Chapter 2

Activities

Research Committee

- The Research committee is one of the standing committees and was established in 2017. The chairs and co-chairs from 2017 until now were shown in the below.

Term	Chair	Co-chair
2017-2018	Tatsunori Matsumoto	Stuart Haigh
2019-	Yoshiaki Kikuchi	Stuart Haigh and Kenneth Gavin

- Terms of reference were approved by the Board of Directors meeting in 2021 as follows.

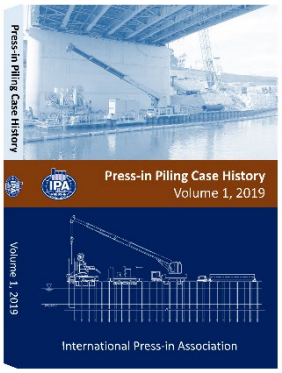
1) Identify relevant research subjects with consideration of Academia-Industry fusion
2) Form research groups to each research subject as a new Technical Committee
3) Coordinate Technical Committees for steady research activities, and encourage TCs for publishing research outcomes and/or holding a symposium
4) Allocate and manage the research budget for activities of Technical Committees
5) Encourage and support Technical Committees to apply for outside research funds available
6) Gather case histories for publishing Case History Volume
7) Plan and organize IPA Press-in Engineering Seminar

- Activities

Technical Committees (See Details from P10 to P22)

TC1	Application of cantilever type steel tubular pile wall embedded to stiff ground (Ended)
TC2	Estimation of Subsurface Information from Data Obtained during Press-in Piling (Ended)
TC3	Expansion of Applicability and Assessment of Seismic Performance of PFS Method (Ended)
TC4	Vertical performance and construction management of sheet piles installed by the Press-in Method and tubular piles installed by Rotary Cutting Press-in Method
TC5	Influence of operator skill and experience on field performance of Press-in Piling
TC6	Investigation and analysis of the development status of Press-in technology in China

Case History Volume



Volume 1, 2019

IPA Press-in Engineering Seminar

11th IPA Press-in Seminar 2019 in Tokyo

Technical Committee (TC1)

- Committee Name: Application of cantilever type steel tubular pile wall embedded to stiff ground
- Chair: Jiro Takemura (Director of International Press-in Association, Associate Professor of Tokyo Institute of Technology)
  Secretary General: Kouhei Sawada (Taisei Co., Ltd.)
- Members: 18
- Period: From FY 2017 to FY 2020 (Ended)

Fig. 1

➢ Background and Objectives

Thanks to the innovative pile installation method, like Gyro-press, the applicability of cantilever type tubular steel pile walls have increased significantly, e.g., large diameter pile in very hard ground (Fig.1). For relatively large wall height, large diameter and high stiffness piles are preferably used for stiff embedment ground, since the wall top displacement caused by the wall deformation can be minimized. However, the current design method of the embedded cantilever retaining wall has been developed for the relatively flexible steel sheet pile wall into soft grounds. Therefore, simple application of the current design method to this type of wall may require unnecessary embedment depth, or increase a risk of failure. IPA Technical Committee TC1 was set up to answer the above questions and establish a rational design procedure of embedded cantilever tubular pile wall as the final goal. TC1 has three objectives as terms of reference for four years committee period from FY 2017 to FY 2020.

1) To clarify the behavior of large-diameter tubular steel pipe wall in stiff ground using centrifuge model tests.
2) To propose new rational design method over the simple beam model supported on elastic springs.
3) To implement activities to support young engineers and researchers associated with foundation structure for their capacity building.

➢ Activities

Four working groups were created in TC1 and conducted the tasks as shown below.

♦ **WG1 on design method:**

- ✓ To analyze present design methods, and identify the issues, such as, embedment depth, soil characteristics, and seismic design.
- ✓ To analyze the design procedure of existing large diameter tubular steel pipe walls.
- ✓ To propose new rational design method of large diameter tubular steel pile wall including seismic design.

♦ **WG2 on centrifuge model tests:**

- ✓ To clarify mechanical behavior of large diameter tubular steel pile wall subjected to static load in stiff grounds.
- ✓ To analyze the influences of critical conditions, such as, embedment depth, ground stiffness and strength on the behavior of wall.
- ✓ To discuss the difference between the behavior of actual structures and that predicted by the simplified design model.
- ✓ To simulate the deformation and failure behavior against earthquake load.

♦ **WG3 on numerical analyses:**

- ✓ To verify and calibrate 3D FEM method by centrifuge modeling.
- ✓ To analyze the detail and local behavior of wall and ground, which cannot be observed in the centrifuge model tests.
- ✓ To analyze the influence of parameters on the behavior of large diameter tubular steel pile wall using subgrade reaction method with bi-linear p-y curve and 2D FEM.

♦ **WG4 on case study of construction:**

- ✓ To collect construction cases with design details as many as possible.
- ✓ To collect the data observed during and after construction, if available, with the collaboration of TC2.
- ✓ To identify the concerns in the actual construction, in particular on the cost and time.

➢ Outcomes

■ Seminar presentations

May 2018	IPA Seminar on Press-in Technology in Thailand
May 2018	IPA Seminar on Press-in Technology in Philippines
November 2018	IPA Seminar on Press-in Technology in Sao Paulo, Brazil
November 2020	12th IPA Press-in Seminar 2020 in Tokyo
June 2021	The Second International Conference on Press-in Engineering 2021, Kochi, Japan (ICPE2021)

Fig. 2. Associate Prof. Takemura made the presentation in Philippines

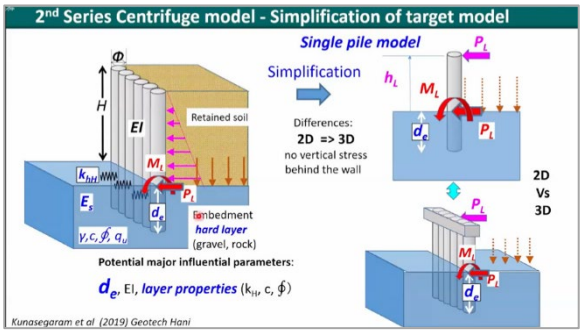


Fig. 3. Presentation data of the ICPE2021

■ Publications

September 2018	Proceedings of the First International Conference on Press-in Engineering ・Evaluation of Deformation Behavior of Self-Standing Retaining Wall Using Large Diameter Steel Pipe Piles into Hard Ground. (WG1) ・Issues for the Reduction of the Embedded Length of Cantilevered Steel Tubular Retaining Wall Pressed into Stiff Ground. (WG1) ・Behavior of a Large Diameter Piles Subjected to Moment and Lateral Loads. (WG2) ・Stability of Self-Standing High Stiffness-Steel Pipe Sheet Pile Walls Embedded in Soft Rocks. (WG2) ・Overview of the Self-standing and High Stiffness Tubular Pile Walls in Japan. (WG4)

November 2019	Proceedings of Geotech Hanoi 2019 ・Centrifuge Model Study on Cantilever Steel Tubular Pile Wall Embedded in Soft Rock. (WG2) ・Numerical simulation for centrifuge model tests on the stability of self-standing steel pipe pile retaining wall by Rigid Plastic FEM. (WG3) ・Analytical evaluation of deformation behavior of cantilever type retaining wall using large diameter steel tubular piles into stiff ground. (WG3)
June 2021	International Journal of Physical Modelling in Geotechnics, Vol.21 no.3, 114-134. Deflection and failure of high-stiffness cantilever retaining wall embedded in soft rock (WG2).
June 2021	Proceedings of the Second International Conference on Press-in Engineering ・State of the art report on application of cantilever type steel tubular pile wall embedded to stiff grounds ・Numerical simulation for centrifuge model tests on cantilever type steel tubular pile retaining wall by rigid plastic FEM (WG3) ・Reliability analysis on cantilever retaining walls embedded into stiff ground (Part 1: Contribution of major uncertainties in the elasto-plastic subgrade reaction method) (WG1,WG4) ・Reliability analysis on cantilever retaining walls embedded into stiff ground (Part 2: Construction management with piling data) (WG1, WG3) ・Dynamic behavior of cantilever tubular steel pile retaining wall socketed in soft rock (WG2) ・A centrifuge model study on laterally loaded large diameter steel tubular piles socketed in soft rock (WG2) ・Summary of case histories of retaining wall installed by rotary cutting press-in method (WG4)
March 2021	IPA News Letter (Volume 6, Issue 1)

Technical Committee (TC2)

- Committee Name: Estimation of Subsurface Information from Data Obtained during Press-in Piling
- Chair: Osamu Kusakabe (President of International Press-in Association)
  Secretary General: Yukihiro Ishihara (Director of International Press-in Association, GIKEN LTD.)
- Members: 9
- Period: From FY 2016 to FY 2017 (Ended)

Positions and affiliations are as of the date of the TC2.

➢ Research Subject

♦ Press-in method utilizes static pressure by hydraulic cylinders for jacking a pile into the ground. Actual press-in operation often adopts serval cycles of press-in and pull-out processes (sometimes called as surging). With these features, if continuous measurements of the hydraulic pressure were applied and the pile penetration depth were performed, the data thus obtained (Press-in piling data) could be used for driving control and even for evaluating subsurface information. Fig. 1 illustrates the concept of the use of Press-in piling data. TC 2 focused on subsurface investigation technique in the figure.

♦ TC2 dealt with Standard Press-in, Press-in with Augering and Rotary Cutting Press-in. The proposed methods of estimating SPT N from the piling data may be briefly summarized as follows. In Standard Press-in, a pile is installed with a static jacking force and the process of the penetration of a pile is similar to that of a cone in CPT. Taking advantage of this similarity, the base resistance Qb, and the shaft resistance Qs can be obtained by subtracting Qb from the head load Q. Then they can be converted into CPT cone resistance (qc) and sleeve friction (fs) by considering the scale effect and the rate effect on Qb. Subsequently, the soil type and SPT N can be estimated based on the methods developed by Robertson and other researchers. Regarding Press-in with Augering, two methods to estimate SPT N values were proposed based on the knowledge in the field of rock drilling. The first one uses the proportional correlation between the parameter $Tb/(dc)\gamma$ and the unconfined compressive strength of a rock where Tb is the torque on the auger head, dc is the depth of cut (ratio of downward to rotational velocity) and γ is a constant. The second method adjusts the parameters used in the technique of Measurement While Drilling to link the resistance on the auger head with SPT N values. In Rotary Cutting Press-in, SPT N values are estimated by assuming a proportional correlation between the SPT N values and the energy (δE) required for deforming a soil below the pile base by a volume of δV. This assumption is based on the knowledge of the linear correlation between the Specific Energy (= $\delta E / \delta V$) in rock drilling and the unconfined compressive strength of the rock. The calculation of the Specific Energy requires the information of the resistance on the pile base. The processes of estimating SPT N from the piling data in Standard Press-in and Rotary Cutting Press-in are summarized in Fig. 2.

➢ TC Activities

♦ Prior to the establishment of TC2, there already existed ample technical information and papers related to the subject were published. Thus, the actual task of TC2 was to put the information available together into a technical document which was subject to thorough review by the committee members consisting of various experts both academic and practitioner. Mr. Ishihara, Secretary of TC2 took a lead for drafting the technical document. After several revisions considering the comments from the members, TC2 successfully published the technical document entitled “Technical Material on the Use of Piling Data in the Press-in Method, I. Estimation of Subsurface Information” in Japanese in 2017.

♦ English version of the above Technical Material published in Japanese is under preparation by TC4.

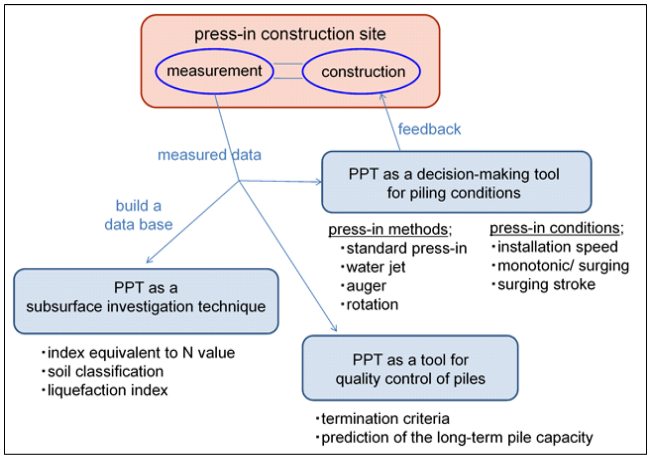


Fig. 1. Concept of the use of press-in piling data

Fig. 3. Mr. Ishihara made a presentation in the 11th IPA Press-in Seminar

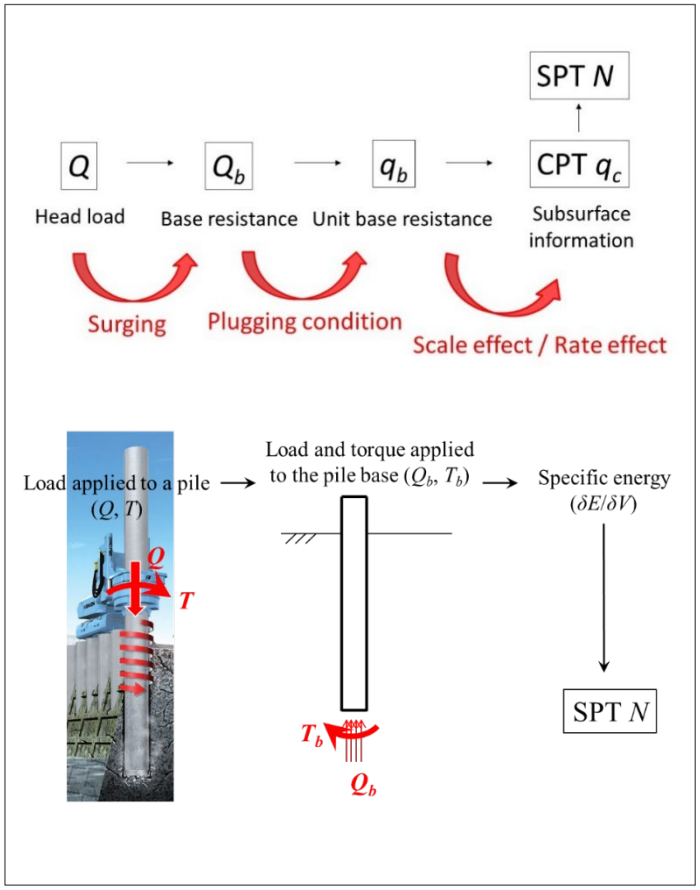


Fig. 2. Processes of estimating subsurface information from piling data

➢ Outcomes

■ Seminar presentations

September 2019	11th IPA Press-in Seminar 2019 in Tokyo (Fig. 3)
June 2021	The Second International Conference on Press-in Engineering 2021, Kochi, Japan (ICPE2021)

■ Publications

November 2017	Technical document: Technical Material on the Use of Piling Data in the Press-in Method, I. Estimation of Subsurface Information, 63p. (in Japanese) (Fig. 4)
June 2021	State of the Art Report: Y. Ishihara and O. Kusakabe (2021), Use of press-in piling data for estimating subsurface information, Proceedings of The Second International Conference on Press-in Engineering, pp.42-66.
February 2022	Development of PPTs, Chapter 3, A brief development history of press-in machinery, IPA Booklet, pp. 31-36.

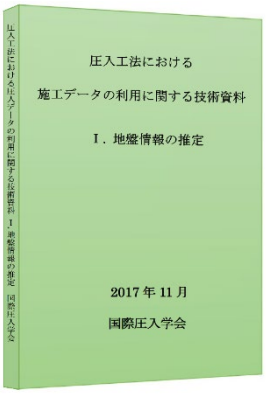


Fig. 4

Technical Committee (TC3)

- Committee Name: Expansion of Applicability and Assessment of
  Seismic Performance of PFS Method
- Chair: Jun Otani (Director of International Press-in Association, Professor of Kumamoto University)
  Secretary General: Shinji Taenaka (Nippon Steel Corporation)
- Members: 33
- Period: From FY 2017 to FY 2020 (Ended)

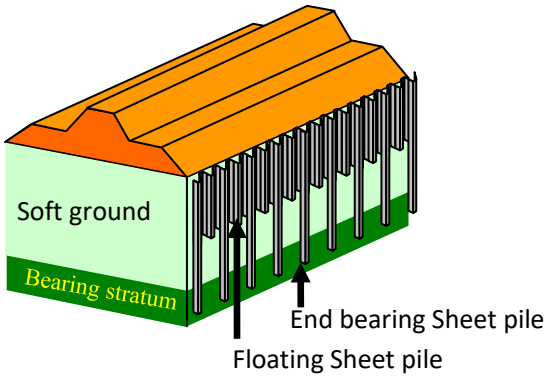


Fig. 1

➢ Overview

The steel sheet-pile method has long been used as a temporary construction work but in recent years, it has been used as a permanent structure. The Partial Floating Sheet-pile (PFS) method is one of the methods to install sheet piles near the tow of the embankment as a countermeasure of ground subsidence due to river embankment construction on soft ground, and this method is a partially floating sheet-piles with the combination of the end bearing sheet-piles and can be easily realized its cost effectiveness and construction feasibility. Regarding the steel sheet-pile method, the effectiveness under the earthquake motion has been also reported in the Great East Japan Earthquake (2011) and the 2016 Kumamoto Earthquake in Japan but there are still the needs for the quantitative discussion to clarify the effectiveness.

The Technical Committee focuses on the PFS Method and aims to develop the method realizing cost effectiveness and construction feasibility contributing to enhancement of national resilience, and also to promote this method worldwide with offering the relevant information.

➢ Activities

In this Technical Committee under the International Press-in Association, the PFS method is on the discussion and the aims of this committee is to propose the quantitative scope of application such as lateral displacement and also to discuss its effectiveness and performance under the earthquake. Specifically, as an activity for four years from 2017, the following items of references are shown.

1) To reconsider the quantification of the lateral displacement of the ground as a condition for the use of countermeasures against settlement
2) To discuss the precise performance of PFS method under the earthquake
3) To propose guidelines for design manual of PFS method
4) To disseminate this method in Asia

In this committee, as shown in the committee list to be shown later, participants from industry, government, academia, stakeholders and experts were involved. We established five WG (Working Group) with the aim of making the missions of the committee clear. Those are as follows.

- **Survey WG**：Accumulation and analysis of actual site data for the performance of the sheet-piles
  - Evaluation of actual site data and applicability analysis (Kyushu Area, Japan), etc.
- **Experiment WG**：Study by centrifugal model test
  - Evaluation of seismic behavior of PFS Method in sandy and cohesive soils, etc.
- **Analysis WG**：Study by numerical analysis
  - Lateral flow effect of cohesive soil and seismic performance evaluation under earthquake, etc.
- **Design WG**：Study on the design method
  - Reevaluation of applicability, study on introduction of aseismic design, and design examples
- **Overseas WG**：Having seminar(s) worldwide
  - Plan for international activities
    e.g., Promotion PFS Method, Education for local researchers and engineers, etc.

➢ Achievements

■ Symposia in Overseas

Oct. 2017	Steel Sheet-Pile Symposium in Vietnam (HCMCUT, Ho Chi Minh)
Dec. 2018	Steel Sheet-Pile Symposium in Malaysia (UTHM, Batu Pahat)
Oct. 2019	Steel Sheet-Pile Symposium in Thailand (KMUTT, Bangkok)

Fig. 2. Symposium in Vietnam

Fig. 3. Symposium in Malaysia

Fig. 4. Symposium in Thailand①

Fig. 5. Symposium in Thailand②

Seminar & International Conference

Nov. 2020	12th IPA Press-in Seminar 2020 in Tokyo
Jun. 2021	The Second International Conference on Press-in Engineering 2021, Kochi, Japan (ICPE2021) *Online Conference

Presentations & Research Papers

Otani, J. 2017. A new sheet-pile method for countermeasures against the settlement of embankment on soft ground (Development of PFS Method), IPA News Letter, Vol. 2, Issue 3, pp. 8-10.

Tung, D. D. 2017. Steel Sheet-Pile Seminar in Vietnam on October 25, 2017. IPA News Letter, Vol. 2, Issue 4, p.21.

Yusoff, N. A. 2018. Steel Sheet-Pile Symposium in UTHM, Malaysia, on December 6, 2018. IPA News Letter, Vol. 2, Issue 4, p.21.

Kitiyodom, P. 2020. IPA-TC3 Steel Sheet-pile Symposium in KMUTT, Thailand, on October 31, 2019. IPA News Letter, Vol. 5, Issue 1, pp. 20-22.

Hizen, D., Kijima, N. and Ueno, K. 2018. Centrifuge model tests and image analysis of a levee with partial floating sheet-pile method. Proc. of 1st ICPE 2018 Kochi, pp. 215-220.

Nakai, K., Noda, T., Taenaka, S., Ishihara, Y. and Ogawa, N. 2018. Seismic assessment of steel sheet pile reinforcement effect on river embankment constructed on a soft clay ground, Proc. of 1st Int. Conf. on Press-in Engineering, pp. 221-226.

Yamamoto, S., Kasama, K., Ohno, M., Tanabe, Y. 2018. Seismic behavior of the river embankment improved with the steel sheet piling method. ICPE2018, pp. 227-232.

Fujiwara, K., Nakai, K. and Ogawa, N. 2019. Quantitative evaluation of PFS (Partial Floating Sheet-pile) Method under liquefaction、Duc Long P., Dung N. (eds) Geotechnics for Sustainable Infrastructure Development. Lecture Notes in Civil Engineering, vol 62. Springer, Singapore.

Kasama, K., Ohno, M., Tsukamoto, S. and Tanaka, J. 2019. Seismic damage investigation for river levees reinforced by steel sheet piling method due to the 2016 Kumamoto earthquake, International Conference on Geotechnics for Sustainable Infrastructure Development (GEOTEC HANOI 2019).

Fujiwara, K., Mallyar, E. 2021. Experimental study for liquefied soil in a gap between underground walls. ICPE2021, pp. 358-363.

Kasama, K., Fujiyama, H. and Otani, J. 2021. 3D fem analysis of partial floating steel sheet piling method on two-layered ground, ICPE2021, pp. 352-357.

Nakai, K., Fujiwara, K. and Ogawa, N. 2021. Seismic performance evaluation of PFS method by soil-water coupled finite deformation analysis. International Journal of GEOAMTE, (in-press).

Ogawa, N., Fujiwara, K. and Nakai, K. 2021. Analytic considerations on two-dimensional modeling of partial floating sheet pile method. International Journal of GEOMATE, (in-press).

Otani, J. 2021. State of the art report on steel sheet pile method in geotechnical engineering -development of PFS method. ICPE2021, pp. 67-85.

Fujiwara, K., Ogawa, N. and Nakai, K. 2021. 3-D numerical analysis for partial floating sheet-pile method under liquefaction, Journal of JSCE, Vol. 9, No.1, pp. 138-147.

Technical Committee (TC4)

- Committee Name: Vertical performance and construction management of sheet piles installed by the Press-in Method and tubular piles installed by Rotary Cutting Press-in Method
- Chair: Stuart Haigh (Director of International Press-in Association, Professor of The University of Cambridge)
  Co-chair: Tatsunori Matsumoto (Vice President of International Press-in Association, Honorary Professor of Kanazawa University)
  Secretary General: Yukihiro Ishihara (Director of International Press-in Association, GIKEN LTD.)
- Members: 27
- Period: From FY 2019 to FY 2022 (planned)

➢ Overview

Recently, sheet piles have been known to be effective not only for temporary but also for non-temporary structures, and the Press-in Method is often chosen in a dense area mainly due to its lower noise and vibration as well as its spatial efficiency. The piles installed by Rotary Cutting Press-in, which can be embedded in a hard ground, are increasingly expected to be utilized not only for retaining structures but also for foundations. However, the design methods of piles installed by these methods have not been well prepared, which has been restricting their practical use. Several researches revealed the high vertical performance of the pressed-in piles compared with piles installed by other methods, but this advantage has not been incorporated into design, partly because the effect of the installation process has not been fully understood and partly because the load test database is limited. On the other hand, the piling data obtained in press-in piling has been shown to be used for estimating the subsurface information. The use of piling data could be expanded for assuring the pile performance.

To provide practical design methods for the pressed-in piles, this technical committee will investigate the existing researches on the vertical performance of the pressed-in piles and the design methods for pressed-in piles that are provided in limited fields. Focusing on the press-in method without the use of installation assistance (Standard Press-in, SP for short) and Rotary Cutting Press-in (RCP), it will aim at providing a recommendation for the construction management of the piling work and the estimation methods of the vertical performance of SP piles and RCP piles. To do these, activities will be conducted in three working groups: Construction Management WG, Vertical Performance Assessment (Japanese Issues) WG and Vertical Performance Assessment (International Issues) WG.

➢ Activities

Based on these backgrounds, this technical committee (IPA-TC4) will mainly work on the followings:

1) Establishing the estimation method of vertical performance and the method of construction management of SP piles,
2) Establishing the estimation method of vertical performance and the method of construction management of RCP piles,
3) Enhancing the reliability of the technique to estimate subsurface information from the press-in piling data and the translation of IPA-TC2 technical material into English,
4) Training young engineers and researchers who are engaged in Press-in Engineering.

➢ Achievements

■ Presentations & Research Papers

Ogawa, N. and Ishihara, Y. 2019. Discussion on the estimation of subsurface information from the press-in piling data of sheet piles. Japan Society of Civil Engineers 2019 Annual Meeting, 2p. (in Japanese)

Suzuki, N. and Ishihara, Y. 2019. Discussion on the method of estimating the second-limit-resistance of the pressed-in pile from the load-displacement relationship at the end of installation. Japan Society of Civil Engineers 2019 Annual Meeting, 2p. (in Japanese)

Suzuki, N. and Ishihara, Y. 2019. Case study on the application of press-in piling data to design and construction of pile foundations for reducing the expected total cost. International Conference on Case Histories & Soil Properties, Singapore, 16p.

Ishihara, Y., Ogawa, N., Mori, Y., Haigh, S. and Matsumoto, T. 2020. Simplified static vertical loading test on sheet piles using press-in piling machine. Japanese Geotechnical Society Special Publication, 8th Japan-China Geotechnical Symposium, pp. 245-250.

Zheng, T. 2020. The vertical and horizontal performance of pressed-in sheet piles. M. Eng. Thesis, University of Cambridge, 52p.

Ishihara, Y., Haigh, S. and Koseki, J. 2020. Assessment of base capacity of open-ended tubular piles installed by the Rotary Cutting Press-in Method. Soils and Foundations, Vol. 60, pp. 1189-1201.

Ishihara, Y. and Kusakabe, O. 2021. State of the art report on the use of press-in piling data for estimating subsurface information. Proceedings of the Second International Conference on Press-in Engineering 2021, Kochi, Japan, pp. 42-66.

Ishihara, Y., Eguchi, M., Brown, M. J. and Koseki, J. 2021. Comparison of penetration resistance and vertical capacity of short piles installed by Standard Press-in in loose sand. Proceedings of the Second International Conference on Press-in Engineering 2021, Kochi, Japan, pp. 260-271.

Zheng, T., Haigh, S. K., Dobrisan, A., Willcocks, F., Ishihara, Y., Okada, K. and Eguchi, M. 2021. The vertical and horizontal performance of pressed-in sheet piles. Proceedings of the Second International Conference on Press-in Engineering 2021, Kochi, Japan, pp. 138-148.

Toda, K. and Ishihara, Y. 2021. An investigation into vertical capacity of steel sheet piles installed by the Standard Press-in Method. Proceedings of the Second International Conference on Press-in Engineering 2021, Kochi, Japan, pp. 177-184.

Toda, K., Ishihara, Y. and Suzuki, N. Comparison of SPT-based design methods for vertical capacity of piles installed by Rotary Cutting Press-in. Proceedings of the Second International Conference on Press-in Engineering 2021, Kochi, Japan, pp. 169-176.

Brown, M. J. and Ishihara, Y. 2021. Predicting the capacity of push and rotate piles using offshore design techniques and CPT tests. Proceedings of the Second International Conference on Press-in Engineering 2021, Kochi, Japan, pp. 185-193.

Technical Committee (TC5)

- Committee Name: Influence of operator's skill and experiences on field performance of Press-in Piling
- Chair: Osamu Kusakabe (Executive Director of International Press-in Association)
  Co-chair: Kiyoshi Minami (Director of International Press-in Association, Muramoto Corporation)
  Secretary General: Masayuki Kitamura (GIKEN SEKO LTD.)
- Members: 12 (all Japanese, having ample experiences in press-in operation on site)
- Period: From FY 2020 to FY 2022

➢ Research Subject

- Field performance of press-in piling greatly depends both on performance of machine and on operators' experiences and skills. The operator's experience and skill play an important role in effective Press-in piling with minimum risk for damaging the machine. Firstly, TC5 tries to demonstrate the difference in Press-in piling operation between experienced and less experienced operators.

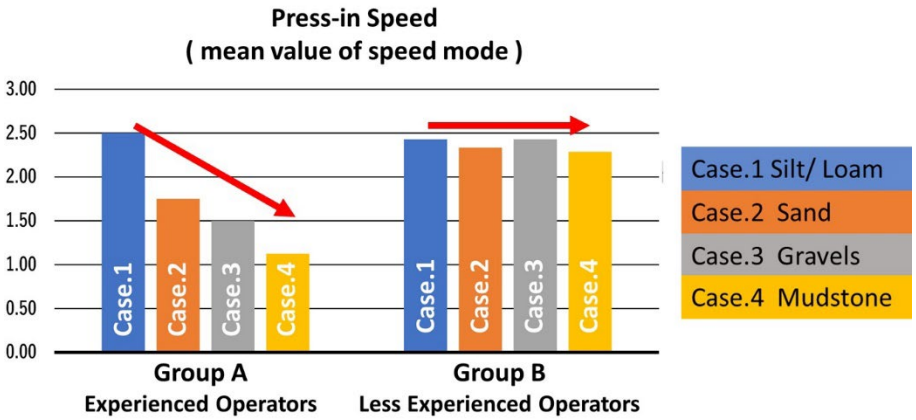
- The information gathered will be of vital importance for providing useful training material for beginners of Press-in piling, for future development of piling machines, and for machine designers. In near future, the accumulated know-how will become an essential database for developing an automatically operating system as a deep learning database based on AI technology.

➢ TC Activities

- A questionnaire survey was conducted on the field performance of press-in piling machine, with the special attention to Gyro Piler. 15 operators were selected from a piling company and were asked to fill in their answers in the sheet of questionnaire. The survey aimed at identifying how experienced operators select key Press-in parameters which would affect effective piling operation, depending on the type of soil profile and on the diameter of steel tubular pile. 21m long piles were assumed to be installed at 20m embedment. The four referenced soil profiles for this survey were selected, covering from soft clayey ground to stiff mudstone ground.

- The first-round survey was conducted during the period of April 2020 to May 2020 to examine the feasibility of the questionnaire items. Based on the results of the first-round survey, the items of questionnaire were reviewed and modified. The second-round survey was then conducted during the period of May 2020 to June 2020. Supplementally, some respondents were interviewed to clarify their answers.

- The questionnaire survey thus conducted revealed the interesting findings related to a picture of how operators use Gyro Piler on site in different soil profiles. It is clear that there is a tendency that the experienced and skillful operators carefully choose the values of initial setting of the machine operation and the number and arrangement of water lubrication system in order for smooth piling operation and for avoiding a possible risk of damaging the machine, taking into account the soil profile and the pile diameter. It is also noticed that the less experienced operators tend to select the similar initial setting values regardless of soil profiles. Figure 1 shows one of the results, demonstrating that less experienced operators select almost the same value regardless of the ground stiffness, while experienced operators set the press-in speed gradually lower as the ground becomes stiffer



Further survey is currently in progress to carry out for cases of other Press-in machines with another group of operators.

➢ Outcomes

■ Publications

T. Takeuchi, S. Sato, T. Takehira, M. Kitamura & H. Murashima (2021), Preliminary results of questionnaire survey on field performance of press-in machine, Proceedings of The Second International Conference on Press-in Engineering, pp. 558-565.

Technical Committee (TC6)

- Committee Name: Investigation and analysis of the development status of Press-in technology in China
- Chair: Ou Xiaoduo (Professor of Guangxi University)
  Secretary General: Guozhu Chen (GIKEN LTD.)
- Members: 11
- Period: From FY 2021 to FY 2023

Objectives

- It has been 10 years since Press-in technology was introduced into China, and there are nearly 300 construction cases. However, the collection and analysis of the construction cases are not systematic. Moreover, problems in the construction and the training of machine operators have become one of the major issues.

- Therefore, by collecting the construction cases of Press-in technology and investigating the construction problems, the problems in the development of Press-in technology in China are clarified and solutions are formulated.

Activity Plan

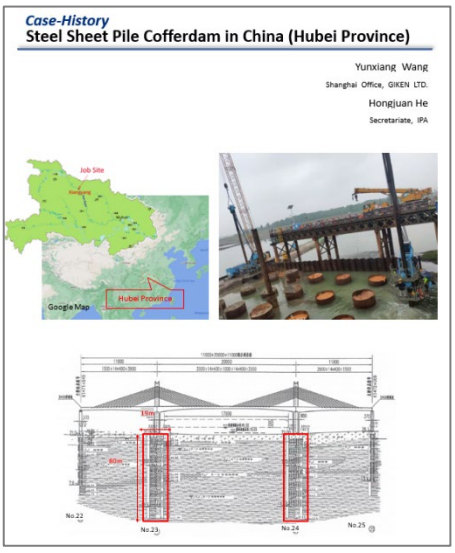
Activities	Outcomes（Planned）
Collection and analysis of case histories on Press-in Methods in China	・Contribute a series of case histories to IPA Newsletter; ・Building the database of construction cases with Press-in technology; ・Updating "Chinese version of「Press-in retaining structures: a handbook」"; ・Holding seminars
Investigation and solution of problems in constructions	Making the investigation report and the manual how to solve these construction problems

●静压植桩工程案例　　年 月 日

1.所有项目并非必填，但请尽可能详细的填写。
2.关于地质状况、基础构造等，也可以图纸形式提供。
3.提供照片、图纸、观测数据等，根据需要，请事先征得业主或总包的同意。

工程信息	工程名称		
	业主单位		
	总包单位		
	施工单位		
	工程地址		
	工程目的		
	施工环境（海、河、住宅区、街道）		
	工程整体工期		
	静压施工工期		
	地质信息	有无地勘资料	有 · 无（如果“有”，请附上详细资料）
		地层结构	
		N值、qt值等	
		地下水位	
		其他	
	基础构造 / 支护构造	结构形式	
		选用理由	
		设计时参照的规范、标准	
	桩/板桩	是否使用循环利用桩材	是 · 否
		型号	
		数量、长度	
		入土长度	
		焊接位置	

Format of the case histories collection



The case history which was published in Newsletter

Award Committee

➢ The IPA can recognize studies, technologies and practices which advanced the Press-in engineering and award honors. The Award Committee was established in 2017 to call for and receive nominations, review them and recommend candidates for awards to the Board of Directors for approval.

Term	Chair	Co-chair
2017-2018	Masaaki Terashi	Andrew McNamara
2019	Masaaki Terashi	Andrew McNamara and Limin Zhang
2020-	Andrew McNamara	Limin Zhang

➢ The current IPA Awards are:

■ **Outstanding Project Award:**

IPA recognizes and honors a project that exemplifies superiority of embedded structures/walls in meeting project requirements and public expectations.

♦ **2019 Award**

「Construction project of retaining wall adjacent to railway in Kyushu, Japan」

♦ **2021 Award**

「Emergency Bridge Abutment Repair with Pressed-in Pipe Piles 」

■ **Innovative Technology Award:**

IPA recognizes and honors innovative technologies that significantly contributed to the advancement of Press-in engineering.

♦ **2019 Award**

「Development of "Headroom restriction Clear Piler for ultra-low overhead clearance" and "steel sheet pile mechanical joint"」

♦ **2021 Award**

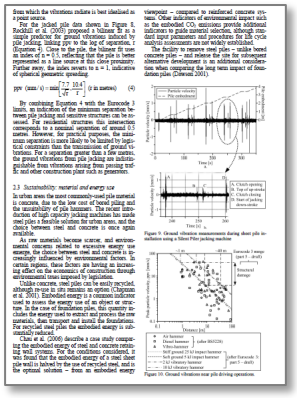
「Effective Utilization of Underground Space in Urban Area」(Underground automated mechanical bike stand)

Distinguished Research Award:

IPA recognizes and honors distinguished research outcomes that contributed to the advancement of Press-in engineering.

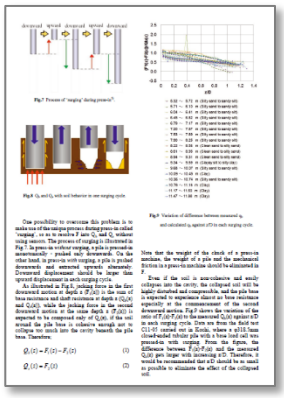
2019 Award

D.J. White and A.D. Deeks
「Recent research into the behaviour of jacked foundation piles」



2021 Award

Ishihara, Y. et al.
「Estimation of N Value and Soil Type from PPT Data in Standard Press-in and Press-in With Augering」



Life-long Contribution Award:

IPA recognizes and honors individuals who have made great contributions to the advancement of Press-in engineering for a long period of time.

2018 Award

- Mr. Akio Kitamura, the Executive Chairman of GIKEN LTD. and the honorary president of the International Press-in Association
- Late Mr. Yasuo Kakiuchi and Mr. Takaharu Kakiuchi, Former and current chairman of the Kakiuchi Ltd.
- Dr. Malcolm David Bolton, Emeritus Professor of the University of Cambridge, Ph.D. and a FREng.

2021 Award

- Dr. Masaaki Terashi, the Advisor of GIKEN LTD. and Director of IPA

The Award Ceremony in 2018

■ **ICPE Best Paper Award:**

The organizing committee and IPA jointly honor the best paper(s) submitted and included in the ICPE* proceedings.

*ICPE is the triennial International Conference on Press-in Engineering

♦ **2018 Award Ceremony at ICPE2018**

♦ **2021 Award Ceremony at ICPE2021 (Online)**

- ✓ The Press-in engineering is multi-disciplinary engineering for improving the planning, design and construction of embedded structures and walls. It covers, but not limited to, geotechnical engineering, environmental engineering, mechanical engineering, measuring-surveying-monitoring engineering, data and information processing.
- ✓ Before the establishment of the current award scheme, IPA awarded the IPA Research Grants once every two years to promising research proposals. The research outcomes were published in the Press-in Engineering 2009, 2011, 2013 and 2015.
- ✓ Furter details of the IPA Award may be found at: https://www.press-in.org/en/page/award

Publicity Committee

- The Publicity committee is one of the standing committees and was established in 2017. The chairs and co-chairs from 2017 until now were shown in the below.

Term	Chair	Co-chair
2017-2018	Yukihiro Ishihara	Michael Doubrovsky
2019-2020	Taro Uchimura	Michael Doubrovsky and Nor Azizi Yusoff
2021-	Yusoff Nor Azizi Bin	Michael Doubrovsky and Ramin Motamed

- Terms of reference were approved by the Board of Directors meeting in 2021 as follows.

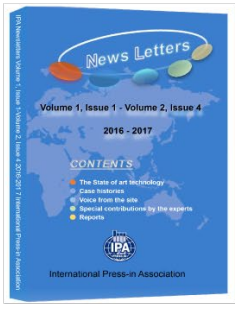
1) Increase IPA Membership working with Administration Committee
2) Publish IPA newsletter and its compact edition (IPA magazine)
3) Maintain and update IPA website
4) Work with Research Committee for publishing and disseminating research outcomes and Case History Volume
5) Develop a long-term plan for IPA publication, including multilingualization of the handbook
6) Plan annual public relations schedule

- Activities

IPA Newsletters

The “IPA Newsletter vol.1, 1” was first published on September 2016, sending out the latest information of Press-in Method. Since then, IPA Newsletter has been published quarterly (March, June, September and December) and delivered to over 2500 readers involved in Press-in Method like academic researchers and practical engineers.

Quarterly Issues ***Combined Version*** ***Special Issue for ICPE***



ICPE2018

ICPE2021

- **Case-histories**
- **Voice from the site**
- **Young Members Column**
- **Special contributions by the experts**
- **Directors’ research and development activities**
- **Reports & Event Dairy**

IPA Website

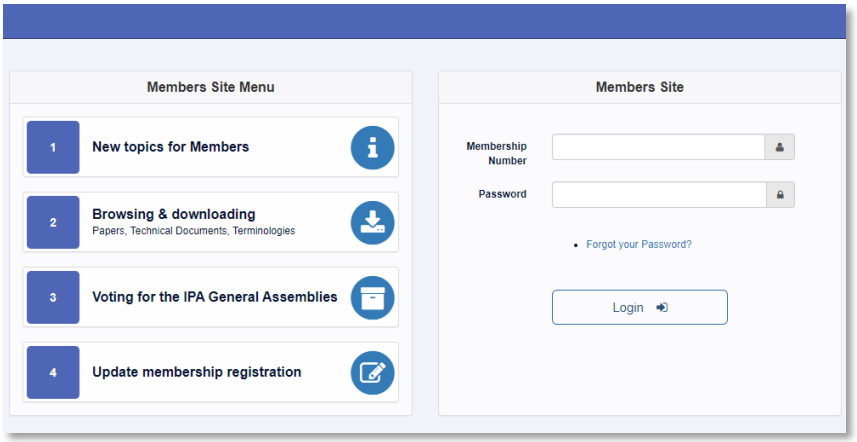
Website

- English and Japanese
- URL: https://www.press-in.org
- Renewed in 2017

Website

- Chinese
- URL: https://ipa-press.org/cn/
- Established in 2020

IPA Members Site



- English and Japanese
- URL: https://member.press-in.org
- Renewed in 2018

Development Committee

- The Development committee is one of the standing committees and was established in 2017. The chairs and co-chairs from 2017 until now were shown in the below.

Term	Chair	Co-chair
2017-2018	Jun Otani	Jiro Takemura
2019-	Jiro Takemura	Yukihiro Ishihara

- Terms of reference were approved by the Board of Directors meeting in 2021 as follows.

1) Plan and develop new activities of the IPA, and support the teams for these newly implemented activities.
2) Plan and organize seminars, symposia and lecture tours
3) Assist the organizing committee for the International Conference on Press-in Engineering (ICPE)
4) Utilize the Handbook at any chances of meeting and seminars

- Activities

■ IPA Seminars on Press-in Technology

Seminar	Date	Participants
IPA Seminar on Press-in Technology in Singapore	2 March, 2017	over 100
IPA Seminar on Press-in Technology in Malaysia	1 November, 2017	over 100
IPA Seminar on Press-in Technology in Thailand	18 May, 2018	103
IPA Seminar on Press-in Technology in Philippines	21 May, 2018	over 100
IPA Seminar on Press-in Technology in Vietnam	6 December, 2018	227

Seminar in Vietnam

Flyer of seminar

International Conference on Press-in Engineering (ICPE)

Conferences	Date	Participants
The First International Conference on Press-in Engineering 2018, Kochi, Japan	19 - 20 September, 2018	418 (from 17 countries)
The Second International Conference on Press-in Engineering 2021, Kochi, Japan (Online)	19 - 20 June, 2021	430 (from 19 countries)

Keynote Lecturers in ICPE

ICPE2018

Fumihiko Imamura
Professor, Tohoku University

Kenjiro Shimada
Team Leader, Komatsu Ltd.

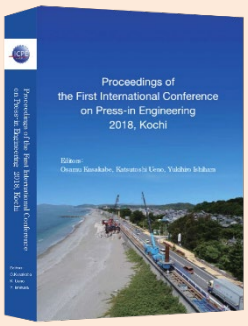
ICPE2021

Mark Randolph
University of Western Australia

Yozo Fujino
President, Josai University

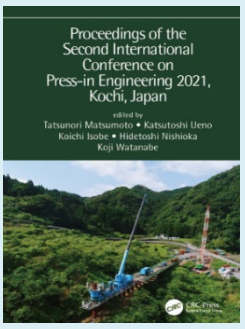
Proceedings

ICPE2018



- 83 papers
- 671 pages

ICPE2021



- 65 papers
- 600 pages

Administration Committee

- Due to the importance of the Administration committee, it was decided that Chair of the committee be IPA President and Secretary of the committee be IPA Secretary General.

Term	Chair	Secretary	Members
2017-2019	Osamu Kusakabe	Kazuyoshi Ishii	-
2020-	Chun Fai Leung	Hisanori Yaegashi	Osamu Kusakabe and Masaaki Terashi

- Terms of reference for Administration Committee were approved by the Board of Directors meeting in 2017 as follows.

1) Maintain Constitution, By-laws, and Regulations
2) Manage the General Assembly and the Board Member meetings
3) Assis Research Committee and Award Committee on administrative activities
4) Assist Publicity Committee to organize various activities on scheduling and coordination
5) Assist Development Committee to organize seminars and International Conferences
6) Manage financial matters on Budget and monthly cost control
7) Develop alliance or collaboration with other entities.

- Activities

♦ 2017-2019

As was specified in the terms of reference, the Administration committee was responsible for supporting activities of other four committees, reflecting the fact that other four standing committees were newly established, and that the manpower of the IPA Secretariate was rather limited. The Administration committee was also responsible for day-to-day management on various matters, thus the working load on the Administration committee was intense. Major achievements during the term may be summarized as follows.

1) Through the revisions of Constitutions and By-laws in 2018 and 2020, and the development of major regulations during the term, the management and operation of overall IPA activities becomes stable and easy to handle.
2) By strengthening the manpower of the Secretariat, the Secretariat was reformed, consisting of four sections (Public Relation Section, Research Support Section, Financial Section, Member Section) and regional office, enabling the Administration committee effective and easier administration.
3) By assisting Research Committee, Research Committee has established six technical committees, promoting research activity.
4) By assisting Publicity Committee, the editorial committee under Publicity Committee regularly publishes quarterly newsletters.
5) By assisting Development Committee, four Press-in Seminars were organized in Singapore, Malaysia, Thailand and Philippines, and the first International Conference on Press-in Engineering was held in 2018.

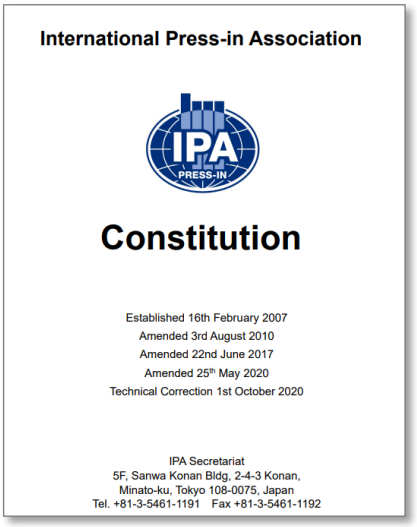
♦ 2020-

1) Continued to institutionalize the Secretariat in particular and the IPA as a whole.
2) Amendments to the Bylaws concerning the Nomination Committee were approved at the December email Board meeting.
3) Assist the Organizing Committee of ICPE 2021.
4) Worked as the engine for organizing events to commemorate the anniversary.

Board Meeting in 2017 (Kochi, Japan)

Board Meeting in 2019 (Tokyo, Japan)

Board Meeting in 2021 (Online)



International Press-in Association

IPA PRESS-IN

Constitution

Established 16th February 2007
Amended 3rd August 2010
Amended 22nd June 2017
Amended 25th May 2020
Technical Correction 1st October 2020

IPA Secretariat
5F, Sanwa Konan Bldg, 2-4-3 Konan,
Minato-ku, Tokyo 108-0075, Japan
Tel. +81-3-5461-1191 Fax +81-3-5461-1192

Constitution

With the COVID-19 situation not so good globally, much of the IPA activities were held online. Despite this, ICPE 2021 attracted over 400 participants and managed to break even. In view of the current COVID-19 situation, the 15th anniversary function will likely be held online in late February 2022 together with the IPA Newsletter for the 15th anniversary special edition. It hopes that face-to-face meetings/functions could resume by mid-2022.

Future development and practical applications of results achieved from IPA Scientific Grant Awards

Michael Doubrovsky
Professor, Odessa National Maritime University

Such interesting IPA initiative as Scientific Grant Awards was launched in 2007 just after IPA creation. This event has sustained 5 calls started in 2007, 2008, 2010, 2012 and 2014. At every call, submitted proposals were assessed by special IPA commission according to the established requirements. Selected proposals were awarded by IPA Scientific Grants at the special ceremony (as part of the IPA workshops). Winners were greeted and awarded by IPA Honorary President Akio Kitamura. In total there were 36 awarded studies in the field of research and 2 awarded studies related to the potential market survey of press-in piling in some regions. Almost all awardees were from universities (excepting 2 cases) located in 11 countries: Australia, China, Great Britain, Ireland, Japan, Malaysia, Netherlands, Singapore, Ukraine, USA, Vietnam (countries are named in alphabetical order). Awarded studies were fulfilled during 1-2 years depending on subject and provided funding.

5th Scientific Grant Award Ceremony

In order to analyze results achieved from IPA Scientific Grant Awards during 10-years research period of 2007-2017, we worked out related questionnaire and gained interesting information based on the structure presented in the following table.

Type of information	*Considered questions*
General	Title of the awarded research
	Years of awarding and research fulfillment
	Awardee(s)/Principal Investigator
Main results of the research	1. Scientific achievements and importance 2. Form of research results presentation • Scientific reports on IPA seminar and other conferences • Publications (articles, books, etc.)
Further development of the awarded research (after awarded period)	1. Kind of further researches (theoretical, experimental, design, consulting, other) 2. Achieved results of further researches 3. Publications 4. Conferences/seminars reports 5. Practical implementation (projects, consulting, designing) 6. Theses (Ph. D., M. Sc., etc.) and/or scientific advising and supervising
Recommendations	Awardee's opinion on IPA Scientific Grant Awards

Our questionnaire was shared with almost all awardees (Principal Investigators) of IPA Scientific Grant Awards whom we could reach due to available contact information. We got 11 responses covering the whole period of grant awards application (2007-2014). Reactions were received from Japan (8), China (1), Vietnam (1) and Ukraine (1).

Summarizing aims, subjects, results of all made researches (in general) and gained commentaries from IPA awardees (in particular) it is possible to conclude the following.

1. Fulfilled researches covered such topics as:
    - Press-in technology, pilers and related machines
    - Piles and their features (mainly tubulars and sheet piles): stress-strain state, bearing capacity, etc.
    - On-site investigations, ground properties and soil behavior
    - Experimental and numerical studies of pressed-in structures including influence on neighboring buildings
    - Case studies and environmental issues, projects and designs
2. Research teams mainly consisted of Principle Investigator and younger colleagues (PhD students, MS students, etc.)
3. Methods of research were rather diverse, but mainly experimental studies had been applied: physical modelling in laboratory conditions, large scale on-site tests or numerical modelling (FEM was applied as main instrument which effectiveness depends on correct selection of the "structure-soil interaction" model). Most important results were obtained due to combined application of experimental data and advanced theoretical models; in particular it relates to such actual problems as sheet piling behavior and tubular piles bearing capacity
4. Process of reporting on obtained results was coincided with regular IPA workshops. Considerations on each research were not formal procedure but free professional discussions leading to the better understanding of the subject of disputes.
5. Importance of achieved results and conclusions have been confirmed by their publications not only in the Proceedings of workshop but also in the well-known scientific journals with high impact factor and in the proceedings of prestigious international conferences, etc.
6. According to the gotten awardees' responses, a lot of obtained results (about 75%) occurred to be rather perspective for their further development. In most cases researches were continued after awarded period either in the form of further experimental and numerical studies or by the way of summarizing achieved scientific information resulting in reports to the international conferences, articles in the journals. Also, due to IPA Grant Awards several Ph.D. and MS theses were developed and defended (at least 6 theses were reported). It is worth to mention that many awarded principal investigators have applied information related to the Press-in method in the educational process in their universities.
7. According to the opinions of principal investigators, awarded grants gave them and their colleagues new interesting possibilities, in particular:
    - to up-date experimental facilities and instrumentation and, correspondingly, to get new research results,
    - to use the grant as the incubator to expand the scope of engineering since the topics were rather cross-disciplinary issues,
    - to have the opportunity to participate in international conferences and workshops with students, present research results, visit sites (where press-in engineering and press-in machines are applied) and conduct language training, which led to an increase in their motivation for research,
    - to update the analysis software (for example, for the three-dimensional FEM and for liquefaction analysis),
    - to set the research theme in the graduation research of the students of the main course and the special research of the students of the advanced course.
8. In order to support prospected researches, IPA initiated creation of specialized technical committees which have some resources to provide their fruitful activity (see related articles (P10-P22) in this Newsletter issue)
9. Finally, it is possible to conclude that IPA Grand Award initiative had played an important role to select topical directions of Press-in related researches, to check perspectivity of the proposed scientific approaches and to provide further development of the most promising ideas. So, why not to consider some form of restoration in coming future of such memorable and useful event as IPA Grand Award? Obviously, its organization and arrangement may be modified regarding current situation. In particularly, from the point of view of regularity, this event may be correlated with International Conferences on Press-in Engineering.

It is my pleasure to express gratitude to Dr. Osamu Kusakabe (IPA Executive Director) and Ms. Hongjuan He (IPA Secretariat) for kind support, useful advice and interesting information during preparation of this material.

Science, Engineering and Press-in Piling – the Headwaters of the IPA

Dame Sarah Springman FREng

Formerly Professor of Geotechnical Engineering and Rector of ETH Zurich
Principal, St Hilda's College, the University of Oxford

There are many examples of practical expediency leading to the creation and evolution of new technologies in ground engineering that are more effective and efficient, and hence these become more economic, too. When environmental sustainability is added to the equation, then it is quite likely that a winning formula has been found and should be commercialised and shared around the world. This is why the International Press-in Association was formed 15 years ago, to promote the understanding and use of this mode of pile and piled wall installation. The IPA seeks to bring experts from geotechnical, environmental, mechanical and electrical engineering together to explore and explain unseen phenomena and mechanisms in the ground.

This short retrospective recounts the early days of the relationship between the Soil Mechanics Group from the University of Cambridge and GIKEN LTD., dating back a further 15 years.

Pragmatic geotechnical engineering in terms of 'Just doing it' led Mr. Kitamura to evolve the Silent Piler technology, to improve the installation and performance of piles and sheet pile walls, environmentally and economically. Initially, this was for the Japanese market, and later for the Asian market and thereafter, further afield. His style of conceiving and thinking through what he wanted to achieve, and how he delivered it, was deeply impressive: from the perspective of mechanical, electrical and process engineering, through to the kit of parts from the smallest bolt to the biggest item, and how they should be manufactured, instrumented and fitted together.

Since the science behind the mobilisation of pile and piled wall resistance during and post silent-driving was in its relative infancy, in terms of identifying and quantifying the interacting mechanisms, Mr. Kitamura and his colleagues at GIKEN LTD. in Kochi, Japan, approached the Soil Mechanics Group at the University of Cambridge. Professor Malcolm Bolton and the author visited Kochi in December 1993 to explore future possible relationships (see pictures below).

Subsequent negotiations following the visit led to annual selections of Masters' students from Cambridge, who would visit GIKEN / GIKEN subsidiaries / GIKEN projects and engage in research for their Masters' projects, arising from their observations in the field. The first two students were Ms. Fiona Gooch and Mr. Matthew Carter, who visited GIKEN in summer 1994 and identified the following issues to be of relevance and interest to them:

1. Strength mobilised in the pressure bulb with time during driving, surging and in service.
2. Predicting the maximum press-in force and productivity rate.
3. Calibrating penetrometer (CPTu/SPT) data with data obtained during silent-piling to assist with point 2.
4. How to apply water jetting most effectively to ease driving and in view of environmental considerations.
5. Opportunities to develop air jetting to improve driving in some soils.
6. Determining lateral stresses acting on the sheet pile walls over time.
7. Comparisons of press-in methods with pile driving methods.
8. Developing an effective reaction base from past/recently driven piles.
9. Influence of silent-piling on novel prefabricated structures.

Their reports and theses were submitted as the first of a series of Cambridge students, who have benefited from this relationship early in their careers. Dr. Stuart Haigh remains active in this field today, nearly 30 years on from the initial meetings in Kochi. Personally, may I wish the IPA all the very best, and much success in the future!

Fig. 1. Mr. Kitamura (left) in his office with members of his team (2nd left and right), getting to know the Sensei, Professor Malcolm Bolton and his colleague, Dr. Sarah Springman!

Fig. 2. Sensei Bolton in action, discussing the Press-in installation mechanisms.

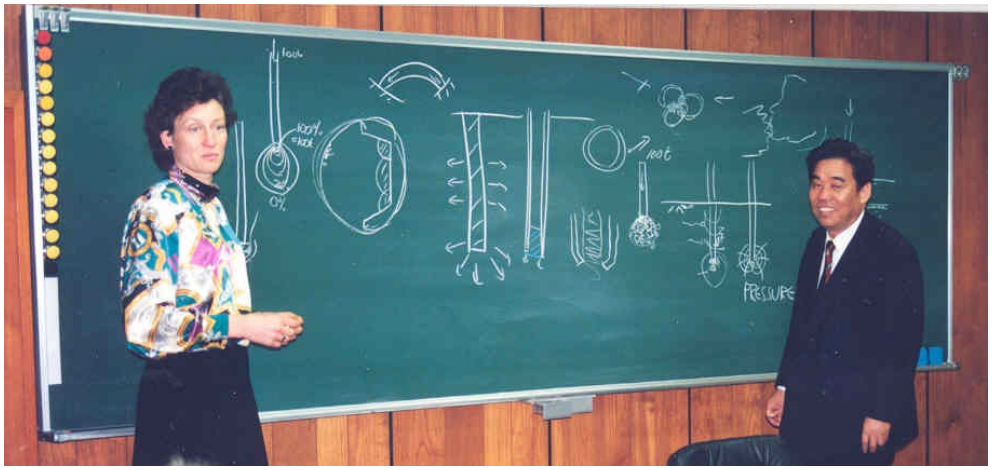


Fig. 3. Mr. Kitamura advising the author

Fig. 4. The author obtaining practical experience in driving the SILENT PILER.

Fig. 5. Powering the SILENT PILER: a triathlete in action

Fig. 6. Mr. Kitamura (centre) with Professor Malcolm Bolton (left) and Dr Sarah Springman (right) in front of one of the earlier silent-piling rigs.

Fig. 7. With the support team (Mr. Stephen Hodge)

Fig. 8. At Katsurahama Beach

Fig. 9. In Lilliputian style below Ryoma Sakamoto

IPA NewsLetter Volume 7, Issue 1 February 2022

Remembering early press-in research – the Headwaters of the IPA

David White

Professor, University of Southampton

Introduction

It is a pleasure to reflect back on the early years of press-in research for this special 15th Anniversary issue of the IPA Newsletter. During my third year as an undergraduate student, a scholarship was advertised offering a bursary and the opportunity to visit Japan during the summer vacation period to carry out fieldwork. I applied and was interviewed by Professor Malcolm Bolton. A few days later I heard I had been successful and was told to get organized to visit Kochi during the summer, as one of three Giken Scholars. This began my 10 years of involvement in annual summer visits to Japan by Cambridge students, to participate in press-in engineering research at the Giken test sites in Kochi, on Shikoku Island. These visits combined cultural exchange and targeted research. Every year, the group of students would assemble at Heathrow, accompanied by Malcolm, and board a flight to Kansai. For the new scholars this was usually their first visit to Japan, and in some cases a first trip outside Europe.

Giken Scholarships: collaborative research and cultural exchange

We were always given a remarkable welcome on arrival at Kochi's small airport. Mr. Akio Kitamura, Founder and Executive Chairman of GIKEN LTD., would usually be waiting in the driving seat of his restored vintage bus, ready to drive us to our hotel in downtown Kochi.

The Giken Scholarships were the core element of a collaboration between Giken Seisakusho and the University of Cambridge that originated when Mr. Kitamura contacted the university around 1993. These early interactions with Malcolm Bolton and Sarah Springman (who was a lecturer in Cambridge at the time) led to a first visit by Cambridge students to Kochi in Summer 1994.

The resulting collaboration began as a very loose arrangement, unburdened by work packages or specific deliverables. Instead, the aim was to bring bright and enthusiastic Cambridge students to Kochi to immerse themselves in the philosophy of the company, and to collaborate on topics of mutual interest. Since Giken is primarily a mechanical engineering firm, and the Cambridge cohort were focused on geotechnics, there was plenty to learn from each other as we explored the possibilities of Giken's press-in technology.

Fig. 1. The Cambridge team pressing-in piles: Gulin Yetginer, Malcolm Bolton and David White take turns to operate a Silent Piler under the watchful eye of Kayoko Yamamoto at Giken's Takasu facility in July 2001.

Visits would often begin with a tour of the Takasu site, including Mr. Kitamura's personal museum of pile driving equipment. We would also enjoy demonstrations of new types of piling machinery, and there would be a chance to try press-in for ourselves, using a wirelessly-controlled Silent Piler (Fig. 1). We would then spend long sessions at the whiteboard, sketching soil mechanics concepts, pondering the mechanisms of pile capacity and installation resistance, and exploring the possibilities offered by the remarkable robotic control and actuation systems offered by the

Giken technology. These sessions tested the endurance of the English-speaking Giken staff who acted as translators, but were often followed by memorable staff parties with raucous speeches and endless toasting.

The visits soon established a pattern in which a series of pile installations and load tests would be planned, and the test program would keep the Cambridge team occupied for the month of their visit. These tests were primarily conducted at Giken's Takasu facility, under the stewardship of Teruo Nagayama's team (Fig. 2), with occasionally visits elsewhere, to find different ground conditions.

Fig. 2. Giken Scholars working alongside Giken engineers at the Takasu test site
(clockwise from top left: 1997, 2002; 2006; 2002; 2003)

The Cambridge team worked alongside the Japanese engineers on all aspects of the testing. We learned both the practical skills – site safety, machine operation, instrumentation use – and also the Japanese cultural approach to work. This included the morning exercises, the daily environment clean-up (kankyo seibi) and adopting a 'first time success spirit' (ippatsu seikou seishin). I still enjoy using these phrases today. Figure 3 shows the Giken scholars from the first decade of the scheme.

Early research achievements

On returning to Cambridge, the Giken Scholars would extend the summer's work during their final year project. This collaboration format was very productive, leading to outcomes that the Giken Scholars were able to publish in conference papers co-authored with Giken company colleagues. These papers include:

- Measurement of the stresses in pile plugs, using novel instrumented bolts (White et al. 2000)
- Installations with and without pile shoes, to minimize resistance (Finlay et al. 2001)
- Field data confirming the low noise and ground vibration from press-in piling (Rockhill et al. 2003)
- Load tests and interpretation to assess the high stiffness of pressed-in piles (Deeks et al. 2005)

- Load tests quantifying the capacity of pressed-in cell foundations (Yetginer et al. 2003, 2006)
- H-pile load tests confirming a positive group effect from plugging activation (White et al. 2003)
- Observations of rate effects during installation, linked to consolidation (Jackson et al. 2008)

Fig. 3. The first decade of Cambridge Giken Scholars, 1996-2005 (top row: Matthew Carter, Fiona Gooch, Naomi Lyons, David White; middle row: Peter Kirkham, Hari Sidhu, Tim Finlay, Yueyang Zhao; bottom row: David Rockhill, Andrew Deeks, Gulin Yetginer, Helen Dingle and Melvin Hibberd)

A common thread throughout these studies is the linkage between the special features of press-in construction and the underlying soil mechanics. The insights have led to improved recommendations for the design of pressed-in piles, for example to harness the higher stiffness created by the jacking process, or the activated plug capacity from a pressed-in H-pile wall. The research has also led to new ideas for the design and operation of press-in machinery. For example, Andrew Deeks' PhD demonstrated the easier installation that can be achieved by combining press-in with rotation – a technology used by the Gyropress system. Other work led to improvements to the water jetting systems used to ease high jacking forces.

The papers authored by Giken Scholars on their press-in research have now been cited >250 times, and the early work was consolidated into two invited keynote papers (White & Deeks 2007, White et al. 2010). A full list of the early Cambridge-Giken projects was presented in Volume 2 Issue 2 of the IPA Newsletter.

The research outcomes from the visits to Japan are only part of the impact of Mr. Kitamura's support for the Giken Scholarship scheme in Cambridge. The positive experience in Japan was a memorable cultural experience (Figure 4) as well as providing engineering training. It has led many of the Giken Scholars into a successful civil engineering career. Giken Scholars can currently be found working at Arup (multiple!), BP, Beale & Co, Buro Happold, Equinor, Laing O'Rourke, McKinsey, the Norwegian Geotechnical Institute, Ramboll, Skanska and Twinza Oil. Some have pursued different but

equally successful careers, with activities ranging from fair trade policy development to hedge fund management.

Fig. 4. Cultural experiences (clockwise from top left): a fast-flowing noodle flume (2004), a Tea Ceremony (2001), an izakaya in Kochi City (2006) and a Giken party hosted by Mr. Kitamura (2003)

Press-in engineering: visionary foresight

It is remarkable to look back 25 years to the first Cambridge visits, and see the foresight of President Kitamura and the Giken Seisakusho organization. At that time, Giken's machinery was pioneering concepts of robotics, automation and digitalization that are only now emerging into the engineering mainstream. Giken was investing in these technologies more than forty years ago, which led to the first wirelessly-controlled Silent Piler in May 1982 and the first cloud-connected Silent Piler in 2003.

In 2004 the Cambridge team were shown a demonstration of the Giken-IT system which monitors the machine performance and jacking resistance of each a Silent Piler and beams this data back to a control centre in Kochi. This system allowed the Giken engineers to monitor the performance of each machine, and plan predictive maintenance. The measured press-in force also fed into a database of ground-related information, allowing installation rates and operating practices to be predicted and optimized for different ground conditions. In establishing this early form of 'digital twin', Giken realized the value of 'big data' to improve the performance of their machines and assure the performance of the structures they create.

In 2004 we were given a presentation on the Ecopiler, which was then entering production – a Silent Piler that operates on biodegradable lubricants to reduce the environmental impact of construction. Earlier, in 2002, Giken supported a project by Sarah Carley in Cambridge that completed a life cycle analysis to quantify the embedded carbon in different

types of retaining wall. This analysis compared steel and concrete solutions, and accounted for the additional impact from temporary works, which are largely eliminated by the press-in method.

During our visits we were sometimes taken to a demonstration of the Ecocycle facility – an underground circular wall of pressed-in piles, in which a carousel system is installed, to park bicycles. This system could rapidly store and retrieve bicycles using swipecard control, providing a method to add bicycle parking at Japan's crowded public transport interchanges, reducing car use.

Today, with decarbonization and the preservation of biodiversity at the top of the global agenda, and with data science driving advances in many sectors, all industries are heading in the direction that Giken turned towards more than 20 years ago.

Genesis of the International Press-in Association

By 2005, the Giken-Cambridge collaboration had gained a high profile among the geotechnical engineering community, and Mr. Kitamura was looking to raise the profile of press-in engineering further by supporting a wider range of researchers, and establishing an organization that could coordinate and champion this effort.

Initial planning for the International Press-in Association included a preparatory assembly of the IPA in Kochi, Japan, hosted by Hajime Okamura of the Kochi Institute of Technology. This initial IPA event was held one week before the quadrennial International Conference on Soil Mechanics and Geotechnical Engineering took place in Osaka. As a result, Giken were able to host a large group of international geotechnical experts at the Kochi facilities (Fig. 5). The preparatory assembly included demonstrations of press-in technology and presentations of the research work to date. This event was successful in creating wider engagement with the global research community. The seed of the IPA was sown, and over the next year a working group began to develop a framework for the IPA that brought together Japanese and international academia, as well as local and international industry.

Fig. 5. International experts gathered in Kochi for the preparatory assembly of the IPA in 2005. They are seen here in the Monumental Garden of the first Press-in Piling, at Giken's Takasu site, 9 September 2005.

By the end of 2006, arrangements to create the IPA were in place, and the organization was formally established on 16 February 2007, headquartered in Tokyo. A first international workshop of the IPA took place in Cambridge during September 2007, and was attended by 32 participants (Figure 6). The event included state-of-the-art presentations on press-in research and practice, and a ceremony for the award of US$100,000 of new funding to a wide range of other universities. The event closed with a ceremonial dinner at St John's College, Cambridge, exchanges of gifts, and toasts to the success of the IPA.

And so, the IPA was born, with a mission to explore, enhance and promote press-in engineering. Today Giken and the IPA maintain their strong link to Cambridge. Dr Stuart Haigh now leads the collaboration, and the Giken Scholars continue to work alongside the Giken engineering team to explore the potential of press-in engineering. Meanwhile, the IPA has become a well-established organization, with more than 800 members sharing the same excitement for press-in

engineering as the Giken Scholars, contributing research and good practice across the breadth of press-in engineering themes.

Fig. 6. A photo montage of the first International Press-in Association Assembly, Cambridge, Sept. 2007

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