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News Letter

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Message
from New Vice President

Prof. David White

University of Southampton

I am writing this message for the IPA newsletter as I settle into a new role at the University of Southampton, UK, as Professor of Infrastructure Geotechnics. I have returned to the UK after 12 years at the University of Western Australia. It is great to be back in my home country and it is fantastic to have the opportunity through the IPA to reinvigorate my involvement in the press-in movement, which began during my undergraduate studies at the University of Cambridge in 1997. I can still clearly recall my first visit to Japan as a Giken Scholar. After a tour of President Kitamura's collection of pile driving equipment in the Kochi Seko yard I was given the wireless controller of a Silent Piler and installed my first sheet pile under the watchful eye of Yamamoto-san, the most highly skilled operator among the team.

Over the following decade of collaboration, I and the other Giken-supported students were privileged to enjoy fruitful periods of fieldwork alongside Giken's team at sites in and around Kochi City on Shikoku Island. Much of this early work was summarised in a keynote lecture at the 2010 Deep Foundations Institute conference in London, which I co-authored with Giken-supported PhD student Andrew Deeks, and Giken researcher Yukihiro Ishihara.

Photo 1 Research collaboration with GIKEN

As I return to the UK with a renewed focus on construction technology, it is pleasing to see the press-in method finding widespread adoption, but there are further opportunities to harness the benefits of the press-in method for new applications. For example, two of my new colleagues at Southampton, Professors William Powrie and David Richards, have been heavily involved supporting the UK railway industry to improve their foundation design methods for railway infrastructure following many highly publicised difficulties with the UK's railway modernisation plan. Poor performance of the railway-mounted piling system used for the overhead electrification of the railway network in the UK's west played a major part in >£800M of cost overruns in the past two years, and led to cancellation of parts of the program.

Meanwhile, in the offshore environment, I and my Southampton colleague Professor Susan Gourvenec are challenging technology conventions for offshore foundations in new frontiers. These include novel support methods for the 'subsea factory' required for remote oil and gas developments and reinvention of the monopile for structures such as wind turbines, to overcome the difficulties associated with increasing water depths and unwieldy large pile diameters.

All of these applications seek foundation solutions for a challenging working environment that offer easy installation, predictable capacity and potential for end-of-life removal. Solutions should satisfy the five construction principles promoted by press-in engineering, and technologies such as Giken's remarkable gyropress rotary jacking system provide a powerful starting point.

In a time when construction innovation is turning to the potential benefits of robotics, automation and digitalization, we should acknowledge President Kitamura's remarkable foresight. Giken was investing in these technologies forty years ago, which led to the first wirelessly-controlled Silent Piler in May 1982 and the first cloud-connected Silent Piler in 2003, providing continuous monitoring of machine performance and jacking resistance back at the Kochi headquarters.

At the start of my career I was very fortunate to collaborate with President Kitamura and the team of innovators within Giken Seisakusho, who are thought leaders in the realm of construction technology and smart infrastructure. Here in Southampton we are privileged to be hosting the UK's new National Infrastructure Laboratory (NIL) on our campus, which is part of UK:CRIC – the UK's Collaboratorium for Research on Infrastructure and Cities. The NIL is currently under construction, will host academics, students and industry partners, working together to address critical engineering challenges we face today. Giken's technology and innovative spirit, and the collaborative track record of the IPA, are inspiration for the type of relationships we are aiming to foster, to create the engineering advances needed to sustain today's society and to protect our environment.

So I take great pleasure in enjoying a continuing connection with Giken Seisakusho and the IPA more than twenty years after my first encounter with press-in technology, and look forward to supporting many further advances in construction technology under the auspices of the International Press-in Association.

◆ A brief CV of Prof. David White

1994-1998	BA, MEng, University of Cambridge (1997-1998: Giken Scholar)
1998-2002	PhD "An investigation into the behaviour of pressed-in piles", supported by Giken, supervised by Professor Malcolm Bolton
2001-2003	Research Fellow, St John's College, 2003-2006 Lecturer, Cambridge University
2006-2017	Professor, University of Western Australia
2017-	Professor, University of Southampton

David has published more than 250 papers, receiving 9 awards and >6000 citations. His primary research areas are foundations, pipelines and anchors. He and his colleagues have received 8 awards from industry groups, recognising the impact of their research, and he serves on various code-writing committees, supporting the advancement of engineering practice.

Special Contribution

Measures for Earthquake– and Tsunami–Resilience Enhancement of Industrial Parks in Bay Areas

Dr. Masanori Hamada

Professor Emeritus, Waseda University

E-mail: Hamada@waseda.jp

During past earthquakes and tsunamis, industrial parks have been repeatedly damaged by the strong earthquake motions amplified by the soft reclaimed grounds, the liquefaction of the sandy soil, and its induced ground displacements, and tsunamis. Heavy damages to industrial parks caused by future earthquakes and tsunamis will make huge impacts on the safety and the security of the nations and the people, as well as the worldwide economic activities. Therefore, the enhancement of earthquake- and tsunami-resilience is one of most urgent national subjects in earthquake- and tsunami-prone countries such as Japan.

Keyword: earthquake, tsunami, industrial park, soil liquefaction, ground displacement, oil tank, earthquake-resilience enhancement

1 Damage to Industrial Parks during Past Earthquakes

1.1 Damage to oil tanks caused soil liquefaction and its induced ground displacement

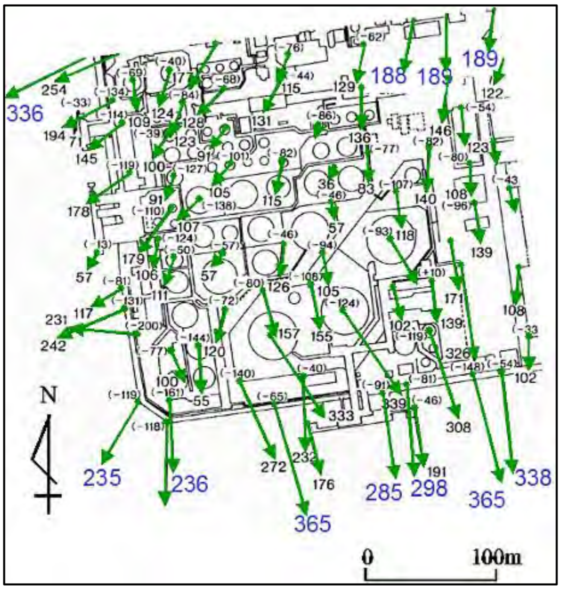
The soil liquefaction tilted and subsided a number of tanks for the storage of oil, high pressure gas and petrochemical products during past earthquakes in Japan. Figure 1 shows one of examples of tilted and subsided tanks due to a large decrease of the bearing capacity of the foundation ground by soil liquefaction during the 1995 Kobe earthquake [1]. Soil liquefaction has also ruptured oil protection walls as shown in Fugure2, which were caused by the 2011 Tohoku earthquake at Kashima petroleum plant along the Pacific coast.

Figure 1 Tilting and Subsidence of Oil Tanks by Soil Liquefaction (1995 Kobe earthquake)

Figure 2 Damage to Oil Protection Wall (2011 Tohoku earthquake)

Oil protection walls have an import role to prevent the outflow of the oil from the tanks to the plant site as well as into the sea. The damage shown in Figure 2 recognized as again that a great length of oil protection walls remains un-reinforced against the soil liquefaction.

(a) Tank site in Kobe, Aerial photo taken two days after the earthquake



(b) Ground displacements（cm）

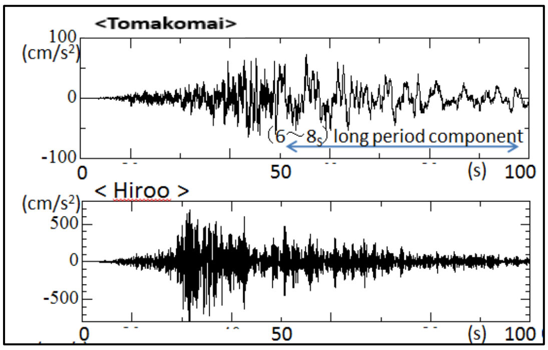
Figure 3 Ground Displacements of A Manmade Island in Kobe Caused by Soil Liquefaction (1995 Kobe earthquake)

The soil liquefaction has caused one more serious damage to the oil and high pressure gas tanks during the past earthquakes. Figure 3(a) was an air photo taken two days after the 1995 Kobe earthquake over a manmade island reclaimed from the Osaka bay, where had been used for a tank site for storage of petrochemical materials and high pressure gas. The yellow color of the ground surface of the photo shows the sand boiled out of the ground due to soil liquefaction. This photo suggests that the whole area of the tank site liquefied. Figure 3 (b) shows the displacements of the quay walls and the ground surface. The vectors of the figure show the ground displacements in the horizontal direction and the numbers at the top of the vectors are the magnitude of the displacements in centimeters. The quay wall moved towards the sea 3 to 4m, and a whole area of the tank area of about 400m width and length, also moved 2 to 3m toward the sea [2]. These large ground displacements ruptured the pipeline of liquefied propane gas and a large amount of gas leaked. The residents in the neighborhood of the plant were forced to evacuate for about 24hours, but fortunately no explosion occurred.

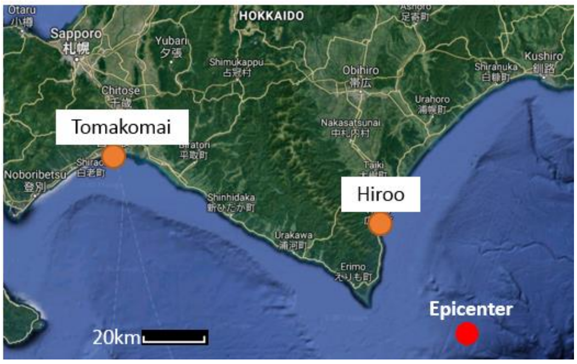
1.2 Fires of tanks caused by long period earthquake ground motion

Long period components of earthquake ground motion caused sloshing vibration of the oil in floating roof type tanks, which resulted in big fires. During the 2003 off-Tokachi earthquake in Hokkaido, two tanks with a diameter about 40m fired and burnt down at an oil refinery plant in Tomakomai, as shown in Figure 4(a). Figure 4(b) shows the earthquake motions on the ground surface at two locations, Tomakomai and Hiroo. Figure 4(b) and (c) show that the earthquake ground motion observed at Tomakomai contained long period components of 6-8s, but, these long period earthquake motions were not observed in the record at Hiroo, where short period vibration components were dominant. The difference of dominant periods resulted from the difference of the ground conditions of the two locations. Tomakomai is located on soft surface soil with thickness about 2km. On the contrary, Hiroo is located on very thin surface soil of several meters thickness over hard rocks. The thick surface soil ground at Tomakomai amplified the long period components of the earthquake ground motion.

(a) Fires of oil tanks



(b) Observed accelerations



(c) Epicenter of the earthquake and observation points of earthquake

Figure 4 Fires of Oil Tanks Caused by Long Period Components of Earthquake Ground Motion (2003 off-Tokachi earthquake)

The diameters of the two fired tanks are about 40m and the natural periods of the sloshing vibration of the oil, depending on the depth of the oil, are estimated to be about 5 to 7s, close to the dominant periods of earthquake ground motion observed at Tomakomai. This long period earthquake ground motion induced sloshing vibration of the oil of the tanks, and the oil spilled out of tank was ignited by the metallic collision between the steel floating roof and the steel side wall. Fires of oil tanks by the sloshing vibration have been also reported during many past earthquakes such as 1964 Niigata earthquake and 1999 Kocaeli earthquake in Turkey.

1.3 Explosions of tanks caused by the short period earthquake ground motion

Besides the long period component of earthquake ground motion, the short period ground motions of less than one second have also caused the fires of oil and gas tanks due to the dynamic inertia forces of tanks and their contents. Seventeen spherical tanks of liquid propane gas in the Tokyo bay were collapsed and exploded during the 2011 Tohoku earthquake, as shown in Figure 5(a). The fire continued about one week, because the firefighters could not approach to the burning tanks. The firefighting was conducted from the sea by fireboats. A steel fragment of exploded tanks with a length of 1.5m and a width of 80cm scattered and dropped in the residential area 6km away from the plant.

(a) Seventeen spherical tanks were fired and exploded [3] (from Tokyo Fire Department)

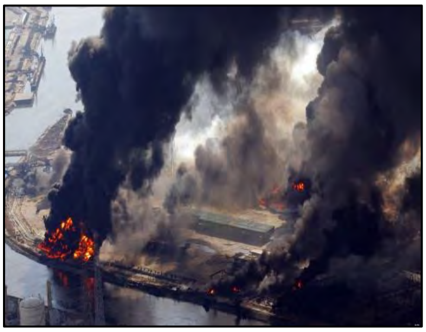
(b) Breakage of steel braces

Figure 5 Fires of Spherical Tanks by Short Period Earthquake Ground Motion (2011 Tohoku earthquake in the Tokyo bay)

The direct cause of the collapse of the tanks is the breakage of steel braces of the support legs due to the dynamic inertia forces of the oil and the tanks. When the earthquake occurred, the tanks were filled with water instead of liquid propane gas for the periodic inspection. The water has about twice the weight of the liquid propane gas.

1.4 Fires of oil tanks due to tsunami

During the 2011 Tohoku earthquake, the tsunami caused serious damage to industrial parks. In Sendai port a big fire was induced at an oil refinery plant, as shown in Figure 6 (a). The cause of the ignition of the fire has not been clearly identified, because all of the workers of the plant were absent due to the tsunami evacuation. It is supposed that tank lorries were floated by the tsunami and hit the pipelines. Figures 6 (b) and (c) show the drift of a fuel tank for fishery boats, and the consequent fire on the sea surface at Onagawa. Tanks were lifted up by the buoyancy of the tsunami, and floated out by the continuous attacks of the tsunami.



(a) Fire of an oil refinery plant

(b) Flowing-out of fuel tanks for fishery boats

(c) Sea surface fire

Figure 6 Damage to An Oil Refinery Plant and Fires on Sea Surface Caused by The Tsunami (2011 Tohoku earthquake)

2 Damage Assessment of Industrial Parks in The Tokyo Bay

1.1 Soil liquefaction and ground displacement

Figure 7 shows the history of land reclamation in the Tokyo bay. These manmade islands include large areas of ground reclaimed prior to the 1964 Niigata earthquake. The phenomena of soil liquefaction and its caused damage were recognized from an engineering viewpoint for the first time at the time of the 1964 Niigata earthquake. Several years after the Niigata event, liquefaction countermeasures were developed and have been put in place. Therefore, no liquefaction countermeasures have been taken for the ground reclaimed prior to that time.

Figure 8 shows a quay wall of a manmade island reclaimed from Tokyo bay and the assessment result of soil liquefaction by the Northern Tokyo bay earthquake, which has been predicted to have a high probability of occurrence directly beneath the greater Tokyo area in very near future. Reclamation began in this area around 1930 and was completed about 1960. As shown in the figure, there are steel sheet pile walls with an anchorage, and the ground is composed of sandy soil of the former seabed (N values are 10 to 15) and a layer of sandy fill (N values are about 5). It is supposed that there would be thick liquefiable ground below the ground surface, and that bottoms of the steel sheet wall would not reach into the lower non-liquefiable clayey soil. If liquefaction occurs, it is likely that there would either be significant deformation of the steel sheet pile quay walls, or in the worst case that they would collapse. If they were to collapse, the reclaimed ground behind the quay walls would substantially move seaward.

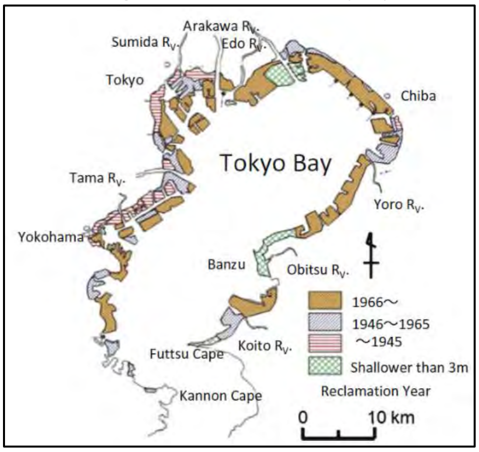


Figure 7 History of Reclamation of The Tokyo Bay [Kaizuka S (1993) Geology and water of the Tokyo Bay (in Japanese)] [4]

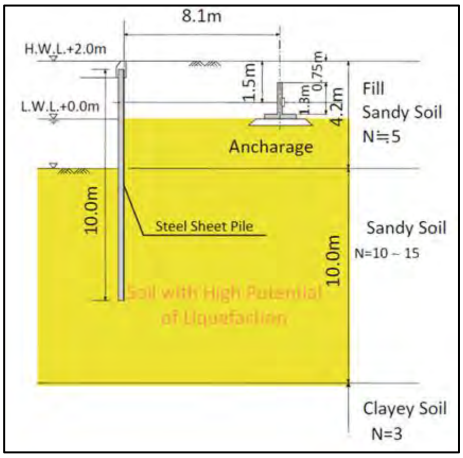


Figure 8 Quay wall of An Artificial Ground Reclaimed from The Tokyo Bay, and Assessment of Soil Liquefaction

Based on a simplified method for the prediction of the movement of quay walls and horizontal displacement of the ground [5], it is supposed that these walls would move up to 7 m seaward and that the reclaimed ground would also be displaced towards the sea, as shown in Figure 9. Thickness of the layer to be liquefied is predicted to be more than 10 m.

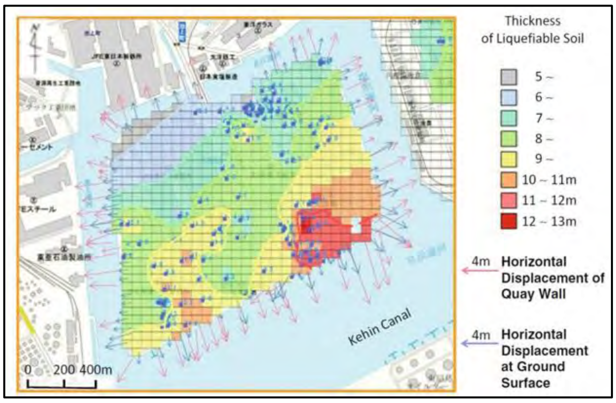


Figure 9 Assessment of Soil Liquefaction of An Artificial Island and Horizontal Displacements of The Quay Walls and The Ground

2.2 Long-period components of earthquake ground motion

Figure 10 shows examples of floating roof-type tanks for the storage of oil in an oil refinery plant in Tokyo bay. It is reported that more than 600 floating roof-type tanks have been constructed on reclaimed ground around the bay.

Figure 10 An Oil Refinery Plant Around The Tokyo Bay

Figure 11 shows earthquake ground motions and the velocity response spectra that have been predicted for coastal areas along the bay, under an assumption of continuous occurrence of Tokai and Tonankai earthquakes along the Nankai trough in the Pacific Ocean. Long period earthquake ground motions of 9–10 s in the Chiba area and 6–7 s in the Kawasaki area would be dominant. The thickness of soft surface soil in the Chiba area is about 3 km, larger than 2 km in the Kawasaki area. Based on the analysis of the sloshing vibration of the oil in tanks, it is estimated that the oil of 64 tanks, approximately a tenth of the 600 total, would overflow

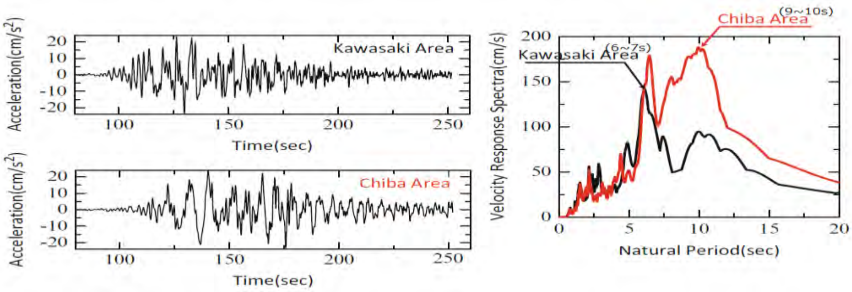


Figure 11 Earthquake Ground Motions with Long Period Component and Their Spectra in the Tokyo Bay (continuous occurrence of The Tokai and Tonankai earthquakes, by Prof. Furumura University of Tokyo).

by the sloshing vibration as shown in Table 1. It is expected that some of these incidents would involve fires, as experienced during past earthquakes.

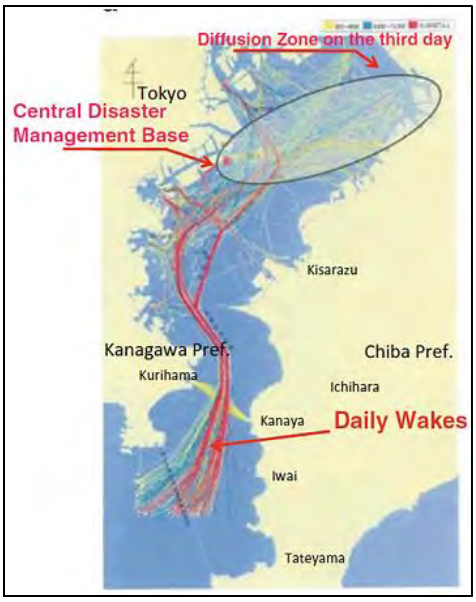
In addition to the large ground displacements induced by the lateral flow of liquefied ground, the sloshing vibration of the oil would spill a large amounts of crude and heavy oil into the Tokyo bay, and the oil would widely diffuse on the sea. It is certainly possible that this oil could be ignited, causing a large scale fire on the sea surface.

Diameter of tanks (m)	Total number of tanks	Number of overflowing tanks
~24	203	13 (6.4 %)
24–34	136	27 (19.9 %)
34–64	118	18 (15.3 %)
~60	159	6 (3.8 %)
Total	616	64 (10.4 %)

Table 1 The Number of Floating Roof-Type Tanks and of Overflowing Tanks

2.3 Simulation of diffusion of oil in the Tokyo bay

Figure 12 shows results of a simulation of the diffusion of crude oil under an assumption where 12,000 kl of crude oil spills into the Tokyo bay from the Kawasaki industrial park. In the summer season, the crude oil would reach the Chiba area in about 3 days with southwesterly winds of speed 5.0 m/s, drifting and diffusing over a wide area of the bay. In winter, the crude oil would drift toward the mouth of the bay with northwesterly winds, also diffusing over a wide area. Figure 12 also shows a chart of daily wakes of medium and large ships (thin lines in the figure), excluding fishing and leisure boats. About 200 ships navigate Tokyo bay every day. If an oil spill spreads over the sea area as shown in the figure, it would have prevented all ships from coming in or going out of the bay for safety reasons.



(a) Summer season

(b) Winter season

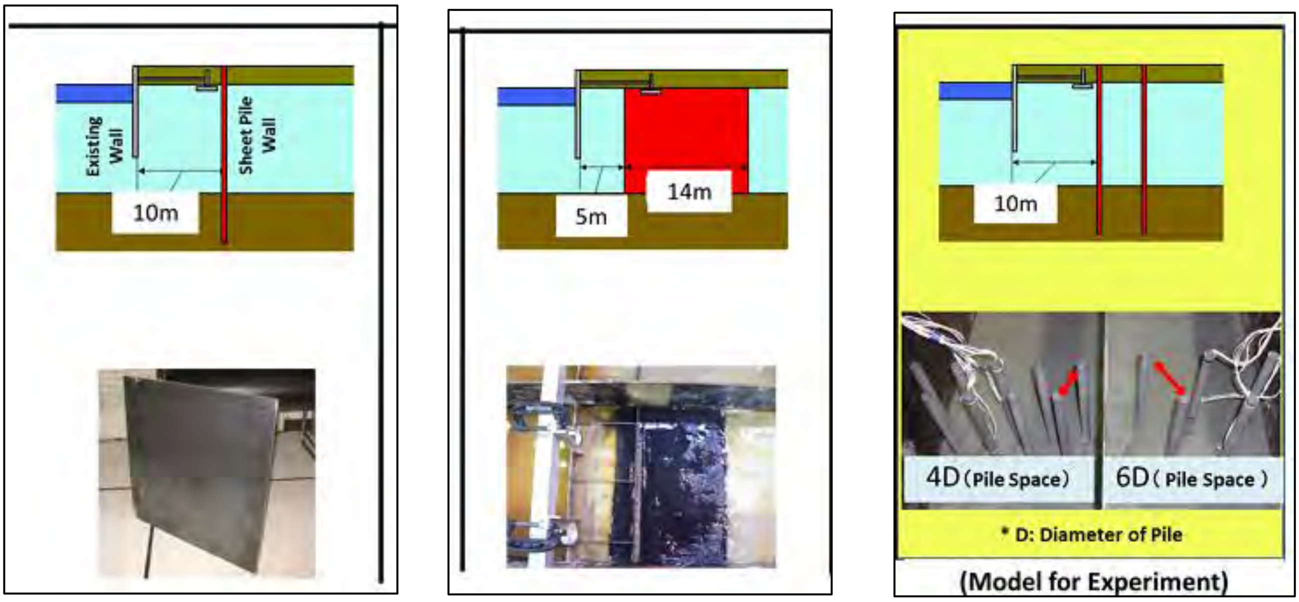
Figure 12 Diffusion of Crude Oil on The Tokyo Bay (Committee on Earthquake Damage to Bay area, Ministry of Land, infrastructure and Transport)

The Disaster Impact Study Committee for the Tokyo bay area organized by the Japanese government has estimated that collection of the spilled oil would take approximately 2 months. Fourteen thermal power plants on reclaimed land around the Tokyo bay are currently in operation, supplying at least 80 % of total electric power usage in the greater Tokyo area. The supply of liquefied natural gas and crude oil imported from overseas would be cut off in a case of the diffusion of crude oil, and this situation would result in a critical shortage of electric power in the greater Tokyo area.

3 Measures and Challenges for Earthquake and Tsunami Resilience Enhancement of Industrial Parks

3.1 Countermeasures against earthquake and tsunami [6]

In order to protect the existing quay walls and to prevent the large displacements of the reclaimed ground, various kinds of countermeasures have been proposed and developed. Figure 13 shows three typical methods for reinforcement of the existing quay walls. The first method is construction of a new steel sheet pile wall behind the existing quay walls. The second method is the soil improvement against liquefaction. The third method was developed by the authors' research group. In this method, steel pipe piles are driven in two rows with a proper interval. It is expected that the pile group prevents the flow of the liquefied soil. This method follows the landslide prevention measure by driving piles on slopes discontinuously with a proper interval. The effectiveness of these methods has been examined by centrifuge experiments.



(a) A new steel sheet wall (b) Soil improvement (c) Pile group

Figure 13 Reinforcement of Quay Walls against Soil Liquefaction and Its Caused Ground Displacement

Figure 14 shows one of the test results. The vertical axis of the figure shows the horizontal displacements on the ground surface, and the transverse axis is the distance from the existing quay walls. The experimental results clearly show the effectiveness of each countermeasure to reduce the ground displacements. Among these countermeasures, the pile group method shows a clear effectiveness for the reduction of the ground displacements, even in the case of the pile interval of several times of the pile diameter. The pile group method is effective as well as most economical among the proposed countermeasures, since construction works and costs can be largely reduced.

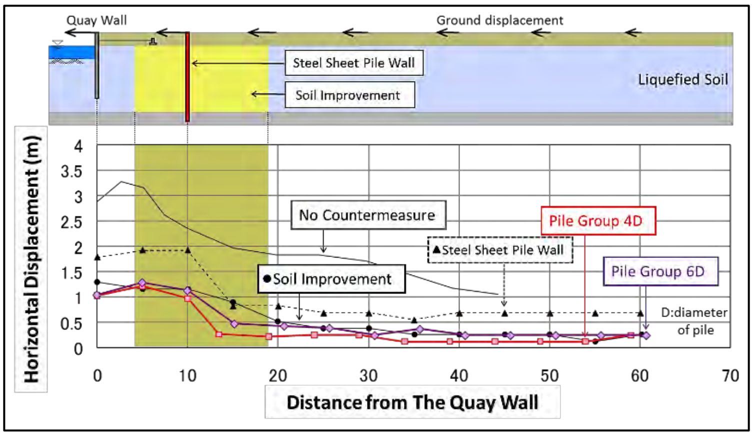
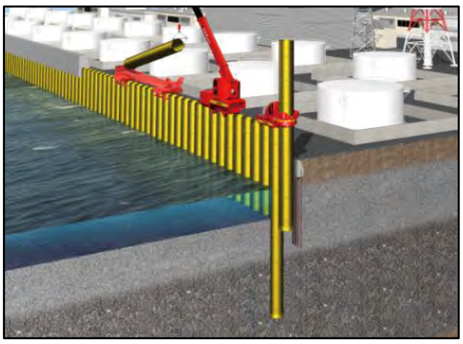
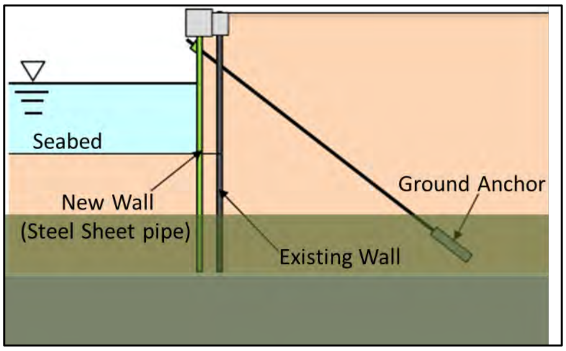


Figure 14 Effectiveness of Countermeasures for The Deduction of The Ground Displacement

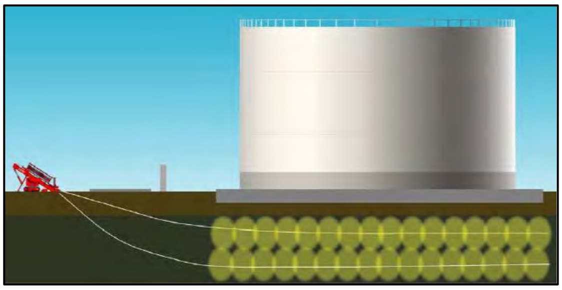
Another examples of the methods for the enhancement of the existing quay walls are shown in Figure 15. Figure (a) is steel sheet pile driving in front of the existing wall, and Figure 15(b) is a method to protect the existing wall by a ground anchor. Figure 15(c) and (d) show grouting into the foundation ground beneath the oil tanks by using bent injection pipes, and the ground water lowering method to prevent liquefaction. These methods were applied to an oil refinery plant in the Tokyo bay. In the ground water lowering method the tank site was surrounded by a flexible cut-off wall, and water level inside the wall was lowered by pumping the ground water to prevent liquefaction.



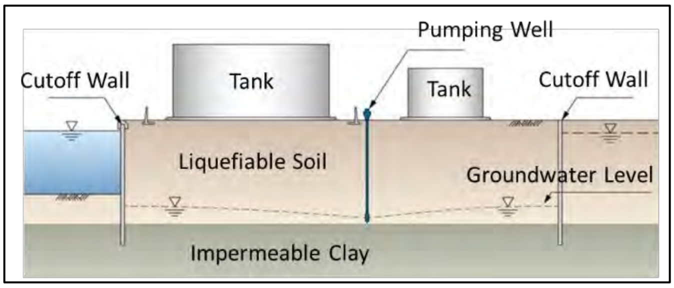
(a) Steel sheet pile wall [7]



(b) Ground anchor



(c) Grouting of foundation ground of tanks [6]



(d) Lowering of level of ground water [6]

Figure 15 Countermeasures Against Soil Liquefaction and Large Ground Displacement

3.2 Policies by the Japanese government for the enhancement of earthquake- and tsunami-resilience of infrastructure and industrial parks [8]

In 2013 the Diet of Japan enacted the fundamental law for the national land resilience against future natural disasters. The law indicates four principal policies for the national land resilience. Those are to save human lives, to prevent critical damage to functions of the nation, and safety of the people, to minimize loss of public infrastructures and people's property, and to prepare for the smooth recovery and reconstruction works after disasters.

The enhancement of earthquake- and tsunami-resilience of industrial parks in water front areas is directly related to the second principle of the fundamental law. Based on the fundamental law, the Japanese government took measures for the enhancement of earthquake- and tsunami- resilience of industrial facilities. Twenty four oil refinery plants were chosen from the areas which have high probability to be hit by large earthquakes and tsunamis in near future. The government has prepared national budget of about 16 billion yen per a year, for the financial support to the industries. The two third of the total construction cost for earthquake- and tsunami- resilience enhancement is paid by the government, and the residual is shouldered by the industries.

The first step of the resilience of the industrial parks is assessment of the damage caused by the future earthquakes and tsunamis. The lower flow chart of Figure 16 shows the procedure of the survey on soil liquefaction, assessment of stability of the seawalls and ground displacements, and assessment of tsunami effects, and their caused damage to industrial parks.

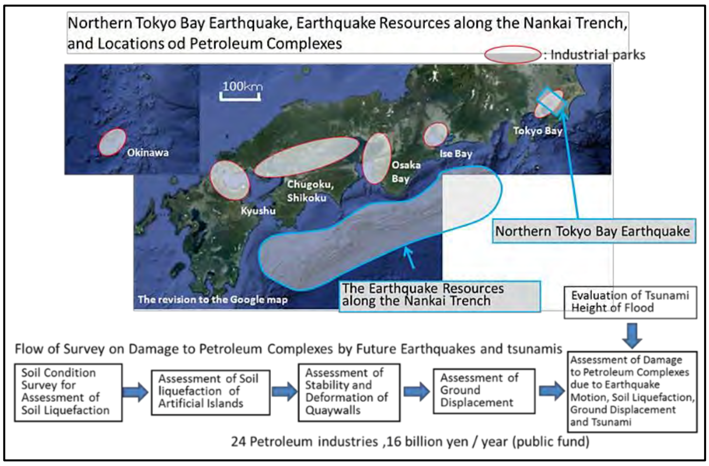


Figure 16 Survey and Practice of Earthquake- and Tsunami-Resilience Enhancement of Industrial Parks, (Policy by Ministry of Economy, Trade and Industry of The Japanese Government, 2013～)

4 Conclusions: Recommendations for Promotion of Earthquake and Tsunami Resilience Enhancement of Industrial Parks

For the prompt and effective enhancement of earthquake- and tsunami-resilience of industrial parks around the big bays in Japan such as Tokyo, Osaka and Ise bays, the following five recommendations have been proposed to the Japanese government and local governments by the author's research group:

1) Earthquake resilience enhancement in larger areas (whole areas of reclaimed lands as well as wide bay areas)
2) Strong leadership by the national and local governments
3) Public investment for private industrial facilities
4) Share of disaster risk information and cooperation among central and local governments, industries and local communities
5) Assessment of the impact of damage to industrial parks by future earthquakes and tsunamis on the national and world-wide economy

The first one is that, in addition of reinforcement of each industrial plant, the earthquake and tsunami resilience enhancement in larger areas such as whole areas of a manmade land including sea areas is essential, because the disaster at one plant may extend to the neighboring plants and affect the wider areas. To achieve the larger area enhancement the strong leaderships of the central and local governments are required to lead the group of the industrial companies. For the enhancement of disaster resilience of the larger areas, more public investment is also required for private properties of the industries, particularly for small industries, most of which has not enough financial bases for the reinforcement. In order to protect the maritime transportation of a canal, the reinforcement including private quay walls of industries is necessary. The fourth recommendation is risk information sharing among industries, local communities and the people for the promotion of earthquake- and tsunami-resilience of the larger areas. The assessment of the impact of a large loss of the function of industrial parks on the national economy and local societies is also necessary for the national policy making.

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◆A brief CV of Dr. Masanori Hamada

Dr. Masanori Hamada is a professor emeritus at the Waseda University, Japan. He is internationally recognized as an authority for the analysis and mitigation of earthquake and tsunami disasters. He established the Institute for Disaster Mitigation of Industrial Complex and had promoted a national project of enhancement of earthquake-and tsunami-resilience of industrial parks in bay-front areas. He was the 94th President of Japan Society of Civil Engineers.

Publications: Engineering for Earthquake Disaster Mitigation, Springer 2014, Earthquake Engineering for Nuclear Facilities, Springer 2016

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Case-history

Singapore Experience in Press-in Piling

Prof. C F Leung
Department of Civil and Environmental Engineering
National University of Singapore

Dr. Teik-Lim Goh
Atsunew Giken Pte. Ltd, Singapore

Singapore is among the first country in Southeast Asia to adopt the press-in piling technology. Being a small heavily built-up country, the installation of sheet pile retaining walls often faces severe challenges such as close proximity to existing buildings in drainage works, low headroom under a bridge and concerns on safety, noise and vibration to nearby buildings. Picture 1 shows the installation of sheet piles right next to existing property for drainage improvement work using the Press-in Method in Singapore (2008). Picture 2 shows the installation of sheet piles very close to existing residential dwellings by the Silent Piler (2012).

Picture 1 Installation of sheet piles in 2008

Picture 2 Installation of sheet piles in 2012

In view of possible adverse impacts on adjacent buildings in terms of noise and vibration, the National Environmental Agency (NEA) of Singapore issued new guidelines on maximum permissible noise levels for construction works for Mondays to Saturdays (Figure 1) and for Sundays in 2007. It should be noted that construction works are generally not allowed on Sundays if there are residential buildings and hospitals within the vicinity of the construction. In addition, there are also vibration limits specified by the government agencies and authorities and the recorded vibration measurements must not exceed the desired value. Otherwise stop work orders may be issued till remedial measures are taken to ensure that the recorded noise and vibration limits would not be violated during construction.

CONSTRUCTION NOISE CONTROL

Maximum Permissible Noise Levels for Construction Work Commenced on or after 1st October 2007

Mondays to Saturdays

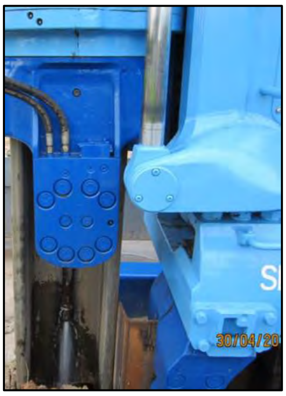
Types of affected buildings	7am - 7pm	7pm - 10pm	10pm - 7am
(a) Hospital, schools, institutions of higher learning, homes for aged sick, etc	60 dBA (Leq* 12 hrs)	50 dBA (Leq 12 hrs)	
	75 dBA (Leq 5 mins)	55 dBA (Leq 5 mins)	
(b) Residential buildings located less than 150m from the construction site	75 dBA (Leq 12 hrs)	65 dBA (Leq 1 hr)	-
	90 dBA (Leq 5 mins)	70 dBA (Leq 5 mins)	55 dBA (Leq 5 mins)
(c) Buildings other than those in (a) and (b) above	75 dBA (Leq 12 hrs)	65 dBA (Leq 12 hrs)	
	90 dBA (Leq 5 mins)	70 dBA (Leq 5 mins)	

Figure 1 Construction noise control

In view of the above, a number of Singapore government agencies/authorities such as Land Transport Authority (LTA) which is responsible for the construction of Singapore Mass Rapid Transit (MRT) station and tunnels, has specified that silent piling technique needs to be employed in projects with adjacent buildings nearby such that the noise and vibration levels would fall within the limits specified by the authorities. Picture 3 shows the Silent Piler being used to install sheet pile at a MRT site for an ongoing Thomson-East Coast Line construction in 2017. Public Utility Board (PUB) is another government agency that requires the press-in piling to be adopted in its works due to its many drainage improvement works (Picture 1) and infrastructure development such as cable tunnel construction.

Picture 3 Press-in piling at a MRT site

With the successful implementation of silent piling for many years in Singapore, the recent development involving press-in technique is the installation of sheet piles and steel pipe piles into harder grounds such as hard stiff soils or even weak rocks. These include the use of Water Jetting System (Picture 4) and Super Crush System (Picture 5). Another recent application of press-in technique in Singapore is to use silent piling to extract existing installed sheet piles and driven piles. It has been found that with the conventional method of extracting sheet pile, the soil would move and fill in the gap left behind after extraction resulting in movements or tilt of adjacent structures. With careful control using the Silent Piler and simultaneously back filling the gap, the movement of adjacent buildings is minimized.



Picture 4
Water Jetting System

Picture 5 Super Crush System

With the support of IPA Research Grant, field studies were carried out in the past 2 years to monitor the noise and vibration in selected sites with press-in piling and conventional piling techniques such as vibratory hammer. A sample recorded noise levels versus distance from the piling is shown in Figure 2. It is evident that the recorded noise levels due to silent piling are considerably lower than those due to conventional piling. However, the difference in noise level is less distinct when the distance exceeds 20 metres from the piling location. Two issues are worth mentioning. It is found that in some sites, the noise levels caused by the power source (Picture 6) can be as severe as or even more severe than that due to silent piling. It is thus worth investigating how to reduce the noise level of the power source. On the other hand, the traffic noise at some sites can be as severe as that of piling and this factor is beyond the control of the construction personnel.

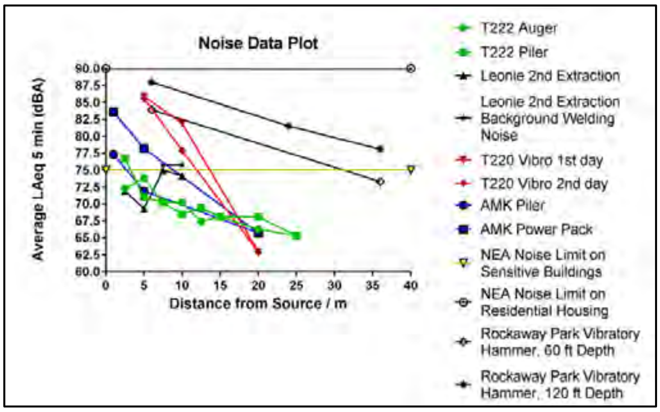


Figure 2 A sample of noise data plot

Picture 6 Power source of construction site

To ensure safety and comfort of adjacent structures, the vibration level is an important indicator. Figure 3 shows the recorded vibration measurements versus distance away from piling location for the studies. The same observation can be made at near distance to the piling location, the silent piling causes considerably less vibration than that due to conventional piling. Once the distance to 20 m and beyond, the difference in the recorded vibration levels is insignificant.

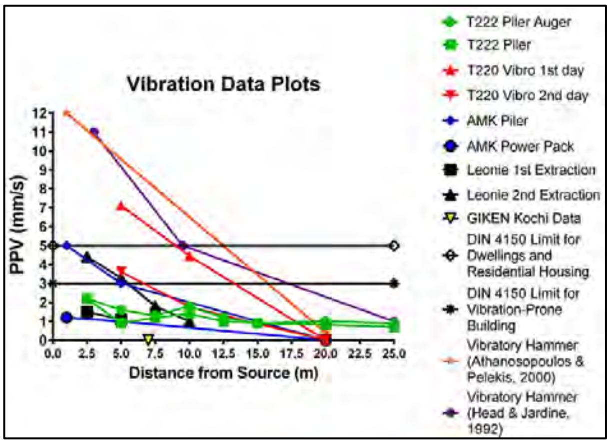


Figure 3 Vibration data plots

Case-history
Development of Sheet Pile Foundation

Dr. Hidetoshi Nishioka
Senior Researcher
Railway Technical Research Institute
Japan

1. Introduction

Since the Great Hanshin earthquake in 1995, the seismic performance of newly designed buildings in the railway industry has been improved by the seismic design reviewed after the earthquakes. In addition, various aseismic reinforcement methods have been developed and utilized into existing buildings, improving their safety. After the massive seismic ground motion that occurred in the Great East Japan Earthquake, 2011, railway structures built after the Great Hanshin earthquake and reinforced by the aseismic reinforcement methods were found to be relatively less damaged, which clearly proved the effectiveness of the improved design and construction methods in the field of railway engineering. The social needs for foundations of railway structures are considered to be (1) Low cost, (2) Narrow space constructions, and (3) Harmony with the environment. This paper introduces “Sheet Pile Foundation” as one method meeting these three requirements.

2. Advantages of “Sheet Pile Foundation”

The “Sheet Pile Foundation” is a method to improve aseismic performance and secure high bearing capacity of shallow foundation by combining a footing and a series of sheet piles installed along the periphery of the shallow foundation. Both of which are firmly connected at the top. The vertical resistance can be obtained from the base of the footing and the installed sheet piles whilst the horizontal resistance can be gained from the group of sheet piles. This time of foundation has so far been applied for over 50 piers of both railway and road bridges as an anti-seismic reinforcement in Japan.

2-1. Temporarily installed sheet piles for a retaining structure can also be utilized for newly constructed foundations as a part of permanent structures.

In practice, excavation works to construct a footing are necessary for the cases of cast-in-situ concrete pile foundations. For this process, sheet piles are temporarily required as a retaining structure. After the footing is built, the installed sheet piles should be extracted and removed, which increases the cost and time of construction. Whereas, in the case of the Sheet Pile Foundation, the construction cost and time can be significantly reduced due to the use of the retaining structure as a part of the foundation (Figure 1).

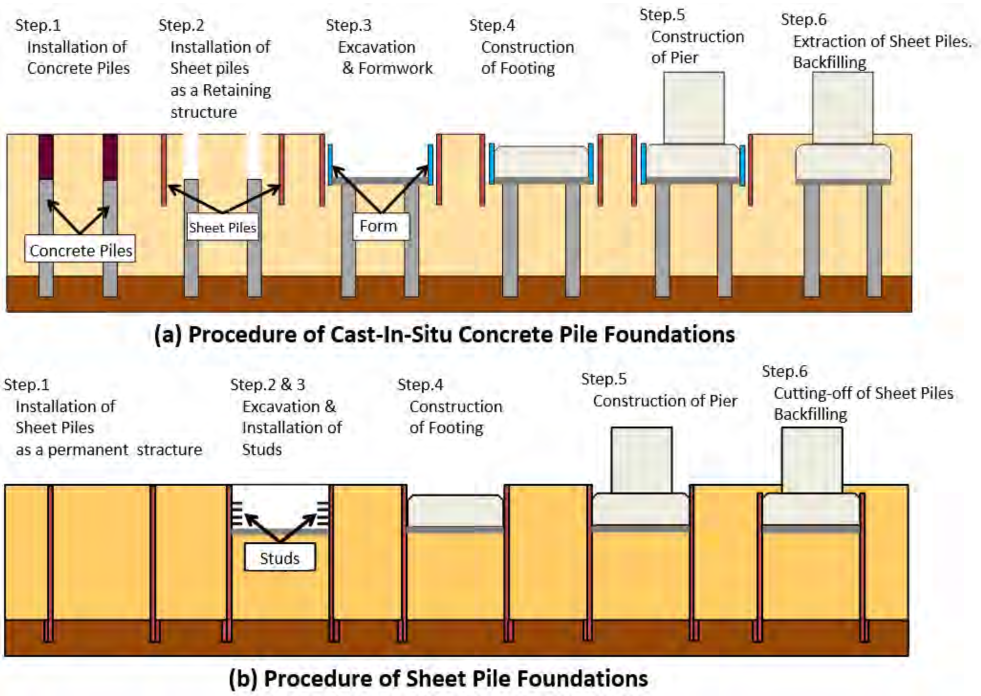


Figure 1 Procedures of cast-in-Situ concrete pile foundations & Sheet Pile Foundation

2-2. Large and heavy construction machines are not required to reinforce existing foundations and the installation can be conducted in a narrow working space.

The construction machines to install sheet piles are relatively compact, particularly press-in machines which can be applicable for constructions in a narrow space by the self-walking mechanism on previously installed sheet piles. Since piling works under low headroom often occur in reinforcement constructions for existing bridges. "Sheet Pile Foundation" in combined with the "Press-in Method" should be, therefore, useful for such a situation.

2-3. Physical interference on existing structures can be reduced and the construction can be conducted during the service period.

Due to the relatively small space required for installation, the reinforcement work can be conducted so as not to prevent both existing bridges and neighboring traffic from being affected.

2-4. Reduction of environmental impact

Comparing the installation of sheet piles with cast-in-situ piles, the volume of sludge is much less (almost zero is in its standard operation), which contributes a reduction of environmental impact.

2-5. More economical than conventional method

The piling plant of sheet piles is smaller than that of cast-in-situ concrete piles to install additional piles along the periphery of an existing footing. Also, the footing size reinforced by the installed sheet piles could be smaller than by conventional techniques like "Additional pile method".

3. Full-scale field test and its result

To examine the performance of "Sheet Pile Foundation", some laboratory model tests and full scale model tests were conducted. The results of the full-scale field test of the performance of Sheet Pile Foundation are presented as below;

3-1. Outline of full-scale models

Full-scale field tests were conducted in Kawagoe City, Japan for verifying the effectiveness of the method in practical use. The soil profile at the experiment site (outlined in Figure 2) showed a layer of volcanic origin clayer soil (Kanto loam) with a thickness of 5 m overlying on a gravel layer. The models for shallow foundation and sheet pile foundation shown in Figs.2 and 3 were constructed with square footings of 3.6 m in width and piers of 6 m in height. At 3.6 m, the sheet pile length (which was the same as the width of the footing) did not extend as deep as the gravel layer.

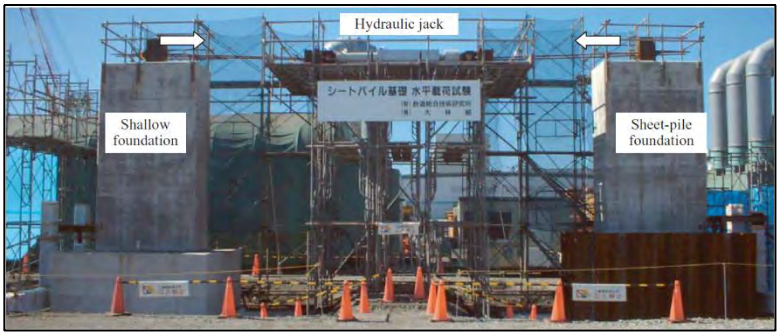


Figure 3 A view of full-scale models

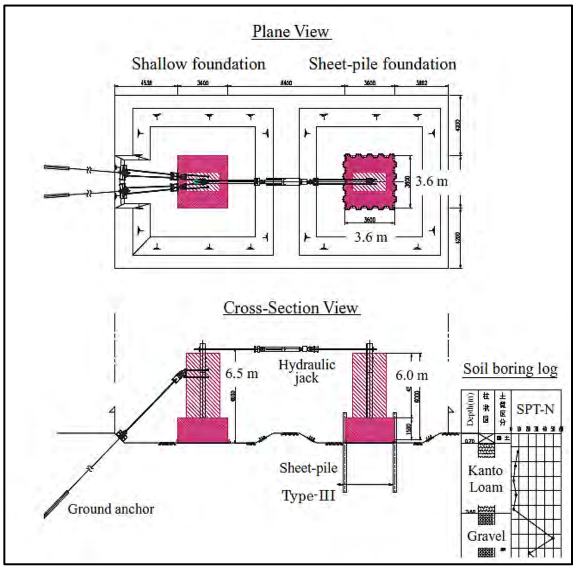


Figure 2 Outline of full-scale model

3-2. Construction experiment

In the practice of sheet pile foundation, it is important to have a method for rigidly connecting the sheet piles to the footing. One simple method involves welding reinforced bars to the sheet piles to unify them with the footing. However, with this method it can be very difficult to arrange the reinforced bars for the footing if the working space is limited. A construction experiment using this method was therefore adopted to confirm the feasibility of arranging the footing bars. Figure 4 shows a photo of the work of welding reinforced bars to the sheet pile, and a photo of the finished state of arrangement. The experiment confirmed the feasibility of this method.

a) Work to weld reinforced bars to sheet pile

b) Work to arrange footing bars

c) Finished state of footing bars

Figure 4 Photos of the construction experiment

3-3. Horizontal static loading test

The horizontal static loading test was conducted by pulling the tops of the two model foundations toward each other using a hydraulic jack. At first, the shallow foundation was pulled by the sheet pile foundation, and the sheet pile foundation was then pulled by the shallow foundation, reinforced by a ground anchor as shown in Figure 2. The horizontal load P and horizontal displacement δ relationship for each case is shown in Figure 5, which also includes a photo of the final deformation of each model. The figure shows that the ratio of the horizontal resistance of the sheet pile foundation to that of the shallow foundation was about four (Actually, this ratio was larger than that obtained in laboratory testing).

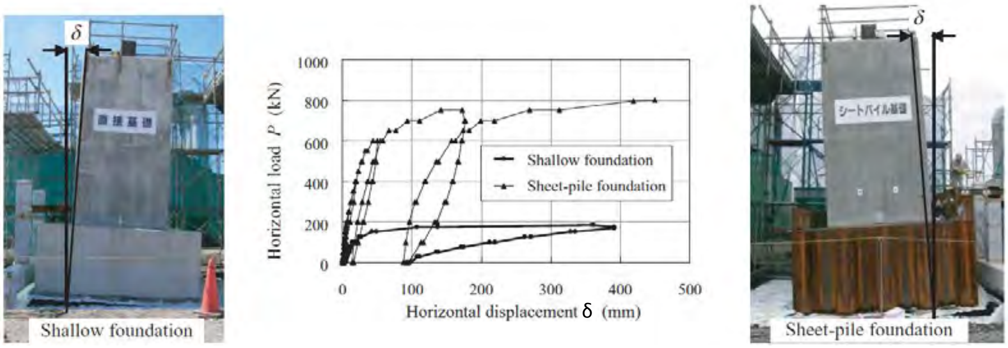


Figure 5 P-δ relationship and pictures of the models after loading

The results of measurements using a soil pressure gauge buried under the footing are shown in Figure 6. The figure indicates that the stress concentration occurs at the right edge of the footing without sheet piles and the contact stress at the edge sharply increases as increasing the jacking load, whereas the contact stresses of the sheet pile foundation are rather evenly distributed.

Figure 7 shows the charge in the axial force distribution of the sheet piles at the back and front sides. Axial compression force increases gradually in the front-side sheet piles, while axial tension acts on those at the back.

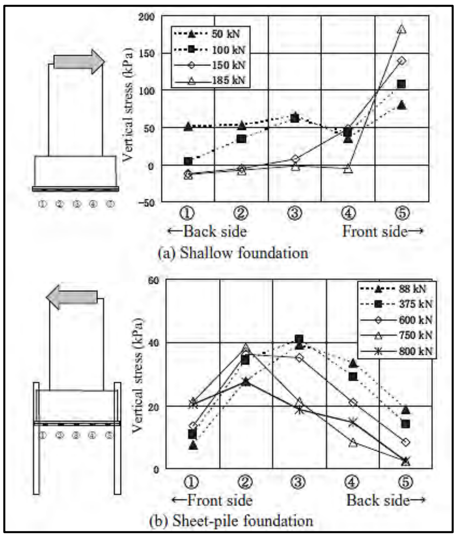


Figure 6 Distribution of vertical contact stress at the bottom of the footing

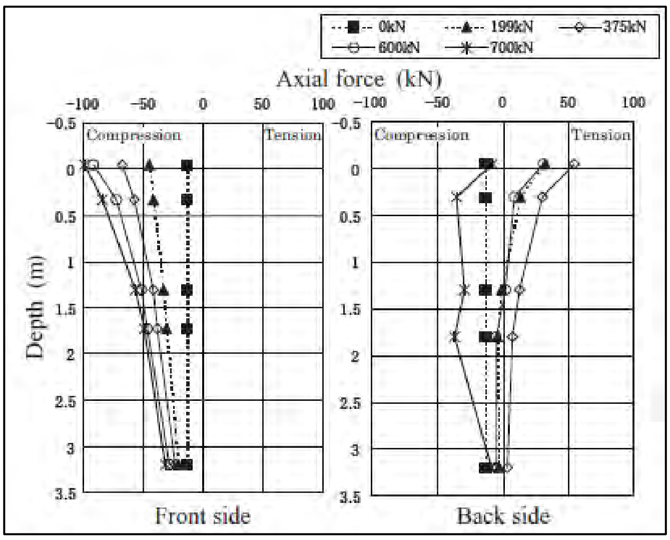


Figure 7 Distribution of axial force of sheet piles

Figure 8 shows the change in the bending moment distribution of the sheet piles at the back and front. The bending moment was the largest at a position of about 1.5 m in depth, but was sufficiently smaller than the yield bending moment.

Figure 9 shows the relationship between the jack load and the shear force at the head of the sheet piles. From this figure, it is clear that the shear resistance of the front-side sheet piles bears a large part of the shear resistance of the sheet pile foundation.

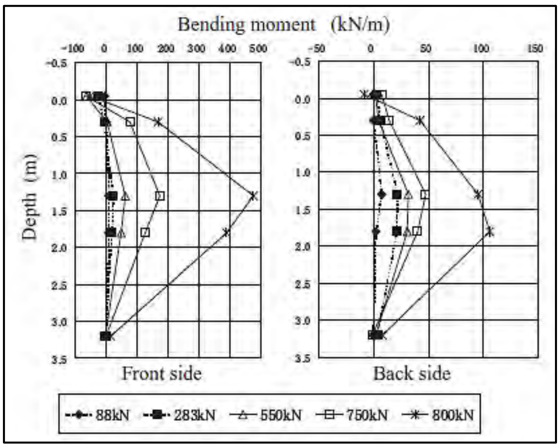


Figure 8 Distribution of the bending moment of sheet piles

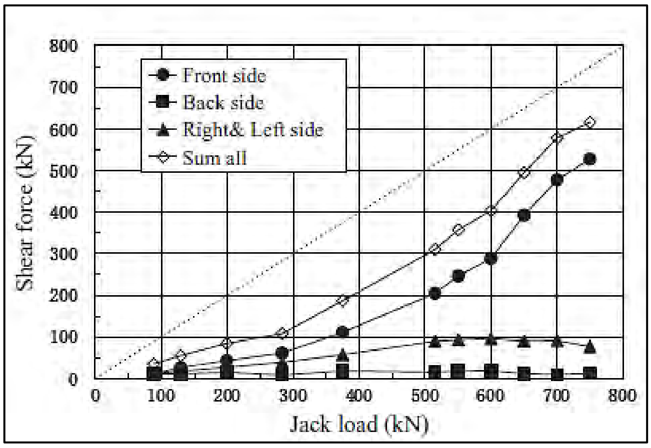
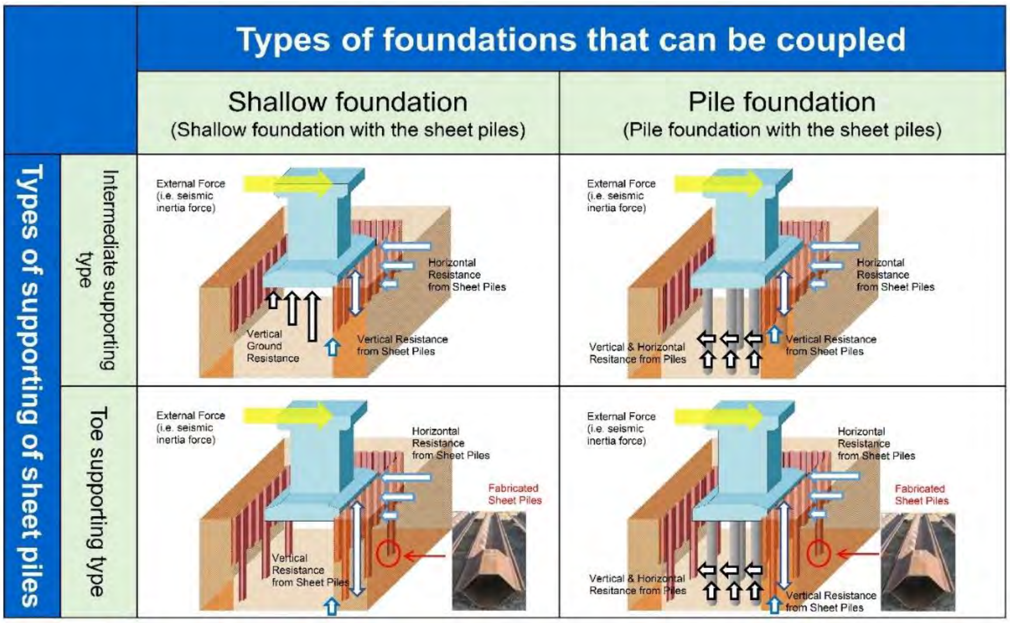


Figure 9 Relationship between the jack load and the share force of sheet piles

4. **Future development of "Sheet Pile Foundation"**

For soft ground conditions, the "toe supporting type" (Figure 9) of the sheet pile foundation has been developed. By utilizing the fabricated sheet piles whose toe is welded with a piece of sheet pile to create the plugged section like tubular piles, the sheet pile foundation can secure higher bearing capacity even when the intermediate layer is a soft layer.



Currently, Railway Technical Research Institute is developing the sheet pile foundation in collaboration with Obayashi Corporation and Nippon steel & Sumitomo Metal Corporation. To expand the applicability of this structure, the research applying the sheet pile foundation to water-saturated ground is being conducted. In addition, the design manual of the sheet pile foundation including the research results of the effect of liquefaction on the sheet pile foundation is available.

Reference:
Nishioka, H., Koda, M., Hirano, J., Higuchi, S., 2008, Development of Sheet-Pile Foundation that Combines Footing with Sheet Piles, Quarterly Report of Railway Technical Research Institute (RTRI), vol.49, Issue 2, pp.73-78 https://www.jstage.jst.go.jp/article/rtriqr/49/2/49_2_73/_article

On-site interview

Harajuku station, Tokyo, Japan

Ms. Hongjuan He
IPA Secretariat

I interviewed Mr. Okochi (Ozawa Civil Engineering and Construction Co. Ltd. Hereafter, Ozawa) and Mr. Hamada (GIKEN SEKO CO., LTD. Hereafter, SEKO.) on August 22, 2017 who worked in the Press-in project on "Improvement work of Harajuku station". SEKO received the order of this project and was responsible for managing the piling work and installing the steel tubular piles. Ozawa Civil Engineering and Construction Co. Ltd. installed the steel sheet piles under SEKO's management. I thank them for giving us valuable insights during this interview.

Profile of Mr. Yasuaki Okochi , Ozawa Civil Engineering and Construction Co. Ltd.

Mr. Okochi has worked for Ozawa Civil Engineering and Construction Co. Ltd. since 1986. He has experienced in construction for 31 years including 25 years of experience as an operator of the Press-in Machine. He was engaged as a main operator for this project. He has the qualifications of "First-class Press-in Operation Engineer", and the license of welding and various cranes etc.

Profile of Mr. Koji Hamada, GIKEN SEKO CO., LTD.

Mr. Hamada has joined GIKEN SEKO CO., LTD. in 1990 with 25 years of experience in Press-in Method. He had a lot of experiences working in USA, Singapore, Canada, and Mexico for 10 years. He was responsible for operating and managing the project. He has the qualifications of "First-class Press-in Operation Engineer", "Second-class Civil Engineering Works Execution Managing Engineer", and "Supervisor for safety program in charge" and others.

Q1. Can you explain the background, overview and features of this project?

Mr. Hamada: As you know, the Olympic and Paralympic games will be held in Tokyo, in 2020. It can be expected that many people will come to Harajuku Station which is a popular place among tourist. Japanese Railway Company decided to increase entrances and some facilities to avoid congestion. The main purpose of the Press-in project is to construct an embedded retaining wall, adding another platform.

Mr. Okochi: The significant point of the project is to conduct the Press-in operation nearby the Meiji Shrine (Picture 1) which is famous. There are 2 severe limitations for the operation. One is the operation time from 7:00 pm to 4:00 am. In order not to affect the tourists' activities, we can only install the sheet piles during the limited time after the Meiji Shrine closes. The other one is the fact that the Meiji Shrine has many trees planted more than a century ago. It was required to pay very careful attention, particularly for material hoisting to protect the trees in the operation to pitch a sheet pile.

Picture 1 Construction overview

Q2. What were the significant points for the Press-in Method to overcome constraint conditions on the project?

Mr. Hamada: There were 3 points. Firstly, non-vibration and low-noise Press-in Method did not affect interfere waiting passengers at the existing platform. Secondly, the construction site was very close to the busy railway, however, the train operation was required to be in operation as usual. Finally, the most important was to resolve the narrow space problem. It is impossible to utilize the conventional methods which require to place the necessary machines and equipment side by side on the narrow and steep slope. So we introduced the Non-staging system, as shown in Photo 1, which is only the system enabling all the piling machineries for the Piling operation to walk on the previously installed sheet piles by itself (self-walking). It was able to operate in the narrow space and does not require cutting the trees in the Meiji Shrine.

Photo 1 Non-staging System

Q3. What did you need to pay attention at the night operation?

Mr. Okochi: As welding emits light and smoke, we install the protective sheet to protect the eyes of both the driver and passengers, as shown in Photo 2. Because the area of Press-in operation was nearby the railway, so we thought that the measurement should be essential to secure the safety of the project installation.

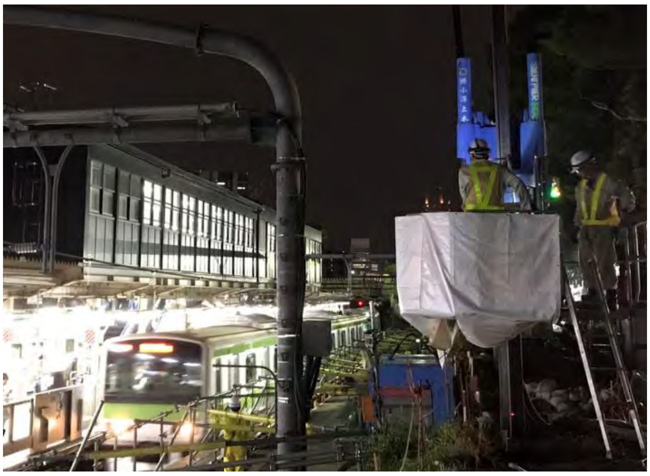


Photo 2 Side-view

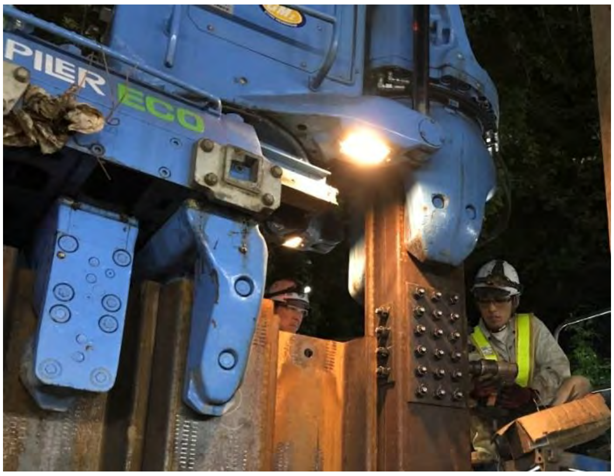


Photo 3 The mechanical joint with bolts

Q4. Has the construction been carried out on time? Can you tell us about difficulties or concerns that you have faced on the project?

Mr. Hamada: Yes, the construction of tubular piles has carried out on schedule. To improve the productivity of the project and reduce the impact of the welding, we adopted the mechanical joints with bolts to connect pieces of the sheet piles, as shown in Photo 3. Actually, the mechanical joint has one disadvantage because we have to remove all the bolts when the sheet pile is extracted, due to the interference of the chuck part of the machine main body and the bolts. At that time, we took out of the bolts, extracting the steel sheet pile and resumed the extraction. It took much more time than usual. Depending on the geological conditions, it was very tough to predict what will happen.

Photo 4 Mr. Okochi is operating the Silent Piler.

Mr. Okochi: The installation of the sheet piles should be completed on time, however, we found obstacles such as concrete rubbles in the ground. It took a week to get rid of the obstacles. It was difficult to assume the underground obstructions. So, we should have prepared the countermeasures against obstructions, just in case.

Q5. Please share with us your toughest operational experience.

Mr. Okochi: I experienced difficulties to install the sheet piles into Lava stones by a Crush Piler in Fujimiya city, Shizuoka Prefecture. At that time, I didn't have enough experience and the ground is absolutely stiff. Finally, I asked my supervisor to send someone from SEKO for help to solve the problem.

Mr. Hamada: It was the embedded retaining wall with steel sheet piles to construct the lamps on the highway in New York. There is a Labor Unions in the United States. Depending on each region or occupation, their system is different. Construction companies must contract with the Labor Unions and hire the members of the unions to work on the project. In this project there were eight employees from different companies. There were labors who set the laser, drive heavy machineries, welding and so on. The division of labors was very clear, and they just did their assigned works. There was a boulder on the planned line where the sheet piles are installed. We could not remove the boulder by ourselves, so we needed to ask earth workers for help. At that time, there was no earth workers on the site. Unfortunately, we had to stop working, waiting for earth workers. This was my first overseas experience. Every country has its own laws and rules, systems and culture. I strongly recognized that it is very important to understand the rules of the country before planning the construction.

Photo 5 Mr. Hamada is checking the laser.

Mr. Okochi: Press-in Method is quieter and more environmentally than any other methods, and it will be more and more popular in the future. If I have a chance, I would go abroad to popularize Press-in technology.

★Comments

When I visited the site of construction, I saw a lot of people from all over the world at the Harajuku station, taking pictures of the construction site. They probably have the same question like me, “The machine is walking by itself?!” It was first time I saw the self-walking system, I was surprised at its speed and safety. I listened to two people's long-term field experience, so I realized that the Press-in method can be applicable for various site conditions, actual construction might not progress as scheduled, and preparing countermeasures against expected problems should be useful. I also confirmed that this technology is the only one that can construct without interfering with the neighboring environment of Meiji Shrine through this interview.

I would like to express my sincere appreciation toward Mr. Okochi, Mr. Hamada and all who are concerned in this interview. Thank you so much.

Photo 6: Interviewing with Mr. Okochi and Mr. Hamada

We welcome the on-site operators who are able to accept the interview. If you have any questions, please contact to IPA Secretariat address to Ms. Hongjuan He (ipa.ka@press-in.org). We are waiting for you!

Event Report

Steel Sheet-Pile Seminar in Vietnam on October 25, 2017

Prof. Dang Dang Tung
Ho Chi Minh City University of Technology, Vietnam

Seminar on "Applying steel sheet-pile as permanent structures" was organized by Technical Committee 3, International Press in Association and Ho Chi Minh City University of Technology on 25th October 2017 in HCMC University of Technology (HCMCUT), 268 Ly Thuong Kiet Street, District 10, HCMC, Vietnam.

The seminar was also supported by Vietnam – Japan Civil Engineering Collaboration Promotion Center (VJCE), which is known as a branch of Japan Society for Civil Engineers (JSCE) in HCMC.

The participants consisted of University Lecturers (HCMUT 8, International University 2, University of Transport 2, Technical Education University 2), Japanese companies 5, Domestic companies 8 and 32 students.

Through the seminar, many Vietnamese and Japanese experts had good chance to share their experiences and to discuss research proposals in order to find out suitable solutions for the development of Vietnam's infrastructure.

The program of seminar is brief summarized as follows:

- Opening speech and introducing guests, presented by Dr. Le Ba Khanh (HCMUT) and Prof. Jun Otani – Chair of TC3 of IPA
- Introduction on IPA and TC, presented by Mr. Yukihiro Ishihara (Giken Ltd.)
- Introduction on TC3 and PFS (Partially floating sheet-pile) method, presented by Prof. Jun Otani (Kumamoto University)
- Current steel sheet-pile method (materials and construction technology), presented by Dr. Shinji Taenaka (NSSM Co. Ltd.) and Mr. Kenji Kono (JFE Steel Co. Ltd.)
- Introduction on Press-in technology, presented by Mr. Seiichiro Oiyama (Giken Ltd.)
- Moderated by Kiyonobu Kasama (Kyushu University)

Photo 1 Presenters and audiences at the Seminar

The audiences concerned the cost of steel pile products, maximum length experienced in press-in piling and water cut-off performance in tubular pile wall. Prof. Otani emphasized PFS method can be cost-effective as it reduces the amount of steel material, but it is necessary to check the effectiveness firstly. It was also discussed that the Press-in Method can save the temporary works and reduce the total cost.

In the coming time, HCMUT and TC3 members will discuss and proceed to developing further training courses on young Vietnamese engineers to understand Press-in Technology.

Event Report

IPA Seminar on Press-in Technology in Malaysia

IPA Secretariat

The IPA Seminar on Press-in Technology held at the Hotel Maya Kuala Lumpur in Kuala Lumpur, Malaysia, on 1 Nov 2017, jointly organized by the IPA Local Organizing Committee and Universiti Tun Hussein Onn Malaysia (UTHM). The Seminar was supported by Department of Irrigation and Drainage Malaysia (DID), Public Works Department (JKR), Malaysia-Japan International Institute of Technology (MJIIT), Universiti Teknologi Malaysia Kuala Lumpur, Research Centre for Soft Soil (RECESS), KLIA Premier Holdings Sdn. Bhd., Malaysian Hydrological Society, Koye (M) Sdn. Bhd., Nippon Steel & Sumitomo Metal Corporation, JFE Steel Corporation, Giken Seisakusho Asia Pte., Ltd. and sponsored by GIKEN LTD. About 80 participants from Malaysia, Indonesia and Singapore attended the Seminar.

◆ Objective of the Seminar

IPA aims to promote the Press-in technology through collaborated effort within industry-academia- government and therefore we are pleased to organize the Seminar in Malaysia to commemorate the release of upcoming handbook, entitled the "Press-in retaining structures: a handbook (First edition 2016)". The Seminar provides guidance on the use of the handbook in the design and construction of Press-in Method.

◆ Presentations

Presentation 1 Title: **"Malaysia Water Security: NAWABS, Case Study & Future Challenges"**
Lecturer: Dr. Asnor Muizan bin Dato' Hj. Ishak (Department of Irrigation and Drainage Malaysia)

Presentation 2 Title: **"Eco-Friendly Raft Pile Foundation System (ERP System) as an Alternative Piling in Coastal Protection Works"**
Lecturer: Ir. Arman bin Mokhtar (Department of Irrigation and Drainage Malaysia)

Presentation 3 Title: **"Usage of Press-in Method in ASEAN Countries"**
Lecturer: Ir. Dr. Goh Teik Lim (Director, AtsuNEW GIKEN, Singapore)

Presentation 4 Title: **"Press-in Retaining Structures: a handbook, Part 1" – Outline of the Press-in and Design overview**
Lecturer: Prof. Yoshiaki Kikuchi (IPA Director / Prof. of Tokyo University of Science, Japan)

Presentation 5 Title: **"Press-in Retaining Structures: a handbook Part 2" – Construction and applications**
Lecturer: Mr. Ryo Kamioka (GM of Giken Seisakusho Asia Pte., Ltd., Singapore)

Presentation 6 Title: **"The Press-in Monitoring System for Observational Construction Management"**
Lecturer: Mr. Tsunenobu Nozaki (GM of GIKEN LTD., Japan)

Presentation 7 Title: **"Press-in Technology: Current Research and Construction Activities in Malaysia"**
Lecturer: Dr. Nor Azizi bin Yusoff (IPA Director/ UTHM)

◆ Message from Dr. Nor Azizi bin Yusoff

(IPA Director / Committee Chair of the IPA Local Organizing Committee)

The Seminar was commenced with the opening address by Professor Dr. Ruzairi bin Abdul Rahim, Deputy Vice-Chancellor of Universiti Tun Hussein Onn Malaysia and followed by the seven (7) meaningful presentations from various fields.

There are various areas of developments to be addressed in Malaysia, such as the implementation of infrastructures, the redevelopment of urban areas, the water management development and etc. The Seminar was a good opportunity to reaffirm and share those issues as a common understanding among participants and also to familiarize the Press-in technology as the applicable state-of-art technology.

I believe that this should be a great step for the Press-in technology to be penetrated into the construction industry in Malaysia, not only to the contractors but also to the government agencies as well as to the designers. I am delighted to observe a great relationship between industri and academia, not only in Malaysia but moreover in an international arena. Thank you to GIKEN LTD. for being very supportive in sponsoring and promoting this advance green technology in Malaysia.

I would also like to convey our thank you to industrial/ university representatives from Japan and our neighboring countries, including Singapore and Indonesia. Not to forget our Malaysia based companies, local authorities, GLC's, NGO's, universities and all of you who may not be mentioned here. Last but not least, I sincerely would like to thank to the Local Organizing Committee members and to the supporting staff whoever contributed a lot toward the successful Seminar in Malaysia. **Terima kasih!**

Photo 1 Group photo of the IPA Seminar in Malaysia

Photo 2 (from left to right)
Dr. Osamu Kusakabe, IPA President
Tan Sri (Dr.) Ir.Jamilus bin Md Hussin, Honorary Chairman / CEO, KLIA Premier Holdings Sdn. Bhd.
Professor Dr. Wahid bin Razzaly, Vice Chancellor of Universiti Tun Hussein Onn Malaysia

Photo 3 Dr. Nor Azizi bin Yusoff (IPA Director / Committee Chairman of the IPA Local Organizing Committee / MD of UTHM Holdings) had a presentation

Photo 4 Ir. Dr. Goh Teik Lim (*Director, AtsuNEW GIKEN, Singapore*) shared his experience on Press-in Technology

Announcement
The First International Conference on Press-in Engineering 2018, Kochi

IPA Secretariat

IPA will hold the『**The First International Conference on Press-in Engineering 2018, Kochi**』(ICPE) from September 19 to 20, 2018 in Kochi Prefecture, Japan. On line registration is now available.

Online registration application URL: **https://www.press-in.org/en/event**

ICPE is based on the three main concepts: "land and city disaster prevention"," i-construction", and "regional revitalization ".

1 "land and city disaster prevention" means to look back at the cases of earthquake and tsunami disasters in the past, and to explore the methods and technologies how to prevent /mitigate/recover from natural disasters in the future.

2 "i-construction" means to promote information technology and artificial intelligence into construction practice using construction machinery to solve the problem of labor shortage as well as to improve productivity in construction industry.

3 "regional revitalization" means to vitalize the areas facing the issue of population decrease by boosting promising local industries in these areas. The Press-in technology is a good example. The Press-in technology was invented in Kochi Prefecture and has been developed in Kochi Prefecture and is now being used all over the world.

For the concept -1 "land and city disaster prevention" we have invited Prof. Fumihiko Imamura (Director, International Research Institute of Disaster Science, Tohoku University), who is a well-known prominent scientist in the field of Tsunami Disaster prevention, and for the concept -2 "i-construction" we have invited a specialist from Komatsu Ltd, one of the world's largest construction manufacturer companies. And because of the concept -3 "regional revitalization", we have received a strong support from Kochi Prefecture where a silent piler was invented.

This international conference will also provide an interesting Site-visit. The detail program, please click here. We have set the reasonable registration fee structure for this conference, in particular, for young researchers/engineers as well as students. Please note that Early Registration is until 31 May 2018. IPA members are also eligible for applying the membership discount.

We are looking forward to having your registration. If you have any inquiry, please don't hesitate to contact us (tokyo@press-in.org). We are readily available to assist you.

Event Diary

Title	Date	Venue
■ **IPA Events** https://www.press-in.org/en/event		
IPA Seminar on Press-in Technology	TBC	Bangkok
International Conference on Press-in Engineering (ICPE) 2018, Kochi	September 19-20, 2018	Kochi, Japan
International Society for Soil Mechanics and Geotechnical Engineering http://www.issmge.org/events		
International Foundations Congress & Equipment Expo	March 5-10, 2018	Orlando, United States
International Symposium on Geotechnics for Transportation Infrastructure	April 7-8, 2018	New Delhi, India
EUROROCK 2018 Geomechanics and Geodynamics of Rock Masses	May 22-26, 2018	Saint-Petersburg , Russia
4th GeoShanghai International Conference	May 27-30, 2018	Shanghai, China
micro to MACRO mathematical modelling in soil mechanics	May 29 - June 1, 2018	Reggio Calabria, Italy
■ **Deep Foundations Institute** http://www.dfi.org/dfievents.asp		
The International Foundations Congress and Equipment Expo (IFCEE 2018)	March 5-10, 2018	Buena Vista, Florida
International Conference on Deep Foundations and Ground Improvement	June 5-8, 2018	Rome, Italy
SuperPile 2018	June 27-29, 2018	New York, United States
■ **Construction Machinery Events**		
OCM2018 (19th Specialized Exhibition of Construction Materials) https://www.osmexpo.com/	Jan 23-26, 2018	Moscow, Russia
INTERMASZ 2018 (International Fair for Construction Machinery, Vehicles and Specialized Equipment) http://www.intermasz.pl/en/	Jan 30- Feb 2, 2018	Poznan, Poland
World of Asphalt Show 2018 http://www.worldofasphalt.com/	March 6-8, 2018	Houston, United States
Bauma CONEXPO AFRICA 2018 http://www.bcafrica.com/	March 13-16, 2018	Johannesburg, South Africa
■ **International Geosynthetics Society** http://www.geosyntheticssociety.org/calendar/		
5th International Conference on Geofoam	May 9-11, 2018	Kyrenia , Northern Cyprus
■ **Others**		
ICDEM 2018 (20th International Conference on Disaster and Emergency Management) https://www.waset.org/conference/2018/03/rome/ICDEM	March 5-6, 2018	Rome, Italy

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Nankoku,Kochi 783-0004,
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Chiyoda-ku, Tokyo 100-0011,
JAPAN

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Sakamoto Sangyo Co., Ltd.
No. 22-5, Oji 2-Chome, Kita-ku
Tokyo 114-0002
JAPAN

J Steel Australasia Pty Ltd
Level 23, 207 Kent Street, Sydney NSW 2000
Australia

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Guangxi Ruiyu Construction Technology Co., Ltd
Xiuxiang avenue, Xixiangtang district
Nanning city, Guangxi 530001,
CHINA

源泉 GUAN CHUAN

Guan Chuan Engineering Construction Pte Ltd
28 Sungei Kadut Way,Guan Chuan Building
SINGAPORE 729570

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Editorial Remarks

The Editorial Board is pleased to publish Volume 2, Issue 4 on schedule. This issue contains message from a new president, case-history reports from Kochi seminar, and event reports. It is 3rd time to publish the On-site interview. This time is about improvement work of Harajuku station for Tokyo Olympic and Paralympic games to be held in 2020. IPA will hold the First International Conference on Press-in Engineering 2018, Kochi, please read the details on the announcement.

This issue also includes a special contribution about "Measures for Earthquake- and Tsunami- Resilience Enhancement of Industrial Parks in Bay Areas" written by Dr. M. Hamada, the professor Emeritus of Waseda University.

Please feel free to contact the Editorial board members below with email address or IPA Secretariat (tokyo@press-in.org) for your clarifications and/or suggestions.