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News Letter

Volume 4, Issue 3 September 2019

Inside This Issue

Editorial Board

Messages
From the Director

Lei Yang

Vice President
Shanghai Tunnel Engineering CO., LTD. (STEC)
Shanghai Urban Construction Group (SUCG)

Over the past years, I have been engaged in pile foundation researchs, especially in how to apply and manage new technology at the construction field. I have experienced in urban rail transit, large cross-river tunnel and bridge construction. I have presided over many municipal projects including Shanghai Yangtze River Crossing Project, The Bund Underground Passage, and urban rail transit projects in Shanghai, Nanjing, Hangzhou, Zhengzhou, Ningbo, Wuhan, Kunming and other cities. Currently, I am responsible for the safety and quality control of Shanghai Tunnel Engineering and dedicated to the construction of Shanghai Metro Line 15, 18 and Shanghai Beiheng Passage.

Due to the need of domestic projects, I came into contact with Press-in technology in 2010, and I believe the Press-in technology is superior to other piling technologies, especially in extreme working conditions. In 2017, on behalf of Shanghai Tunnel Engineering, I started business contact with Japan technical research corporation, and bought a Press-in machine F401 in November 2017. At present, this machine has been successfully used in a tunnel project of our company in Hainan Province. Our technical team and I have also been engaged in research on this advanced engineering method. I think Press-in technology will have future developments in urban infrastructure construction. One of my aims is to promote the know-how of Press-in technology in China. My involvement in IPA dates back to June 2018. I am very interested in the application of Press-in technology, and I believe that I can cooperate and communicate with IPA members and promote the development of Press-in technology togther.

Besides, the Chinese version of “Press-in retaining structures: a handbook” will be published in this month and I believe it is very useful, especially for beginners like me and my colleagues who are trying to apply the Press-in technology. Finally, I would like to express my heartfelt thanks to all the members of IPA. I will fulfill my duties as a director and contribute to the further development of Press-in technology.

◆ A brief CV of Mr. Lei Yang

2003-2009	Vice General Manager of Shanghai Tunnel Engineering
2009-2011	General Manager of Shanghai Tunnel Engineering
2011-2014	Chairman of Shanghai Tunnel Engineering
2014-Present	Vice president of STEC & SUCG
Others:	Director of China Civil Engineering Society Vice President of Shanghai Society of Civil Engineering Vice President of Shanghai Work Safety Association

Messages
From the New Director

Marcos Massao Futai

Associate Professor, Department of Structure and Geotechnical Engineering
School of Engineering – University of São Paulo

I am pleased to write a message for the present issue of IPA Newsletter. Press-in technology is yet not used in Brazil or South America. The first time we heard about the Press-in application was on 28th November 2018 when Dr. Kusakabe, Prof. Takemura and Mr. Takuma presented a seminar in São Paulo and in Rio de Janeiro.

It is my first year as an IPA Director, and I am very happy to be the first director to represent Brazil. Our challenge is to introduce and promote the Press-in technology in Brazil and all South America.

My research and consulting activity focus on geotechnical engineering applied to infrastructure, such as soil and rock behaviour, embankment on soft clay, slope stability and stabilization, dams, tunnels, reinforced soil using geosynthetics, and foundations. All these themes could be Press-in applications. Landslides and flood in the major natural disasters in Brazil and the Press-in technology could be used to mitigate risks.

Brazil is the largest country in both South and Latin America. At 8.5 million square meters and over 200 million people, Brazil is the world's fifth-largest country by area and the word's ninth-largest economy. Recently, from 2015 to 2018, Brazil experienced a severe economic and political crisis. The economy remains stagnant. However, the economy is expected to resume its growth next year. The infrastructure in South America is precarious, and we have a great opportunity in the future for Civil Engineering. When the Brazilian economy resumes its growth, we will need more railways, roads, subways, ports, airports, power plants, dams, tailing dams, tunnels, and energy.

I hope the activities of IPA in Brazil can grow together with the economy. I also hope I have an opportunity to report some applications of Press-in technology in Brazil in the future. I will do my best to introduce and disseminate IPA activities and Press-in technology in Brazil and all South America.

◆ A brief CV of Associate Prof. Marcos Massao Futai

Marcos Massao Futai is currently an Associate Professor in the Department of Structural and Geotechnical Engineering at the University of Sao Paulo. He is a Civil Engineer (Federal University of Mato Grosso 1995). He received his Master (1995) and PhD degrees (2002) in Geotechnical Engineering from the Federal University of Rio de Janeiro. He was an Academic Visitor at the University of Cambridge (2015-2016). Prof. Futai has published some 25 papers in international journals and 130 conferences papers. Prof. Futai was the head of the Civil Engineering Graduate Program – University of Sao Paulo (2012 – 2015). He was the former President (2011-2012) of the Regional São Paulo Nucleus of the Brazilian Association of Soils Mechanics and Geotechnical Engineering (ABMS) and a member of the following committees: Unsaturated Soils; Field Tests; Foundation. He currently is the General Secretary of the Rock Mechanics Technical Committee of ABMS – 2019-2020 and Head of the Research Group of Geotechnical Engineering Applied to Infrastructure (GeoInfraUSP).

IPA News Letter Volume 4, Issue 3 September 2019

Special Contribution

Piled Raft Foundation Combined with Deep Mixing Wall Grid

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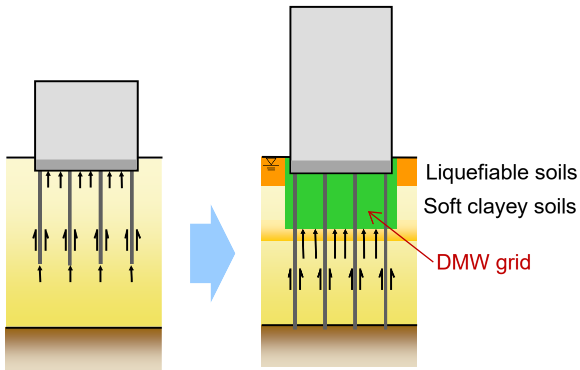
Abstract. An advanced piled raft system, which can be used in very soft clayey soils and/or liquefiable soils, called "piled raft foundation combined with deep mixing wall grid" has been developped. The piled raft system was employed for a 12-story building and field monitoring of the soil-structure system was performed. During the monitoring period, the 2011 Tohoku Earthquake (M9.0) struck the site (about 380 km from the epicenter). In this paper, the static and dynamic monitoring results of the advanced piled raft system, and a numerical simulation using a 3-dimentional finite element (FE) model to examine the performance under strong earthquakes were presented.

1. Introduction

In recent years, piled raft foundation, which means a piled foundation combining piles and raft response in a design, has been used in many countries. In Japan, since a basic design framework for piled rafts was established in the early 2000s, piled rafts have been employed for lots of buildings including high-rise buildings over 200 m in height. At the same time, field evidence, especially the settlement and the load sharing between piles and raft, was accumulated by monitoring full-scale structures, and the effectiveness of piled rafts in reducing average and differential settlements has been confirmed (Yamashita et al., 2011a).

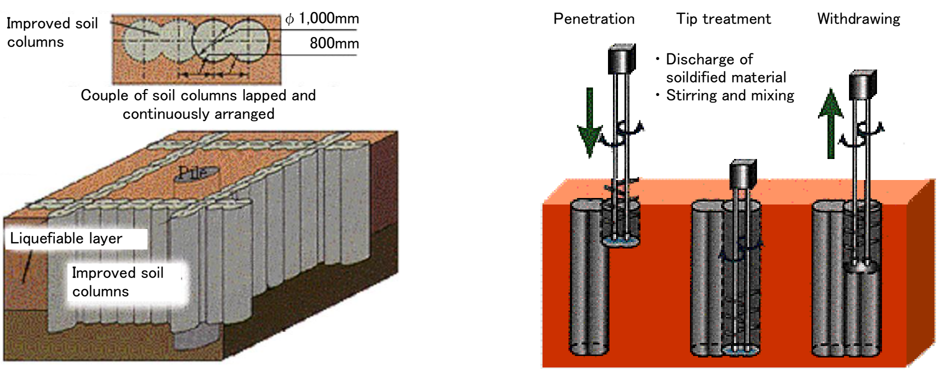
2. Piled raft combined with ground improvement

The most effective application of piled rafts occurs when the raft can provide adequate load capacity but the settlement and/or differential settlements of the raft alone exceed the allowable values, hence favorable situations may be soil profiles consisting of relatively stiff clays and relatively dense sands (Poulos, 2017). On the other hand, unfavorable situations are profiles with very soft clayey soils and/or requifiable soils near the surface of the raft, which may be subjected to consolidation settlement and/or seismic liquefaction. To cope with this, an advanced piled raft system, i.e., a piled raft foundation combined with gound imprpvement, has been developed (Yamashita et al., 2011b).



(a) Piled raft foundation (b) Piled raft combined with DMW grid

Fig. 1. Advanced piled raft system



(a) Schematic of DMW grid (b) Construction procedure (2-axle type)

Fig. 2. Deep mixing wall (DMW) grid

Fig. 1 illustrates the advanced piled raft system called “piled raft combined with deep mixing wall (DMW) grid”. The DMW grid (illusutrated in Fig. 2), which is expected to restrict the shear deformation of the soil within the grid, is used as a countermeasure of soil liquefaction under the raft as well as to increase the bearing capacity of the raft foundation. Moreover, the DMWs are expected to resist the inertial force from the structure during strong earthquakes.

3. Static and Dynamic Monitoring of 12-story Building on Soft Ground

Fig. 3 illustrates a schematic view of a 12-story residensial building and its foundation with a typical soil profile. The building located in Tokyo is a reinforced-concrete structure with a seismic base-isolation system. The total load in the structural design was 198.8 MN (average pressure over the raft was 200 kPa). The subsoil consists of very soft to medium clayey soil layers to a depth of 43 m, underlain by dense sandy layers. The groundwater table appears about 1.8 m below the ground surface, and it was ascertained that the silty sand near the ground surface had a potential for liquefaction with a peak ground acceleration (PGA) of 0.2g.

Hence, to prevent liquefaction of the silty sand as well as to provide adequate load capacity of the raft, a piled raft combined with DMW grid (which was extended to a depth of 16 m with the bottom being embedded in the stiffer silty clay) was employed. Sixteen PHC piles, whose toes reached the very dense sand-and-gravel layer, were used to reduce the settlement to acceptable levels. Fig. 4 illustrates the foundation plan with the layout of the piles and the DMW grid (area replacement ratio is 0.25). The effectiveness of the piled raft system was confirmed by comparing performance and cost with conventional large-diameter cast-in-place concrete pile foundation.

Field monitoring on the settlement and the load sharing between piles and raft was performed both statically and dynamically (Yamashita et al., 2012). The locations of the monitoring devices are shown in Fig. 4. Two piles, 5B and 7B, were provided with LVDT strain gauges. Fig. 5 shows the measured vertical ground displacement just below the raft after the casting of the raft. The vertical ground displacement might be approximately equal to settlement of the raft, and it refers as raft settlement here. Fig. 6 shows the time-dependent vertical load sharing among the piles, the DMWs, the soil and the buoyancy in the tributary area of columns 5B and 7B indicated in Fig. 4. During the monitoring period, on March 11, 2011, the 2011 Tohoku Earthquake (M=9.0, about 380 km from the epicenter) struck East Japan, and the seismic responses of the 12-story building were successfully recorded. The PGA recorded at the site was 0.18 g as shown in Fig. 7. Just before the earthquake, the raft settlement was 17.3 mm, and the ratio of the load carried by the piles to the net load (the gross load minus the buoyancy) was estimated to be 0.67 where the ratio of the net load carried by the DMWs to the net load was 0.26, fairly greater than that carried by the soil. After the earthquake on March 15, the raft settlement increased by only 0.3 mm to 17.6 mm, and thereafter, the raft settlements ranged from 17 to 18 mm. Furthermore, almost no change in load sharing among the piles, the DMWs and the soil was observed after the earthquake. Thus, both the raft settlement and the load sharing were quite stable after the earthquake.

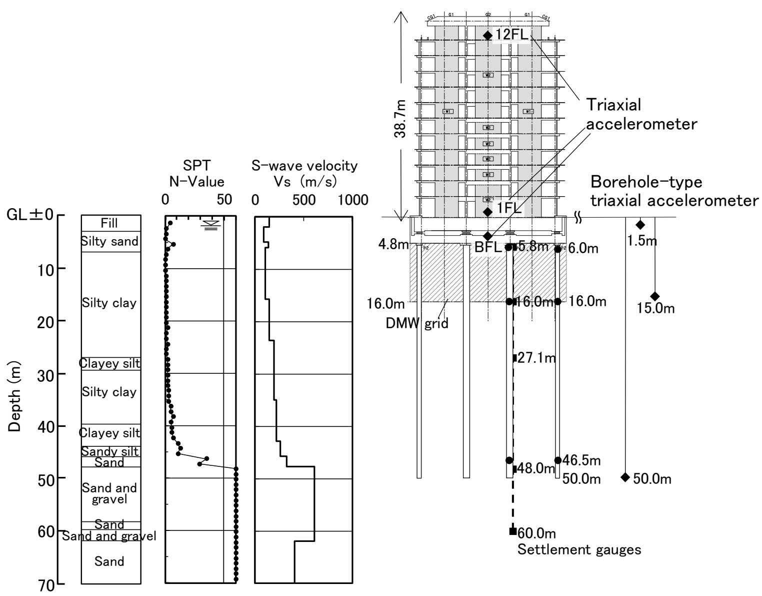


Fig. 3. Schematic of 12-story building and foundation with soil profile

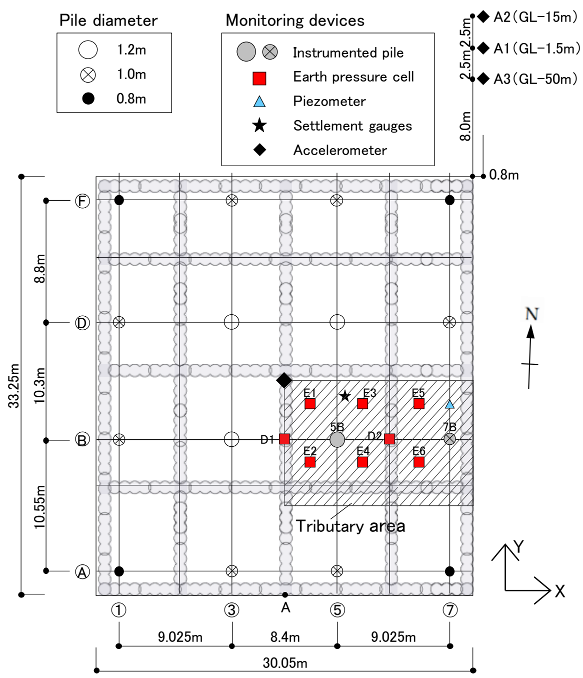


Fig. 4. Foundation plan with layout of piles and DMW grid

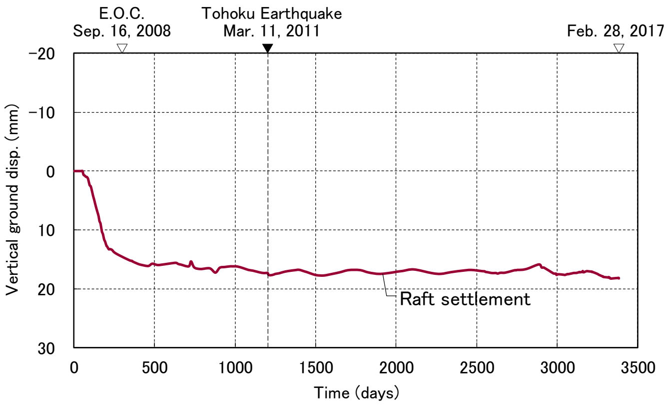


Fig. 5. Measured vertical ground displacements just below raft

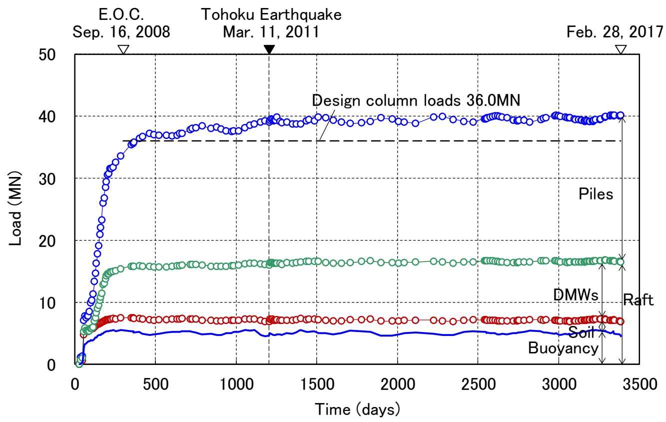


Fig. 6. Load sharing among piles, DMWs and soil in the tributary area

Fig. 7 shows the acceleration time histories recorded near the ground surface, on the raft and the 1st and 12th floors in the EW direction. The duration of the seismic motion was longer than 600 s. The peak acceleration on the 1st floor was significantly reduced compared to that on the raft, which indicates that the base-isolation system acted quite well. In addition, the peak acceleration on the raft was clearly reduced compared to that near the ground surface due to the input losses caused by the dynamic soil-structure interaction.

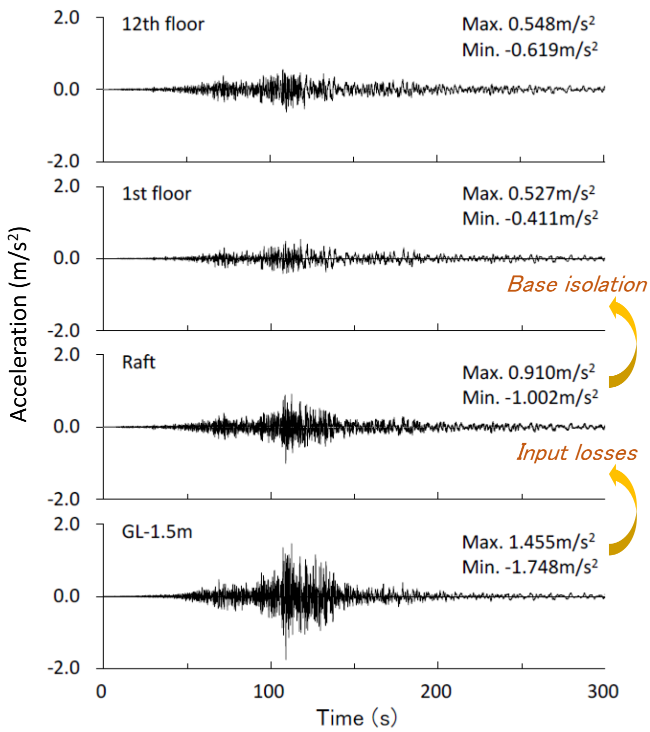


Fig. 7. Acceleration time histories recorded on the ground and structure (EW)

Fig. 8 shows the relationship between the axial force and the bending moment measured at the pile head of Pile 5B, which were obtained by combining the components in NS and EW directions. In order to check the performance of the piles, the design interaction curves of the SC pile (which was used for top portion) are also shown in Fig. 8. It was found that the increments in axial force were remarkably small due to the action of the base-isolation system, and that the measured bending moments were fairly small compared to the damage limit state values (the unit stress at the edge of the concrete is almost in the elastic condition).

4. Performance Under Strong Earthquakes through Numerical Simulation

To examine the seismic performance of the piled raft system under strong earthquakes, a numerical simulation was conducted using a nonlinear 3-dimentional FE model illustrated in Fig. 9 (Yamashita et al., 2018). As strong earthquake motions for the present analysis, input motion of Level 2 earthquake (with mean return period of approximately 500 years) was employed. Fig. 10 shows the code-defined acceleration response spectrum of the Level 2 motion on the engineering bedrock. Fig. 11 shows the acceleration time history of the input motion using Kobe phase data on the bedrock (2E). The input motion was applied horizontally in the NS direction at a depth of 75 m.

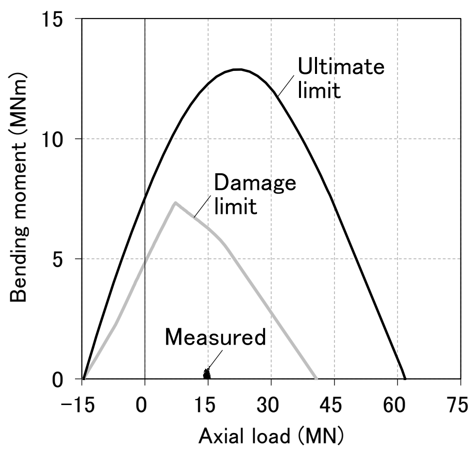


Fig. 8. Relation of axial force with bending moment (Pile 5B)

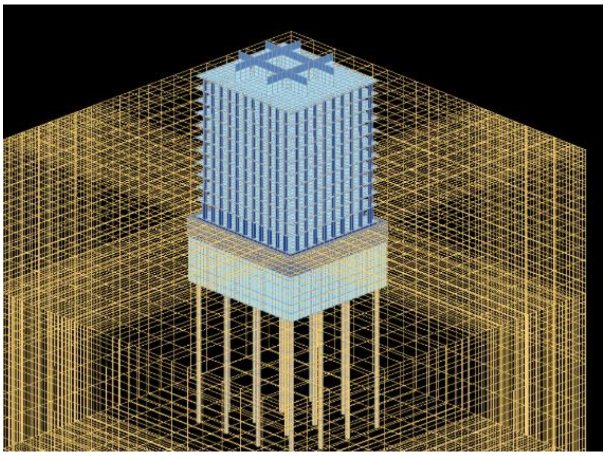


Fig. 9. 3-dimentional FE model

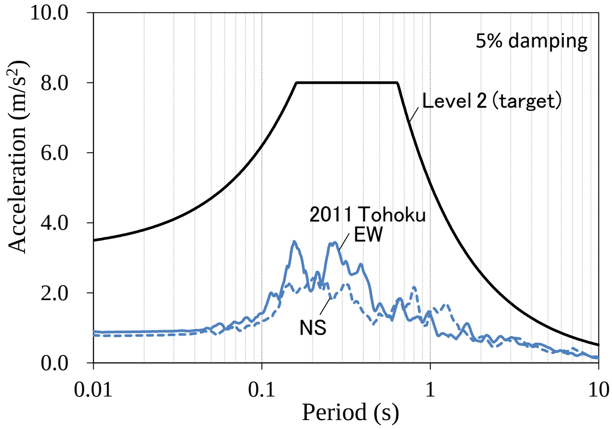


Fig. 10. Acceleration response spectra of Level 2 motions and 2011 Tohoku Earthquake on bedrock

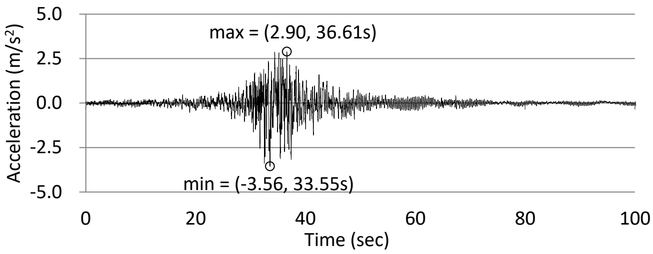
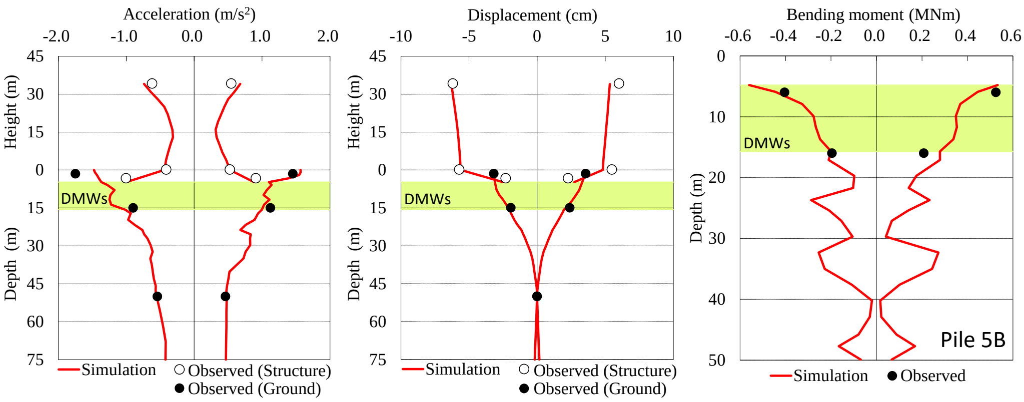


Fig. 11. Input acceleration time history (Kobe phase)

To verify the deformation parameters of the DMWs and the soil and to validate the simulation method, a numerical simulation was carried out using the moderate earthquake motion recorded during the 2011 Tohoku Earthquake. The response spectra of the input accelerations on the bedrock (which was derived from the records at a depth of 50 m) is shown in Fig. 10. The peak horizontal displacement profiles of the ground and superstructure at the center and the peak bending moment profiles of Pile 5B are shown in Fig. 12, compared with the observed values. The displacements are relative ones to the reference point at a depth of 50 m. It is seen that the simulated values of ground and structure response and those of pile bending moment agree well with the observed ones, and that the dynamic 3-dimentional FE simulation method is capable of reproducing the observation records and that the deformation parameters of the unimproved and the stabilized soils at relatively small strains were appropriate.

Then, the seismic response analyses under Level 2 earthquakes were conducted, where numerical cases without the DMWs were also conducted. Fig. 13 shows the peak bending moment profiles of Pile 5B. The bending moment near the pile head in the case with DMWs was significantly small in comparison with that in the case without DMWs. To clarify the difference in pile bending moment in the cases with and without DMWs, the ground deformation and the shear force acting at the pile head during the shaking were examined.



(a) Acceleration (b) Displacement (c) Bending moment

Fig. 12. Profiles of peak response of ground and structure and pile bending moment (EW)

Fig. 14 shows the profiles of the peak horizontal displacement of the DMWs and ground under the mid-side of the raft. It is seen that the displacements near the raft bottom of the DMWs were markedly smaller than those of the ground in the case without DMWs. Fig. 15 illustrates the equilibrium of lateral external forces and resistant forces at the raft bottom when the bending moment of Pile 5B was at its maximum. Regardless of the presence of the DMWs, the inertial forces of the superstructure were very small compared to the earth pressure on the raft side. This occurred because of the action of the base-isolation system. In the case with DMWs, the external forces were carried mostly by the DMWs and the load carried by the piles was much smaller than that in the case without DMWs. In addition, it is noted that the tensile failure of the DMW grid seemed to be limited to the bottom portion as illustrated in Fig. 16.

Thus, both the ground displacement near the raft bottom and the shear force acting at the pile head were decreased by the presence of the DMWs. As a result, the bending moments near the pile head were significantly smaller than those in the case without DMWs.

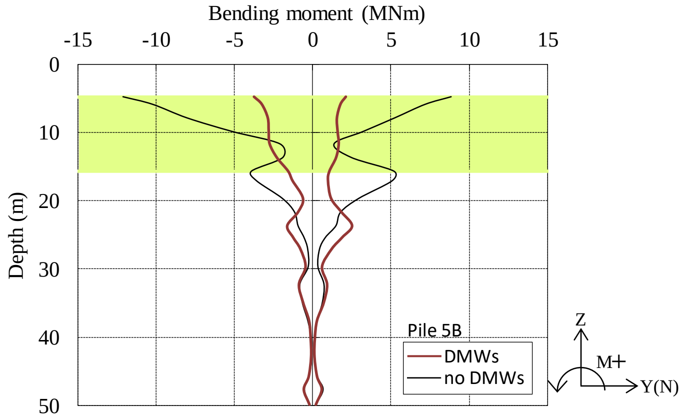


Fig. 13. Peak bending moment profiles (Pile 5B)

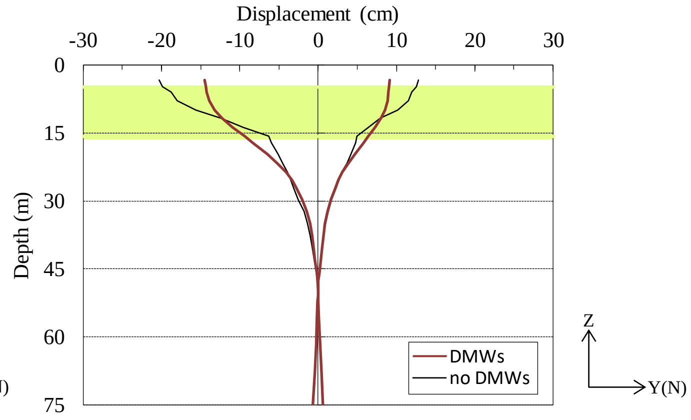


Fig. 14. Peak displacement profiles of DMWs and ground under the mid-side of raft

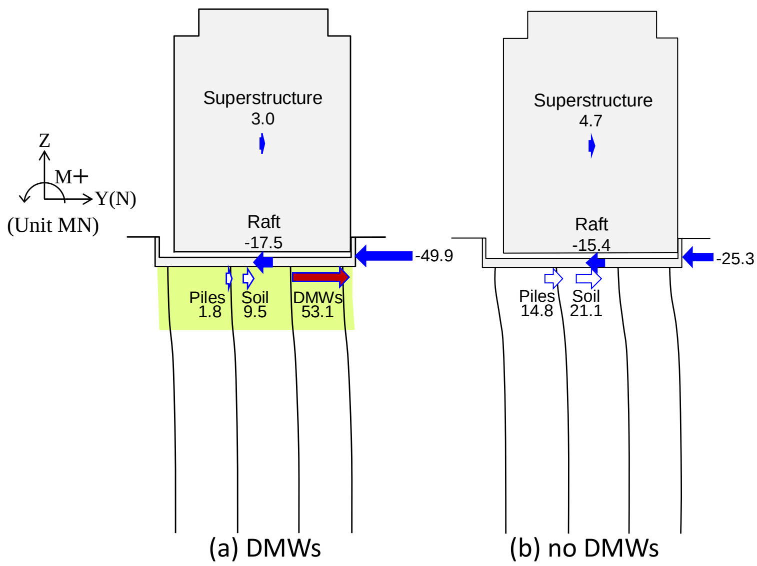


Fig. 15. Equilibrium of lateral forces at raft bottom when bending moment (Pile 5B) was at its maximum

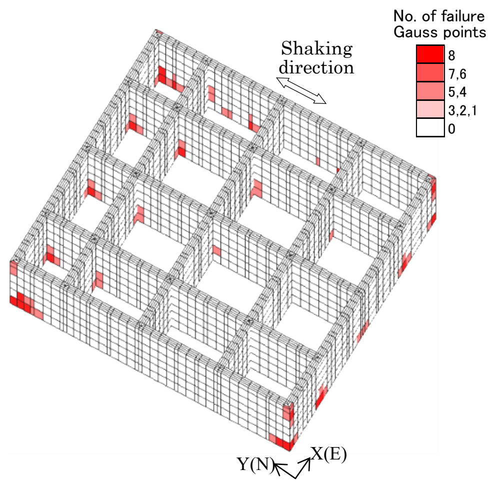


Fig. 16. Extent of tensile failure in DMW grid

5. Concluding Remarks

Based on the static and dynamic monitoring of the 12-story building, it was found that the piled raft combined with DMW grid showed a good performance under the moderate seismic motion as well as ordinary conditions. In addition, through the numerical simulation using a 3-dimentional FE model under strong earthquakes, the ground displacement near the raft bottom and the shear force acting at the pile head were found to be significantly decreased by the presence of the grid. This indicates that the DMW grid was quite effective in reducing the sectional force of the piles in the piled raft system.

The DMW grid could be designed more rationally by following the principles of a performance-based design. The reason is that the DMW grid can be regarded as supplementary structural elements in the foundation system, and minor damage to the grid can be tolerated under strong earthquakes, provided that the required foundation performance has been satisfied.

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◆ A brief CV of Dr. Kiyoshi Yamashita

Dr. Yamashita obtained his Bachelor and Master of Engineering from Tokyo Institute of Technology. He joined Takenaka Corporation in 1977 as a research engineer. He was a deputy general manager in Takenaka R&D Institute from 2009 to 2012. His reserch interests are design and performance of piled raft foundations under both ordinary and seismic conditions. He engaged in foundation design of around 50 buildings in which piled rafts were employed. He also planned and executed long-term field monitoring of the selected piled rafts. He has published more than 150 technical papers including more than 20 journal articles and 40 conference papers. He received the JGS (Japanese Geotechnical Society) Awards in 1996, 2013 and 2018.

Special Contribution

Detection and Geotechnical Characterization of Sinkhole: Central Florida Case Study

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ABSTRACT

Sinkholes are a major geohazard in Karst formed from the dissolution of soluble bedrocks. Due to limestone bedrock and groundwater flow, many sinkholes have been formed, resutling in structural damages to buildings and infrastructure. In this article, types and mechanisms of sinkholes in Florida are presented. In addtion, current practice in detection and characterization of sinkhole subsurface and sinkhole research of Florida Sinkhole Research Institute (FSRI) at University of Central Florida (UCF) are introduced.

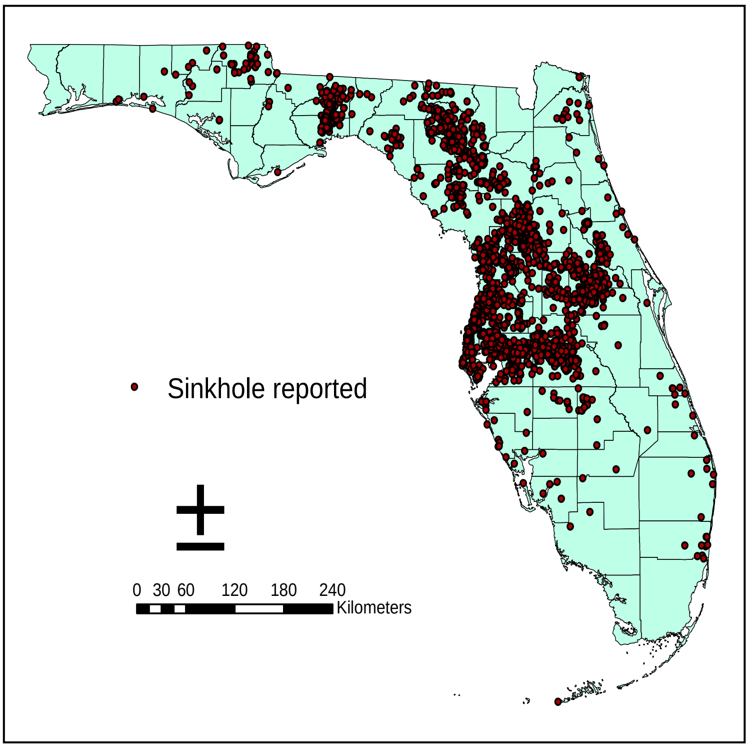
Key Words: Sinkhole, Raveling, Cone Penetration Test, Sinkhole Resistance Ratio

1. Introduction

Sinkholes are a geologic hazard that occurs in areas underlain by soluble bedrock such as limestone, gypsum, marble, anhydrite, or dolomite. Although roughly 15% of the United States is underlain by rock susceptible to sinkhole development (Sinclair 1986), the discussion here after refers to sinkhole occurrence in limestone, which underlays the bulk of Florida's Peninsula (Lane 1986). Example photos showing Florida's karst features are shown in Fig. 1.

Fig. 1. Photo showing typical Florida's karst formation

Sinkholes can cause serious damage to properties and infrastructure, and sometimes human casualties occur, in severe cases. Considerable damage from natural sinkholes is particularly common in Florida, Texas, Alabama, Missouri, Kentucky, Tennessee, and Pennsylvania (Kuniansky et al. 2016). Insurers in Florida, the most vulnerable state to sinkhole damage, received a total of 24,671 claims for sinkhole damage between 2006 and 2010, totaling $1.4 billion (FOIR 2010). According to the Florida Office of Insurance Regulation (FOIR) report, the insurers' expense has been gradually growing with increases in both frequency and severity of sinkholes.



(a) Florida sinkhole map

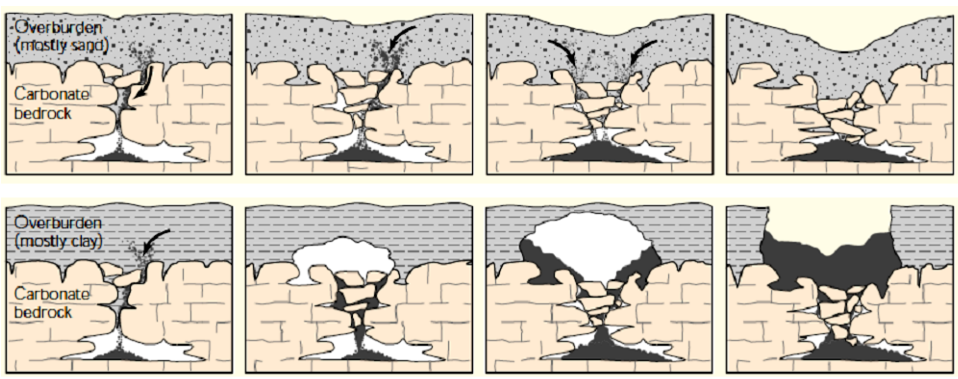
(b) Winter Park sinkhole (in 1981)

(c) Sinkhole near Walt Disney World (in 2013)

Fig. 2. Florida's sinkholes

2. Sinkhole Type and Mechanisms in Florida

In general, sinkholes in Florida are classified into three types, which are cover-collapse, cover-subsidence and dissolution sinkholes. The two sinkhole types that can damage building and infrastructure are the subsidence and collapse types (see Fig. 3). Dissolution sinkholes, also named as cover-sagging sinkholes, commonly take place in mantled karst areas where gradual settlement of the cover by passive sagging may occur due to the progressive corrosional lowering of the rock-head. Sinkholes produced by this mechanism are usually shallow, and they may not be considered a direct threat to human lives due to their significantly slow deformation rates (Gutiérrez et al., 2008). In cover-subsidence (cover-suffusion) sinkholes, the soil depth is large enough for arching to take place, but the high overburden pressure leads the soil to flow into the cavity, resulting in excessive surface settlement. These subsidence sinkholes gradually form over a long period of time. In cover-collapse sinkholes, a subsurface cavity increases due to hydrogeological conditions (e.g. downward seepage) until the overburden depth above the cavity becomes too shallow for arching to develop, then a surface collapse suddenly.



(a) Cover-subsidence sinkholes tend to develop gradually where the covering sediments are permeable sand.

(b) Cover collapse sinkholes may develop abruptly over a short period of time and can result in catastrophic damages.

Fig. 3. Formations of two types of sinkholes common in Florida (from Tihansky, 1999).

3. Sinkhole Detection and Characterization

There have been sinkhole multiple geophysical and geotechnical subsurface methods for sinkhole assessment. In order to identify and estimate subsurface voids, such Ground Penetrating Radar (GPR), surface resistivity, and seismic (or stress) wave methods are commonly used. Advanced data processing technique (e.g. full wave inversion) are also used for 2D or 3D imaging of subsurface cavity. These nondestructive methods are useful as an initial check to identify underground cavity but limited to provide more in-depth engineering information such as soil type, strength(or resistance), stability, and so on.

Therefore, traditional geotechnical subsurface exploration methods such as SPT and CPT are still commonly used for sinkhole geotechnical assessment, particularly for raveling assessment. The natural migration of sandy soil into the cavities within the limestone resulting in the deterioration of overburden soil stiffness is known as the soil raveling concept (Foshee and Bixler 1994). Soil raveling is believed to an initial, and detectible, stage of a sinkhole. The raveling sinkhole concept has been previously studied and supported using SPT and CPT. SPT borings performed within these sinkhole sites, found zones of very low N-value blow counts as well as zones where SPT shows “weight-of-rod (WR)” or “weight-of-hammer (WH)” conditions. In addition, loss of circulation of drilling fluid as well as zones of no recovery from the split spoon sampler were also encountered within these areas. Commonly found directly above the limestone, these soft anomaly zones of sandy material area considered to be due to raveling or subterranean erosion. A typical raveling due to sinkhole activity is presented in Fig. 4. Foshee and Bixler (1994) proposed a CPT-based index, Raveling Index (RI) to quantitatively measure the sinkhole vulnerability. RI is defined as thickness of overburden/thickness of raveled, however, the RI does not account for the magnitude of soil resistance (qc and fs) and has shown some limitations in accuracy and applications.

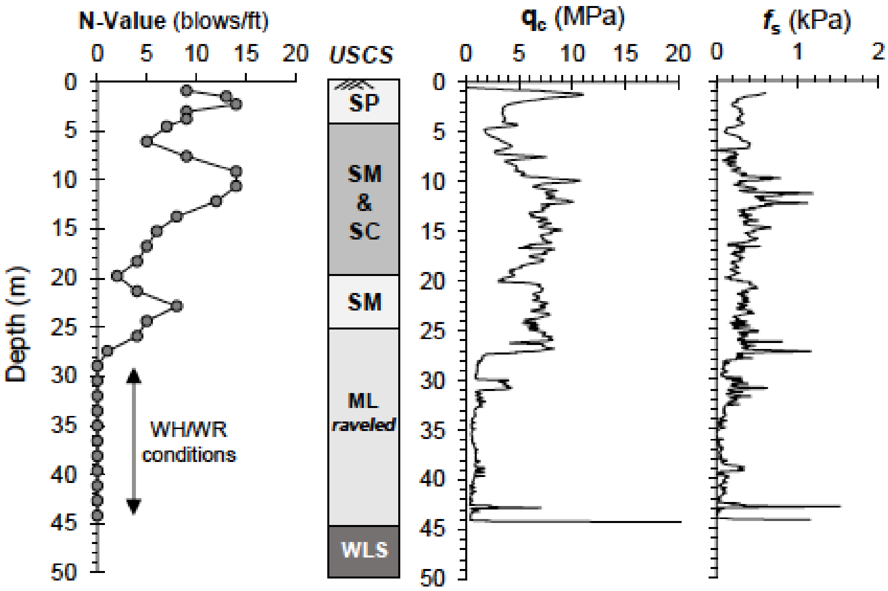
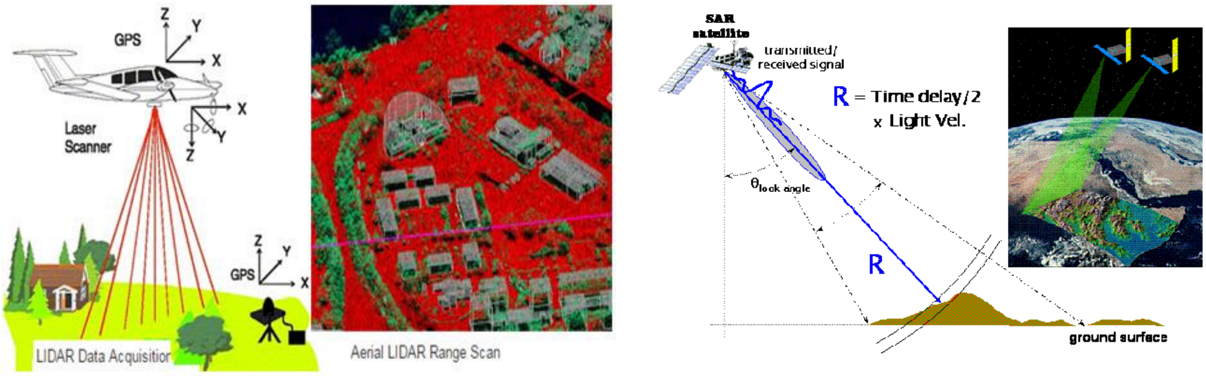


Fig. 4. Sinkhole raveling detected by SPT and CPT.

In addition, remote sensing techniques and methods have been introduced for sinkhole assessment (Kim et al. 2019; Wu et al. 2016). Fig. 6 shows the example figures of LiDAR and InSAR that are used to characterize landform and surface topography. In sinkhole active areas, subsurface soil erosion continues due to groundwater recharge flow, and probably leads to subsidence on the ground. Rainfall events create runoff that can cause significant near surface erosion in the areas of shallow bedrock. Thus, magnitude and rate of subsidence and their shape/trend can be used to detect potential sinkhole in large scale.



(a) LiDAR (b) InSAR

Fig. 5. Remote sensing techniques for sinkhole assessment

4. FSRI's Sinkhole Research

Florida Sinkhole Research Institute (FSRI) at University of Central Florida was established in 1982 after Winter Park Sinkhole, which was opened up in May 1981 with 350 ft wide and 75 ft deep, and have conducted a number of sinkhole research projects. The FSRI constructed sinkhole database, and the database was transferred to Florida Geological Survey (FGS). Recently the FSRI was reactivated with research focus on engineering characterization and mitigation. The institute is also expanding the research to urban ground/road collapse due to aging of underground infrastructure. Example sinkhole research projects of the FSRI are presented in the following sections.

4.1 CPT-based sinkhole vulnerability evaluation

This section presents a CPT-based raveling chart that is used in identifying and classifying raveled soils in Central Florida during initial subsurface exploration. The raveling-chart was developed by collecting a large sample of CPT data (i.e cone tip resistance, qc, and sleeve frictional resistance, fs) from multiple sites within the same geological formation. CPT data was grouped within three categories: collapsed sinkholes, suspected raveling, and no1n-raveled, and plotted using a scatter of data points with coordinates (fs, Qtn,); that is sleeve friction resistance, and normalized tip resistance. A simple statistical analysis was applied for the resulting data group to create envelopes, or threshold lines, which bound the data to create certain categories. The resulting chart provides quantifiable measure of sinkhole raveling due to soil erosion.

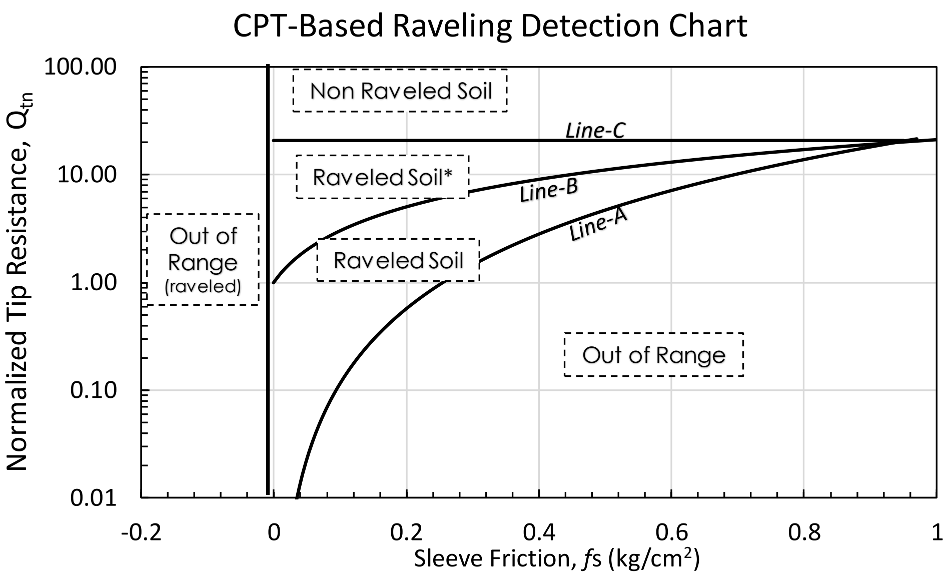
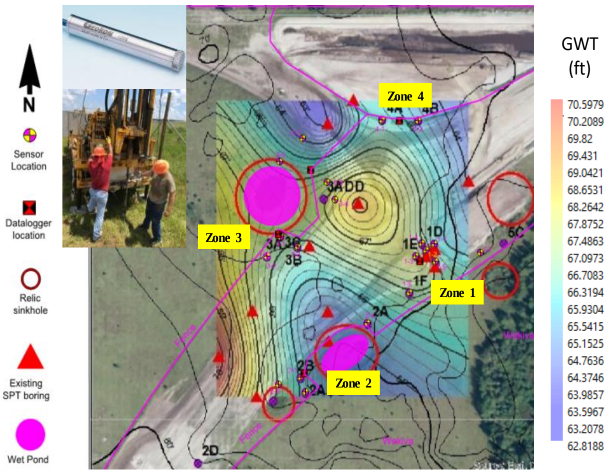


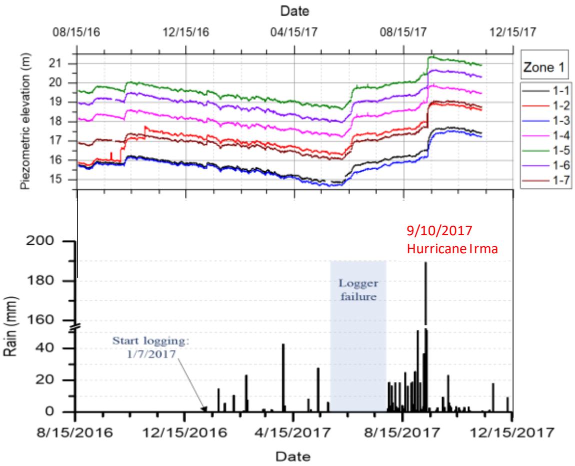
Fig. 6. Sinkhole raveling classification chart (from Shamet et al. 2018)

4.2 In-situ Groundwater monitoring

Hydrogeological approach has been employed because groundwater recharge flow (or seepage downward) is one of major triggering mechanism of sinkhole in central Florida. Multiple piezometer sensors are installed in a pilot study site where SPT and CPT demonstrated active sinkhole activities. The purpose of these piezometer installation is to identify a location of point of recharge, which is assumed as sinkhole source due to higher potential of internal soil erosion. In addition, any sudden change in groundwater table or hydraulic gradient can be a sign of upcoming sinkhole, thus those changes can be detected by continuous monitoring of groundwater. Figures 7a and 7b show the examples how groundwater measurement and monitoring can be used for sinkhole risk evaluation.



(a) Groundwater contour



(b) Groundwater table monitoring

Fig. 7. Groundwater sensing and monitoring for sinkhole risk assessment

4.3 Sinkhole hazard mapping

Mapping of natural hazards has been widely adopted in the areas of earthquakes, tsunamis, flooding, volcanoes, and landslides to help prevent significant damages in vulnerable areas from those specific hazard types. Relatively, sinkhole hazard mapping is not well studied. FSRI has been constructing regional-scale sinkhole vulnerability maps. The probabilistic methods (e.g. Frequency Ratio and Logistic Regression) were used to construct sinkhole hazard models from the statistical analysis of spatial relationships between sinkhole occurrence and a group of contributing factors. The input factors used in computing sinkhole susceptibility index (SSI) include hydraulic head difference, recharge rate, soil permeability, overburden thickness, aquitard layer thickness, depth to water table, and proximity to karst features. Fig. 8 shows the sinkhole vulnerability map of Central Florida area using the Frequency Ratio method. Currently, the authors are exploring a spatio-temporal-magnitude sinkhole hazard approach, which can probabilistically predict location, time, and size of sinkhole.

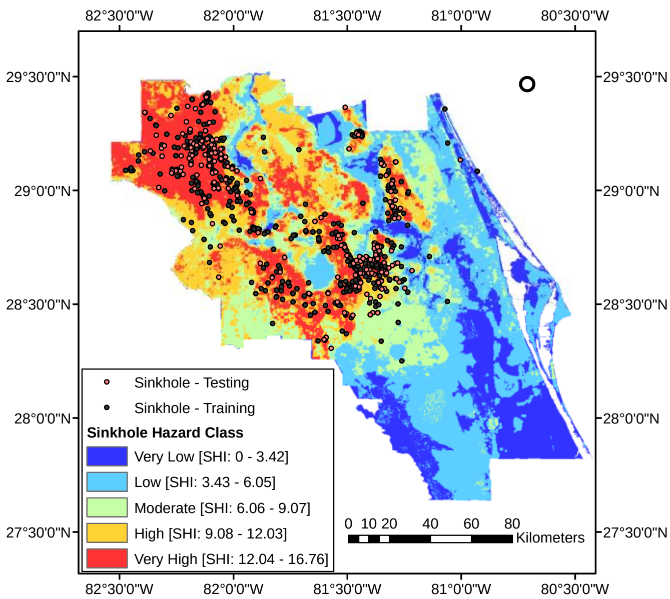


Fig. 8. Regional-scale sinkhole hazard map by FR method

5. Conclusion

Sudden ground/road collapse due to sinkhole (both natural and manmade sinkholes), particularly in urban areas, can cause loss of lives and significant structural damages to buildings and infrastructure. These sinkholes problems have been one of geoscience phenomenon, and thus the topic has received a great attention to geoscience community. Extensive studies, particularly mechanism study, have been carried out from geological, hydrogeologist, geophysical viewpoints, however geotechnical engineering understanding and engineering assessment tools are not well studied. Currently sinkhole problems in the field are mainly based on engineer's knowledge and experience with limited in-situ and lab tests. No systematic and quantitative approaches are available for the sinkhole assessment; therefore quantitative engineering methods are necessary in sinkhole risk assessment. Particularly, engineering methods of cavity detection, stability diagnose, mitigation and reinforcement are crucial in geotechnical engineering community. The authors believe that the role of geotechnical engineers is crucial in the success of sinkhole mitigation and prevention, thus more attention from geotechnical community is necessary.

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◆ A brief CV of Associate Professor Boo Hyun Nam

Dr. Boo Hyun Nam is an Associate Professor in Civil, Environmental, and Construction Engineering (CECE) and Interim Director of Florida Sinkhole Research Institute (FSRI) at University of Central Florida (UCF). He received his Ph.D. in Civil Engineering at The University of Texas at Austin in 2010 and has been working at UCF since 2011. Over the years, Dr. Nam has conducted research in the areas of sinkhole detection and engineering characterization, civil engineering materials (e.g. cement, concrete, and various geo-materials), and interdisciplinary research. He has authored over 120 publications in prestigious international peer-reviewed journals and conferences. Dr. Nam also currently serves in multiple technical committees of ASCE Geotechnical-Institute (GI) and Transportation Research Board (TRB).

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Series Report: Reports from USA (Part 3)

Mitigation of Sinkholes with Press-in Piles

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INTRODUCTION

A sinkhole is a depression or hole in the ground caused by some form of collapse of the surface layer. Certain areas in the world are highly prone to sudden and catastrophic sinkhole formations where the rock below the ground surface is limestone, carbonate rock, or rock of other types susceptible to dissolution by groundwater. For example, Florida, Texas, Alabama, Missouri, Kentucky, Tennessee, and Pennsylvania are known to have highest number of sinkholes in United States (Kuniansky et al., 2015). Depending on when and where they form, sinkholes can cause major damage to properties and threaten people's lives. They vary in size from 1 to 600m both in diameter and depth and also vary in forms from soil-lined bowls to bedrock-edged chasms. Sinkholes may form gradually or suddenly and are found worldwide (Wikipedia, https://en.wikipedia.org/wiki/Sinkhole). Fig. 1 shows six types of sinkholes based on the causes of their formation in limestone-dominant geological conditions illustrated by Waltham et al. (2005).

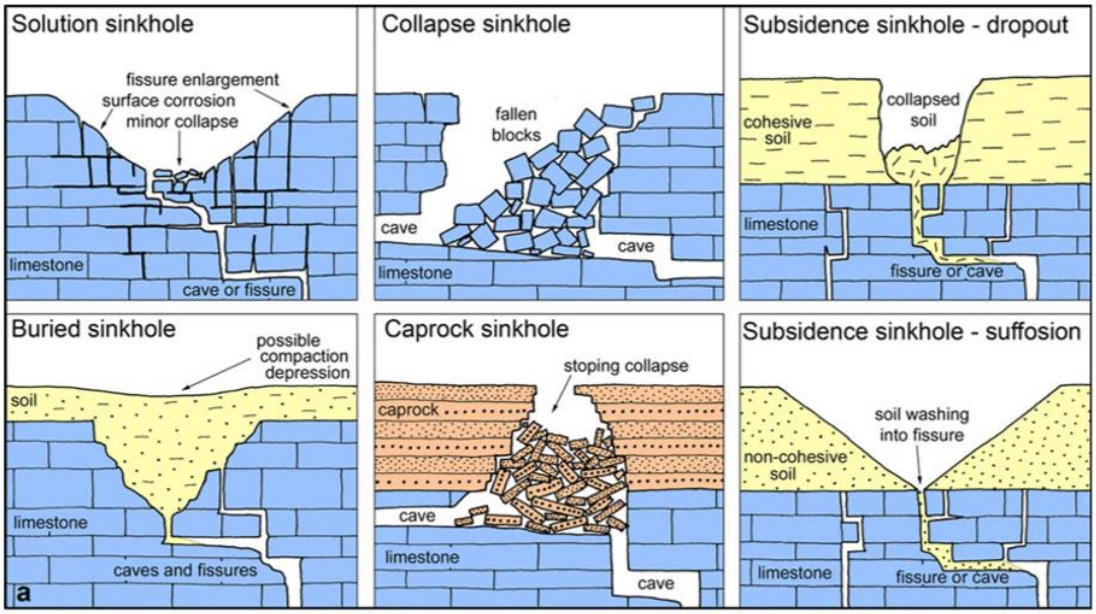

Fig. 1. Six Types of Sinkholes (Waltham et al., 2005)

MITIGATION METHODS

Although grouting is often used to stop sinkholes from further enlarging and/or deepening, it is difficult to predict effectiveness of the work due to the fissured and cavernous nature of the base rock. In addition, it may take a long time to complete grouting with its ever increasing cost. On the other hand, piles can provide a prompt and reliable solution. However, vibration associated with conventional pile driving methods may cause the already sensitive sinkhole to enlarge and put nearby structures more at risk. Among non-conventional piling methods, helical piles may be suited for underpinning existing structures while pressed-in piles are good for slope stabilization, even in the face of a threatening sinkhole; thanks to almost an undiscernible amount of vibration its installation only generates (White et al., 2002). The Press-in Piling Method utilizes a reaction force derived from a few previously installed piles to hydraulically press in the next pile without using vibratory or percussive force to install the pile. In addition, its auger attachment can drill through hard soil including gravel, cobbles, boulders, and soft rock such as limestone concurrently with pile installation (Takuma et al., 2017).

ORLANDO APARTMENT SINKHOLE REMEDIATION PROJECT WITH PRESSED-IN PIPE PILES

A large sinkhole unexpectedly opened up in the middle of an apartment complex during the 2002 summer rainy season in Orlando, Florida in the U.S.A. It increased in size to a 47m x 37m ellipse with a cone shape section of a more than 18m depth, threatening a couple of nearby 2-story apartment buildings. The site access was quite limited with the sinkhole in the middle of the complex. The edge of the sinkhole was only 5m away from one of the buildings (See Fig. 2). Considering that it was at the height of the rainy season of the year, the project needed an expedient and reliable solution, but without disturbing the already vibration sensitive sinkhole and the foundation of the very close apartment buildings. After careful comparison of available remediation methods, constructing an earth retaining wall with pressed-in piles was chosen. Fifty-six 914mm diameter steel pipe piles with interlocks were pressed-in, successfully forming a 61m long solid and self-standing earth retaining wall in 13 days; thus saving the buildings. Fig. 3 shows the site's soil conditions with the depth location of the pipe pile wall. As can be seen, the soil there was generally soft with the SPT values less than 20 except for the weathered limestone layer at 18m below the ground level. See Fig. 4 for the cross section of the project showing the press-in piling machine with a small footprint fitted in the relatively tight zone between the edge of the sinkhole and the apartment building. Piles were hoisted over the apartment building to the piling machine on the other side of the building with a 300-ton capacity truck crane which had sufficient lifting capacity at as much as 39m reach.

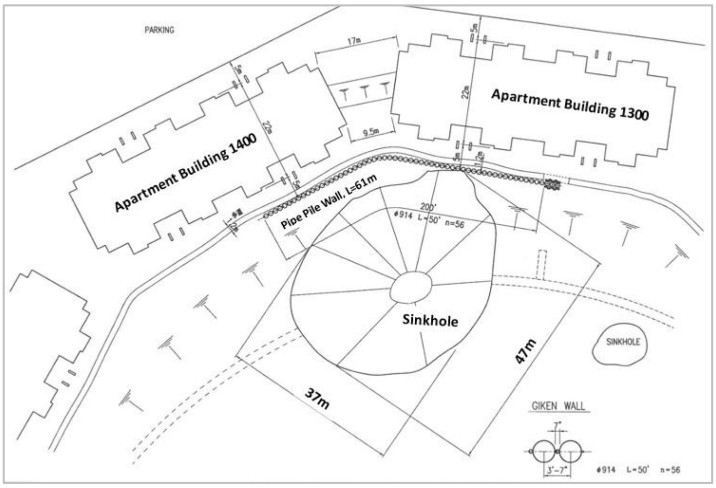

Fig. 2. Plan View of the Sinkhole, Apartment Buildings, and Pipe Pile

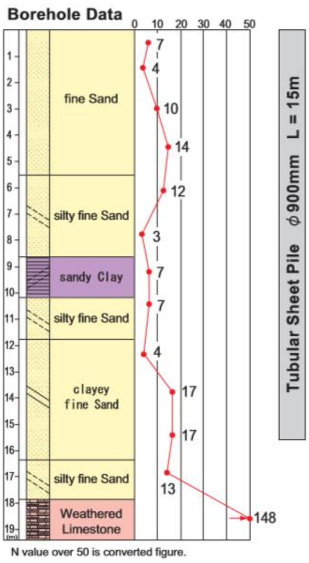

Fig. 3. Boring Data and Pile Location

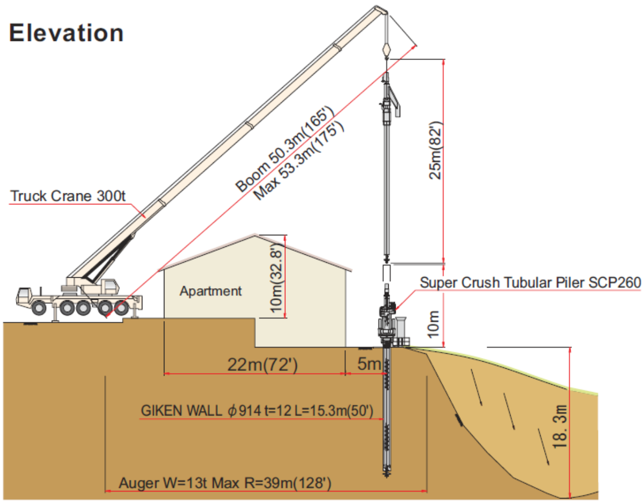

Fig. 4. Cross Section of Sinkhole Remediation Work

Fig. 5 shows pipe pile press-in installation work at the edge of the sinkhole. The gray color tarps were used for temporary slope protection against heavy rainfall. Fig. 6 shows the remediated and landscaped sinkhole with the saved apartment buildings in the background. The pressed-in pipe piles formed a rigid self-standing earth retaining wall without vibration, providing a prompt, safe, and environmentally friendly solution.

Fig. 5. Pipe Pile Being Pressed in at the Edge of Sinkhole

Fig. 6. Remediated and Landscaped Sinkhole

MERIDIAN, MISSISSIPPI CAVE-IN REMEDIATION WITH PRESSED-IN SHEET PILES

12 cars were suddenly swallowed by a 120m-long and 10m-wide cave-in in one November evening in 2015 in Meridian, Mississippi in the U.S.A. The incident occurred in the parking lot of a newly opened family restaurant as shown in Fig. 7. Since the cave-in was on top of the alignment of a newly installed corrugated pipe storm drain, a man-made cause was suspected. Regardless, the restaurant building needed to be immediately protected since it was standing as close as 5m from the edge of the cave-in. Emergency sheet pile installation was planned. However, a conventional installation method with a vibratory hammer would have caused secondary damage due to its vibration-generating nature and proximity to the sensitive cave-in slope and the restaurant building. The press-in piling method was so selected to install 45 pairs of 13.7m long steel sheet piles. The project layout and the section view are as shown in Figs. 8 and 9.

Fig. 7. Cave-in that Swallowed 12 Cars

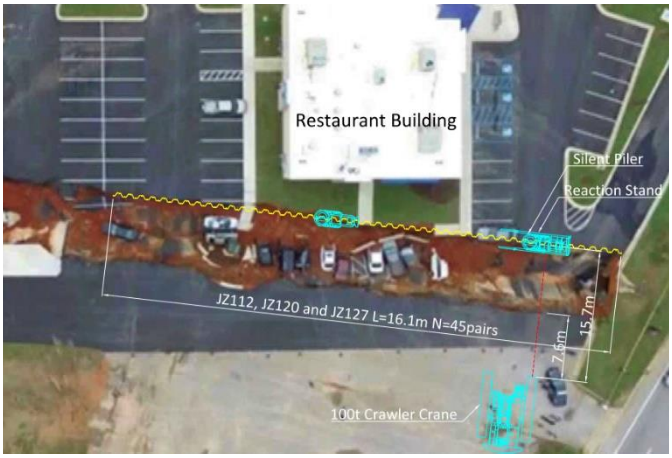

Fig. 8. Plan View of Project

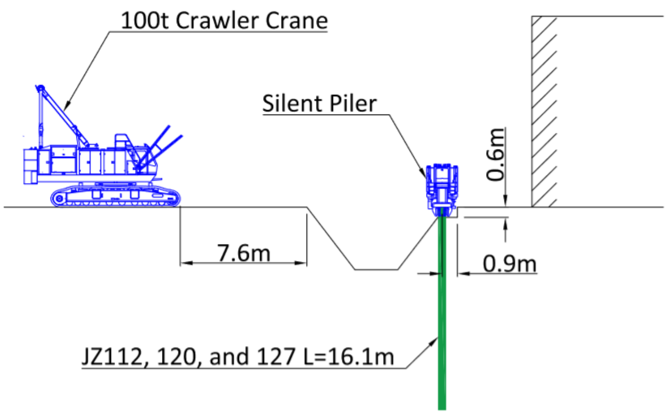

Fig. 9. Cross Section of Project

Fig. 10 shows the soil conditions and sheet pile depth location relative to the soil layers. The top 7 to 8 meters of soil was very soft with a much denser silty sand layer underneath with N values of 20 to 25 all the way down to the design tip elevation of 16m below the ground level. The ground water level was approximately at 5m below the GL near the bottom of the cave-in. The automobiles in the cave-in were removed prior to the remediation work. Due to the emergency nature of the project, sheet piles were continuously installed for 4 days and nights until completion of the 61m long earth retaining wall. See the night time installation in Fig. 11. As a result, further development of the cave-in was prevented and the brand new restaurant building was successfully protected.

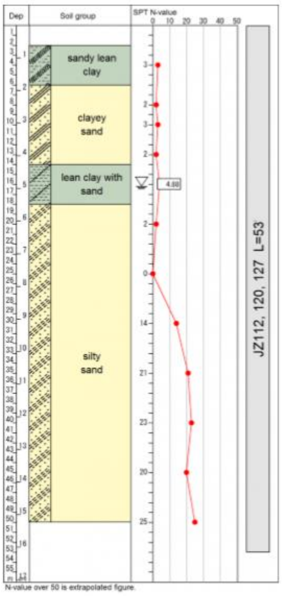

Fig. 10. Soil Conditions and Sheet Pile Location

Fig. 11. Sheet Pile Installation during Night Time

CONCLUSION

Naturally occurring sinkholes as well as man-made cave-ins often threaten existing structures and human lives. They need to be remediated promptly and safely. Pressed-in pile walls can provide solutions for these situations even where the site is physically tight and very close to sensitive structures and delicate sinkhole slopes.

ACKNOWLEGEMENTS

The author appreciates assistance provided by the following individuals.

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Masashi Nagano and Ian Vaz – Giken America Corp.

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On-site Interview

Tide Wall Reinforcement Work by Press-in Method (Keihin Canal, Tokyo)

Hongjuan He, Secretary of IPA
Yuta Kitano, Corresponding Member of IPA Japan Branch Office

Photo 1. The children are playing around construction site.

Koji Hamada

Manager, GIKEN SEKO CO., LTD.

Mr. Hamada joined GIKEN in 1990. He had the 25 years' experience of the Press-in work at construction sites, including the 10-year-overseas work in the USA, Canada, Mexico, etc. He engaged in this site as Manager.

Mizuho Yokoyama

Assistant Manager, GIKEN SEKO CO., LTD.

Mr. Yokoyama joined GIKEN in April, 1997. He has been engaging in all the Press-in Methods including "Hard Ground Press-in Method" and "Gyro Method" for 20 years. He engaged in this work as Main Operator.

Q1. Would you please tell the outline of this construction work including the background?

Mr. Hamada: Tokyo Metropolitan Government is working on further reinforcing countermeasures against earthquakes, tsunamis and high surges for low and coastal areas. This construction site, the tide wall of Keihin Canal (1chome, Yashio, Sinagawa-ku, Tokyo) (Fig.1) is part of the tide wall reinforcement work. This is a very old tide wall constructed in 1963 by steel sheet piles and has been deteriorating as shown in Photo 2. It was required to build a new steel tubular pile revetment in front of the existing tide wall maintaining the current function of the tide wall, and it was decided to adopt a method to Press-in steel tubular piles for a new revetment (L=24.5m,Φ1,400mm,71piles) and steel sheet piles (L=18m,Φ900mm,17 piles). The construction was undertaken dividing the process into three steps as shown in Fig. 2.

Fig.1. Location of construction site

From Google Map

Photo 2. Tide wall constructed in 1963

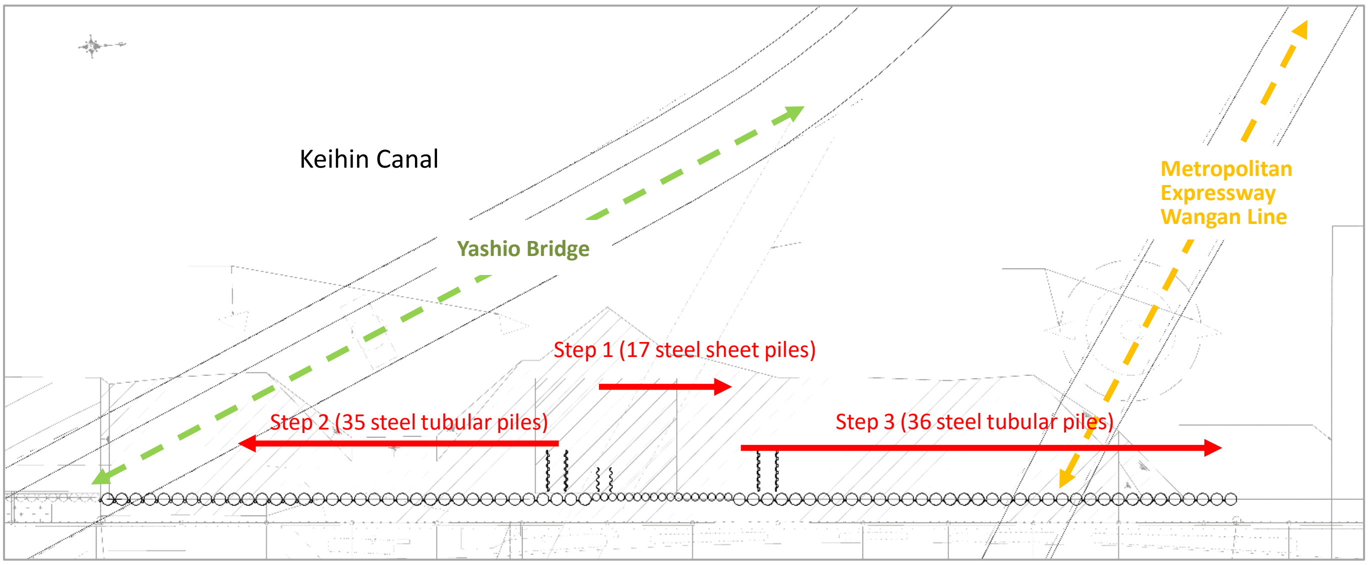


Fig. 2. Construction plan

Q2. What kind of technological features were there in this project?

Mr. Yokoyama: Two features can be pointed out. The first is that part of the construction of steel tubular piles was carried out under a limited overhead clearance of the metropolitan expressway and Yashio Bridge (Photo 3). In the case of driving piles under a limited overhead clearance, usually the length of a steel tubular pile is shortened and welding points are increased. However, if joint points are increased, the cost would rise and the construction period would be also prolonged. As a result of consideration, Y-jibu, a special attachment that our company developed, was adopted. Y-jibu which was used in this construction is a Y-shape attachment that is attached to the toe of a hanging device which a Press-in machine for low overhead clearance is equipped with. The head is lengthened by pinching and raising steel tubular piles with a Y-shape hook on both right and left sides, and by using the lengthened steel tubular piles, it became possible to decrease the welding spots (Photo 4). The second is that, since the site was between the two bridges and the space for barges to put the equipment on was needed, it was quite difficult to secure the construction space in a narrow water area (Photo 5). That is why the GRB system that enables the equipment necessary for the construction to work on the completed piles was utilized. By constructing a continuous wall without temporary works, we were able to clear the problem of limited construction space (Photo 6).

Photo 3. Operating under Yashio Bridge

Photo 4. Low overhead type Piler with Y-jibu attachment

Photo 5. Construction view from a distance

Photo 6. GRB System

Q3. Was there anything you give a special consideration in the schedule of this project?

Mr. Hamada: In this construction, there were a lot of welding spots of steel tubular piles and it took much of the working time for welding. But we were able to shorten the process by increasing the number of welders and complete the construction two weeks earlier than scheduled. The completion of construction as shown in Photo 7.

Photo 7. Completion of Press-in operation

Q4. Did you have anything you found problematic or difficult to deal with? What kind of measures did you take against them?

Mr. Hamada: We carried out the construction keeping the following two points in mind at this site. First one is schedule control. At this construction site, there were time zones when pile driving work could not be done on account of the tidal level, we checked the tidal level in advance and adjusted the working time in order not to have waiting time as short as possible. Second is the issue of environment maintenance in the vicinity of the construction site. In this construction, since all the work was done on the water, we were very careful about prevention of oil spillage. Specifically speaking, we tried locating hydraulic pressure hoses at the positions where they were seen all the time on the water using floats. If we leave the hydraulic pressure hoses in the water, it would become difficult to check the damage condition of the hoses, and consequently, to find the cause of oil spillage. That is why we made hydraulic hoses float on the water and conducted daily check of them.

Mr. Yokoyama: Since it was a construction work on the water, we set up a scaffold around the piles for moving and carrying (Photo 8). In this way, we laid a passage on both sides of the already completed piles so that we could go back and forth smoothly around the Press-in spots.

Photo 8. Scaffold

Q5. The construction industry is now actively working on the reform of working practices. Both of you have been working at construction sites for more than 20 years. Do you find any difference between the time when you joined the company and the present in terms of the way you work?

Mr. Hamada: Working long hours was common in the construction sites in Japan 20 years ago. But our company tried hard to observe the five-day workweek and reduce the overtime work as much as possible by streamlining the construction process, and thus we were able to make our company more appealing. Otherwise, young engineers and competent workers would not join us. As a manager, for instance, I am taking a measure by increasing people when necessary by grasping the workers' labor hours on-site.

Yokoyama: When I started working on-site, there was no working manual. It was common that we learn our job by watching the senior workers' way of working by ourselves repeating try & error on-site. Now it is possible that young generation people study the basics with the manual in the first place, then learn their work efficiently through OJT on-site.

Q6. What does your company think about securing and cultivating young employees at this time of labor shortage?

Hamada: In our company, the average age of the employees who work on-site is over 45, and it is the actual situation that there are not enough middle-class personnel. It is becoming more and more important to secure and cultivate young operators. Also, since there is a big age difference between the senior workers and the young employees who work on-site, there is a generation gap which hinders communication between them. In order to solve this problem, we are working on establishing an OJT system to carry out cultivation young employees strategically. Under advice from an outside consultant, we are now introducing the "Career Plan", with which young employees can envisage their future, and also the "Skill Map", with which employees themselves check how they are improving themselves. At the same time, since the way of cultivating young people changes with the times, we give training for managers to teach how to cultivate young employees.

Q7. What do you think about the future of the Press-in technology?

Yokoyama: I expect that the day will come some day when all the machines are completely automated and there is no need for an operator to operate a machine on-site. I myself felt that there is especially a high risk at the sites of disaster recovery through my many years' on-site experience. If the complete automation is realized, safe and efficient construction work can be undertaken even at the sites of disaster recovery. Using the on-site data which I collected for a long time in GIKEN group, I will work hard to realize automation as soon as possible.

Hamada: I think in the future the Press-in technology will spread all over the world. With a population decline and aging, it is expected that the construction demand in Japan will decrease. I strongly felt that foreign people appreciate the Press-in technology highly while I was working abroad for ten years. I expect that we can contribute to the world by utilizing the Press-in technology in the countries and areas that have the problems such as earthquakes and tsunamis as well as Japan.

★★ Comments ★★

I was very surprised at the quietness of the construction site when I saw the photos where the children at a nursery school were playing joyfully without any affect by the construction noise or vibration. They were watching the construction very interestingly. While I was talking with two engineers, I strongly felt that both of them have strong confidence in the Press-in technology and also they were very proud of taking a leading part in making a contribution to the society. I was deeply impressed by their attitude to make themselves grow even further through cultivating young generation actively for the future world.

I would like to express my special appreciation to Mr. Hamada and Mr. Yokoyama, who gave their kind response to our interviews for the second time, and the Toyo Construction Co. Ltd., the prime contractor, and the people concerned for their cooperation.

Photo 9. Group photo (from left to right)

Mr. Yuta Kitano, Ms. Hongjuan He, Mr. Mizuho Yokoyama, Mr. Koji Hamada

IPA News Letter Volume 4, Issue 3 September 2019

Serial Report

Terminologies in Press-in Engineering (Part 6)

IPA Editorial Committee

Following Terminologies Press-in Engineering (Part 5) in Volume 4, Issue 2, Part 6 is the last issue as follows:

press-in parameters	operational parameters, such as maximum press-in force, press-in speed and the penetration and extraction lengths during repeated and extraction operation, determined as target values for the control of Silent Piler during pile installation. Those are the items affecting the piling efficiency of the press-in operation and construction time control.
reaction pile	piles/sheet piles previously installed into the ground that are gripped by Silent Piler to obtain reaction force for the next pile installation
reaction stand	a stand for mounting counter weights to obtain reaction force during the installation of initial few piles/sheet piles to commence press-in operation
initial press-in	a piling process to install an initial few piles/sheet piles while reaction pile/sheet piles are not available
driving attachment	an equipment used for avoiding the chuck frame of the Gyro Piler from touching the steel tubular piles previously installed. It is used not only for the installation of steel tubular pile to the design elevation, but for the self-walking of the Gyro Piler. It is also used to install joint members such as equal angle steel between steel tubular piles.
embedded wall(s)/structure(s)	generic term for continuous body of embedded wall(s)/structure(s) with piles/sheet piles and it is mainly utilized for earth retaining function
cantilever type embedded retaining structure(s) / wall(s)	the structure(s)/wall(s) formed by simply embedding piles/sheet piles and steel tubular piles, without tie rods, anchors or braces, usually used as earth retaining structures
combined wall structure by Combi-Gyro Method	wall constructed with a combination of hat-shaped steel sheet piles and steel tubular piles by the Combi-Gyro Method
plugging	situation in which the inside of an open-ended pile is plugged with inner soil during pile installation. It also occurs in a concaved portion of the steel sheet pile. This causes an increase in penetration resistance to pile installation.
interlock/interlocking	a joint adjacent sheet piles in the longitudinal direction to form a continuous wall or structure
prefabricated pile(s)	piles/sheet piles commercially fabricated in a factory as a ready-made use on site
bored pile	pile formed with or without a pile casing by excavating or boring a hole in the ground and filling with plain or reinforced concrete. (EN 1536:2010)
driven pile	pile which is forced into the ground by impact/vibratory hammering
pile toe	bottom edge of pile/sheet pile
pile toe ring bits	a steel ring with cutting bits attached to the toe of a steel tubular pile, used for rotary Press-in with cutting bits
pile top	top edge of pressed-in pile/sheet pile
planned installation line	planned line for pile/sheet pile installation specified in construction plan
hollow bored piling method (pile installation method by inner excavation)	pile formed with a pile casing and installed with simultaneous excavation or displacement of soil inside the casing

Young Members Column

Chen Wang
Assistant Professor, Tongji University

I am an assistant professor at Tongji University and I spent two years studying in Case Western Reserve University as a visiting student and got Ph.D. degree in Tongji University in 2019. I also serve as an active reviewer for several journals including Geotechnical Testing Journal and Marine Georesources & Geotechnology. I was first enrolled as a student member when the First International Conference on Press-in Engineering was held in Kochi and registered as an IPA individual member since I become a young faculty at Tongji University. I am horned that I won ICPE Best Presentation Award. The conference (ICPE 2018) is impressive and well-organized, and it is a good chance for me to communicate with researchers in different areas.

Dr. Wang was presenting in ICPE 2018

My research focuses on bridge scour, which has been identified as one of the leading causes of bridge failures. Scour hole has a great influence on the behavior of foundations, e.g. the resistance to lateral loads. Efforts in this area can be mainly divided into two categories, i.e., driven by science or engineering. The former aims to find the mechanism of scour process from an academic perspective, while the latter is important to provide guidance for practice. Although a plenty of academic achievements are accomplished every year, the relationship between bridge scour and these factors are still hard to be unveiled comprehensively due to the complexity involved. Recently, advanced construction and design techniques has provided by the rapid progress of bridge engineering and offshore engineering allows engineers to design and construct emerging structures under complex environmental conditions. It is a great challenge but also an opportunity. As a traditional discipline, civil engineering almost witnessed every step forward in our society. Nowadays, new techniques and strategies develop fast, and it is already a trend to carry out interdisciplinary research. We need to pay more attention to cooperation and communications between disciplines. It would be better if our association can provide more opportunities for young people to learn from the senior people, cooperate with peers and establish their careers.

Nur Khaliesah Arif
3rd year student, Universiti Tun Hussein Onn Malaysia (UTHM)

I am Nur Khaliesah Arif, a 3rd year Civil Engineering students from Universiti Tun Hussein Onn Malaysia (UTHM), Malaysia. I first learned about International Press-in Association (IPA) during the Steel Sheet-Pile Symposium organised at my university on December 6, 2018. Noticing my interest, my lecturer suggested that I contribute to the association by writing an article to this Newsletter.

Civil engineering has always been my main passion as I thrive in critical thinking. Coming upon the IPA Newsletter is like discovering a treasure trove as it is filled with abundant knowledge regarding the engineering field. Starting from its first publication on September 2016, it has maintained its quality content on research, shared experiences and discussions. It is also easily accessible from its website which serves as a helpful reference for many engineering students. IPA has proved to be a paragon that has solved many emerging engineering issues. In fact, I look forward to having my own research paper published within the Newsletter when given the opportunity.

As mentioned by the Malaysian Investment and Corridor Development Committee chairman (2018), Malaysia is in need of more engineering expertise to solve specific problems relating to public transportation, natural disasters, agriculture and other matters without relying on professionals from other fields. I believe that civil engineering is a fundamental component of a country's strength towards a nation's development. I hope, with the help of IPA, civil engineer students in Malaysia will be able to expand their knowledge and skills towards the betterment of our country by, as a start, getting first involved in their many events.

(Ms. Arif is the first one from the left)

Report

The 3rd IPA Board of Directors Meeting

The 3rd Board of Directors Meeting was held on Thursday 4 July 2019 at IPA Headquarters in Tokyo, with the attendance of 20 Board Members, including three newly elected Board Members from Brazil, Philippines and Tunisia, and a newly elected Auditor from China.

Prior to the Board meeting, the meetings of five Standing Committees were held. The key agenda of the Board meeting included the election of vice-presidents, the nomination of Chair and Co-chair of the standing committees, the establishment of new Technical Committee and the preparation of 2nd International Conference on Press-in Technology to be held in 2021.

The Vice Presidents and the Chair and Co-chair of the Standing Committees for the year of 2019 are as follows:

Vice President: Prof. D. White (UK), Prof. C.F. Leung (Singapore), Dr. A. Yusoff (Malaysia) and Prof. Y. Matsumoto (Japan)

Chair and Co-chair of Standing Committee:

Research Committee: Prof. Y. Kikuchi (Chair, Japan), Dr. S. Haigh (Co-chair, UK), Prof. K. Gavin (Co-chair, The Netherlands)
Award Committee: Dr. M. Terashi (Chair, Japan), Dr. A. McNamara (Co-chair, UK), Prof. Zhang (Co-chair, Hong Kong)
Publicity Committee: Prof. T. Uchimura (Chair, Japan), Prof. M. Doubrovsky (Co-chair, Ukraine), Prof. D. Tung (Co-chair, Viet Num)
Development Committee: Prof. J. Takemura (Chair, Japan), Mr. Y. Ishihara (Co-chair, Japan)
Administration Committee: Prof. O. Kusakabe (Chair, Japan), Mr. K. Ishii (Co-chair, Japan)

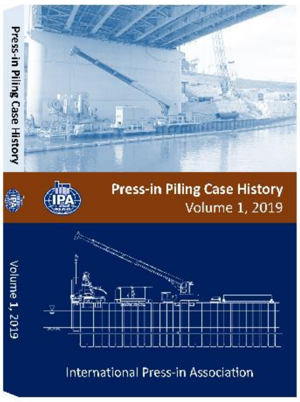
The new Technical Committee (TC4 on Vertical performance and construction management of sheet piles installed by Rotary Cutting Press-in Method) was established for three years term (2019 - 2012), and Dr. S. Haigh (Cambridge University) was nominated for the Committee Chair.

Discussions were also made on the following issues: the operation of IPA regional offices, Award program, the planning of 2nd ICPE, the plans of IPA seminars in the fiscal year of 2019 and the issues to be revised in Constitutions & By laws. The next Board meeting is planned to be held in June 2020.

In the following day, IPA provided the newly elected Board Members either a site visit at a construction site in Tokyo or a one-day visit to GIKEN LTD. in Kochi.

Announcements

Press-in Piling Case History Volume, 2019



"Press-in Piling Case History Volume, 2019" edited by IPA research Committee was published in June, 2019. This is the first book to compile the case histories for Press-in Method. The case history volume 1 includes a total of 28 case histories in following countries and 6 categories.

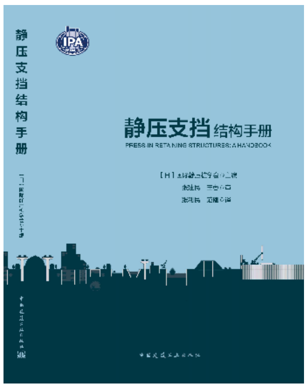
Countries: Singapore, UK, Thailand, USA, China, France, Japan
Categories: Buildings, Roads, Railways, Rivers, Harbours & Coasts, Miscellaneous

This volume gives useful information on the applications of the Press-in Technology to foundation engineers and designers. It is also handy for clients especially for not familiar with the Press-in Method.

The Press-in Technology has been transferred to 38 countries and IPA Research will continue gathering the case histories to publish the next volume. For details of this volume, please see the following URL.

URL: https://www.press-in.org/en/publication/index/1

静压支挡结构手册（Press-in retaining structures: a handbook）



Chinese version of Press-in retaining structures: a handbook based on English Version will be published in September 2019 by China Architecture and Building Press (CABP). The translation of English Handbook into Chinese was completed by the team of the Hong Kong University of Science and Technology (HKUST) led by IPA Director, Prof. Li-min Zhang. IPA also received support from Prof. Jian-min Zhang and Dr. Rui Wang from National Tsing Hua University on for reviewing the manuscript.

This Handbook brings together essential and useful information related to design and construction practices of retaining structures by Press-in Method. The handbook also includes ample application examples of retaining structure construction projects in various parts of the world. This handbook is the first book to introduce the Press-in Method in Chinese and will be of interest to civil and geotechnical engineers with little or no experience of the Press-in Method. The target readers for this handbook are not only clients, engineers and designers but all practitioners on the field.

IPA received strong support from IPA's corporate members SHANGHAI TUNNEL ENGINEERING CO., LTD. to promote this handbook. IPA will make some lectures related to Press-in Method at 4th International Forum on Urban Flood Control and Drainage Capacity (IFUFC) 2019 which will be held on 14-15 November, 2019 in Guangzhou, China. IFUFC 2019 is organized by Chinese Institute of Civil Hydraulic and Engineering (CICHE), China Civil Engineering Society (CCES), Chinese Hydraulic Engineering Society (CHES), and IPA is one of the co-organizers.

For more details about IFUFC 2019, please see the official website: http://www.ifufc.com/

Event Diary

Title	Date	Venue
■ IPA Events https://www.press-in.org/en/event		
11th IPA Press-in Seminar 2019 in Tokyo	September 18, 2019	Tokyo, Japan
International Society for Soil Mechanics and Geotechnical Engineering http://www.issmge.org/events		
International Conference on Landslides and Slope Stability	September 25-27, 2019	Denpasar, Indonesia
3rd International Conference on Information Technology in Geo-Engineering (3rd ICITG2019)	September 29 - October 2, 2019	Guimaraes, Portugal
17th African Regional Conference on Soil Mechanics and Geotechnical Engineering	October 7-9, 2019	Cape Town, South Africa
The 4th International Conference on Geotechnics for Sustainable Infrastructure Development	November 11-12, 2019	Hanoi, Vietnam
International Conference on Case Histories and Soil Properties	December 5-6, 2019	Singapore
■ Deep Foundations Institute http://www.dfi.org/dfievents.asp		
44th Annual Conference on Deep Foundations	October 15-18, 2019	Chicago, United States
9th International Conference on Deep Foundation Technologies for Infrastructure Development in India	November 14-16, 2019	Hyderabad, India
■ Construction Machinery Events		
UK Construction Week https://www.ukconstructionweek.com/	October 8-10, 2019	Marston Green, United Kingdom
Construction Equipment Forum Mannheim 2019 https://www.constructionforum.eu/#basics	November 26-27, 2019	Mannheim, Germany
Committee for European Construction Equipment Summit 2019 https://www.cece.eu/summit	October 16-17, 2019	Brussels, Kingdom of Belgium
■ International Geosynthetics Society http://www.geosyntheticssociety.org/calendar/		
Geo-Structural Aspects of Pavements, Railways, and Airfields Conference (GAP 2019)	November 4-7, 2019	Colorado Springs, United States
■ Others		
The 4th International Forum on Urban Flood Control and Drainage Capacity	November 14-15. 2019	Guangzhou, China

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IPA News Letter

Volume 4, Issue 2 June 2019

Editorial Remarks

Presented Volume 4, No.3 issue contains a lot of interesting materials presented by both experienced well-known specialists and young perspective researchers. As usual, it is published according to the schedule.

Solid messages are presented by IPA director Lei Yang (China) and new Director Marcos Massao Futai (Brazil). The last fact demonstrates extension of Press-In Method to new continent.

The Special Contributions are presented by Dr. Kiyoshi Yamashita (Japan) who has considered behavior of "Pile raft foundation combined with deep mixing wall grid" and by Prof. Boo Hyun Nam (USA), he investigated the problem "Detection and Geotechnical Characterization of Sinkhole: Central Florida Case Study". Both contributions show wide possibilities of press-in technologies and their effectiveness.

Series Report devoted to the "Mitigation of Sinkholes with Press-in Piles" came to this issue from the GIKEN America (Mr. Takefumi Takuma). It also illustrates intensive activity of GIKEN America Corp. at this interesting market. On-site Interview on practical aspects of Press-In Method application was provided by Ms. Hongjuan He and Mr. Yuta Kitano from IPA.

The new content titled "Young Members Column" was written for this issue by Assistant Professor Chen Wang (Tongji University) and by Nur Khaliesah Arif (student, University Tun Hussein Onn Malaysia).

Finally, considered issue includes information about the latest IPA Board Meeting (it took place on 4th of July 2019 in Tokyo); its main decisions are described.

Doubrovsky Michael