sidhu, H. K., Finlay, C. R., Bolton, M. D. and Nagayama, T., 2000. Press-in piling: the influence of plugging on driveability. 8th International Conference of the Deep Foundations Institute, New York, pp. 299-310.

Picture 2

■ **[2000-2001]**

Project title : Friction cutter / Strain measurement

Outline of tests in Kochi : A double-walled tubular pile, shown in **Picture 3**, was pressed-in to investigate the horizontal earth pressure on the internal surface of the pile. Piles with and without friction cutters on their base were also pressed-in, to investigate their effect on reducing the press-in force. The friction cutter reduced the shaft resistance but had little effect on the base resistance during press-in.

Picture 3

Main students : Timothy Finlay, Yueyang Zhao

Related publications : Finlay, T. C. R., 2001. Press-in piling: noise, vibration and the relief of hard driving. M.Eng. Project Report, Cambridge University Department of Engineering, 49p.

Finlay, T. C. R., White, D. J., Bolton, M. D. and Nagayama, T., 2001. Press-in piling: the installation of instrumented steel tubular piles with and without driving shoes. 5th International Conference on Deep Foundation Practice, Singapore, 1, pp. 199-208.

■ **[2001-2002]**

Project title : Press-in force and bearing capacity

Outline of tests in Kochi : A double-tubed tubular pile was pressed-in. The static vertical load test was conducted and its bearing capacity was measured.

Main students : Yueyang Zhao, Gulin Yetginer

Related publications : Zhao, Y., 2002. Pile set-up in sand. M.Eng. Project Report, Cambridge University Department of Engineering, 48p.

Zhao, Y. & White, D. J., 2006. A model-scale investigation into 'set-up' of displacement piles in sand. Physical Modelling in Geotechnics - 6th ICPMG, pp. 889-894.

■ **[2002-2003]**

Project title : Features of pressed-in group piles / Vibration measurement / Time effect

Outline of tests in Kochi : Open-ended tubular piles with an outer diameter of 101.6mm were pressed-in as a cell foundation in a square or a circular manner. A static vertical load test was conducted as

shown in **Picture 4**, and the group effect on the press-in force and the bearing capacity of these pressed-in piles was investigated. The press-in force increased with the progress of the construction of the cell foundation. The group efficiency in terms of the bearing capacity, if the capacity of the single pile was taken as the press-in force of the first pile in the group, was slightly greater than but almost equal to unity.

Picture 4

Main students : David Rockhill, Gulin Yetginer, Andrew Deeks

Related publications : White, D. J., Finlay, T. C. R., Bolton, M. D. and Bears, G., 2002. Press-in piling: ground vibration and noise during pile installation. Proceedings of the International Deep Foundations Congress, Orlando, USA, ASCE Special Publication 116, pp. 363-371.

Yetginer, A. G., 2003. Press-in piling. M.Eng. Project Report, Cambridge University Department of Engineering, 50p.

Rockhill, D., 2003. Ground vibrations due to construction operations. M.Eng. Project Report, Cambridge University Department of Engineering, 46p.

Rockhill, D. J., Bolton, M. D. and White, D. J., 2003. Ground-borne vibrations due to press-in piling operations. BGA International Conference on Foundations: Innovations, Observations, Design and Practice.

Yetginer, A. G., White, D. J. and Bolton, M. D., 2003. Press-in piling: field testing of cell foundations. BGA International Conference on Foundations: Innovations, Observations, Design and Practice.

Yetginer, A. G., White, D. J., Bolton, M. D., 2006. Field measurements of the stiffness of jacked piles and pile groups. Geotechnique 56, No. 5, pp. 349-354.

[2003-2004]

Project title : Load test on groups of pressed-in piles

Outline of tests in Kochi : Open-ended tubular piles with an outer diameter of 101.6mm were pressed-in in a circular manner. Two circular groups of piles were constructed, one with a constant embedment depth **(Figure 1 (a))** and the other with two different embedment depths for each pile **(Figure 1 (b))**. The bearing capacity of these groups were comparable, even though the embedment depth of some piles in group (b) was smaller than the other piles. The group efficiency in terms of the bearing capacity, if the capacity of the single pile was taken as the press-in force of the first pile in the group and the capacity of the pile group was taken as the plunging load, was approximately equal to unity. On the other hand, the stiffness of the group decreased with the increasing number of piles in the group.

Main students : Andrew Deeks, Melvin Hibberd

Related publications : Deeks, A. D., 2004. An investigation into the strength and stiffness of jacked, driven and bored piles. M.Eng. Project Report, Cambridge University Department of Engineering, 51p.

Deeks, A. D., White, D. J. and Bolton, M. D., 2006. A comparison of jacked, driven and bored piles in sand. The 16th International Conference on Soil Mechanics and Geotechnical Engineering, Osaka, Japan, pp. 1685-1688.

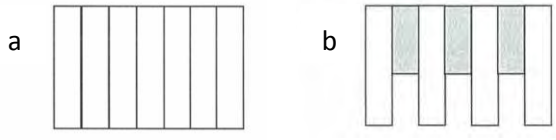


Figure 1 (Deeks (2004))