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News Letter

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Editorial Board

Message
From the Director

Masayuki Koda
Director of Railway Technical Research Institute

I am delighted to be able to post my message in the IPA newsletter. I have been the Director of IPA for four years from 2017 to today. This article introduces some technical issues on railway structures in Japan, and explains an example of R&D related to the Press-in Technology. Finally, I would like to conclude the end of article by my expectations for the International Press-in Association.

The Kumamoto Earthquake in April 2016, heavy rains in July 2018, heavy rains and storms by Typhoon No.19 in 2019 caused great damage to railways and railway structures in Japan, interfered with the railway operation. On the other hand, in urban areas, improvement work of subway stations for the purpose of improving convenience and large-scale improvement work of railway terminal stations for the purpose of anti-aging measures are increasing. In addition, the Shinkansen, a new high-speed railway, is steadily going to extend to Sapporo in Hokkaido, Tsuruga in Hokuriku, and Nagasaki in Kyushu. In this way, the technical issues on railway structures in Japan range from the construction of new railway structures and the improvement of existing structures to disaster countermeasures.

In the following, as an example of R&D of Railway Technical Research Institute related to the Press-in Technology, I introduce "Sheet Pile Reinforcement Method for existing railway structure foundations" that contributes to disaster countermeasures. Sheet Pile Reinforcement Method is a seismic reinforcing technology for existing foundations. Sheet Pile Reinforcement Method is a method in which steel sheet piles are placed around the existing foundation, and steel sheet piles and the existing footing are connected. The steel sheet pile does not necessarily have to reach a bearing layer, and its embedded length is basically the same as the footing width. Currently, it is used as a seismic reinforcing method for road structure foundations and as a scouring countermeasure for railway river bridges. It is one of the research results that are attracting attention these days when the safety of railway river bridges during floods is required.

Press-in Technology is a technical field related to geotechnical engineering and mechanical engineering, and until about 10 years ago, has been a field that only some research institutes and universities that have been interested in so far have been working on. However, with the improvement of noise and vibration during Press-in and the development of the Press-in Technology, the technical field has come to be widely dealt with. This field is a technical field with further development potential. I believe that the development of the International Press-in Association, as a place for geotechnical researchers and engineers to collaborate with mechanical engineering researchers and engineers, will lead to the progress of Press-in Engineering.

◆ A brief CV of Dr. Masayuki Koda

He has worked on R&D for foundation engineering of railway structures, and for geotechnical engineering. He is a code writer for the series of Design Standard for Railway Structures in Japan. He is also one of the developers of the newly foundation with multiple sheet piles, 'Sheet Pile Foundation, and Sheet Pile Reinforced Structure Method for existing foundations'.

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Special Contribution

Subsurface cavities and road cave-ins

Reiko Kuwano

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1. Introduction

Sinkholes and ground cave-ins are usually initiated by the formation of cavities in the ground. When a cavity forms for some reason, and grows/expands by the instability of the cavity ceiling, it may result in the surface collapse. In many ground cave-in cases, it looks as if the collapse occurs all of sudden. It is difficult to catch a sign of the collapse in advance. But, of course, it takes some time for the process from the original cavity to the final surface collapse, as shown in Fig. 1.

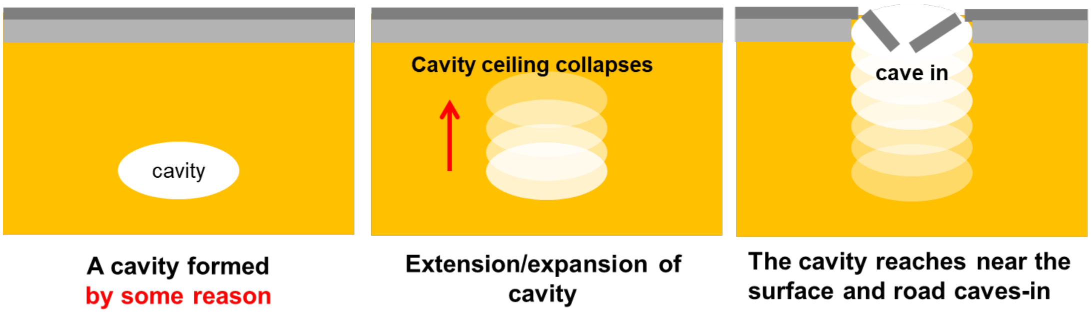


Fig. 1. process of cavity expansion and ground cave-in

In the ground, countless cavities of various causes, sizes and depths exist. Some of them may be on the edge of collapse. But without visible sign such as ground settlement, a cave-in would occur in a very short moment. This makes the countermeasure for the ground cave-in more difficult.

2. Road cave-ins in urban area

The cause of underground cavities can be roughly categorised into two. One is naturally formed cavities such as a cave eroded in calcareous ground. The other major factor is old deteriorated buried infrastructure in urban cities. Especially there is a clear correlation between the aging of sewer pipes and the occurrence of road cave-in. The number of road cave-in due to the failure of sewer pipes starts to increase when the age of sewer pipes exceeds 30 years, as indicated in Fig. 2. However, it is not always easy to identify the cause of road cave-in. In fact, about one third of urban road cave-in cases are due to unknown reasons, as shown in Fig. 3.

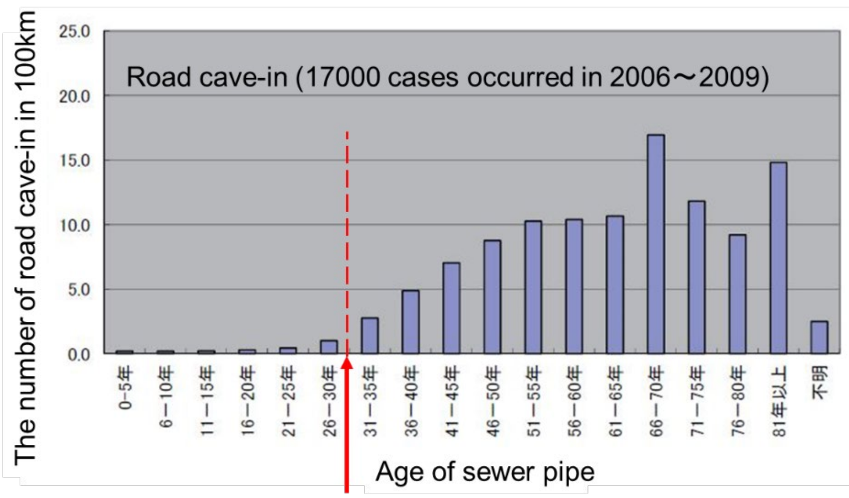


Fig. 2. Relationship between age of sewer pipe and frequency of road cave-in (after Yokota et al, 2012)

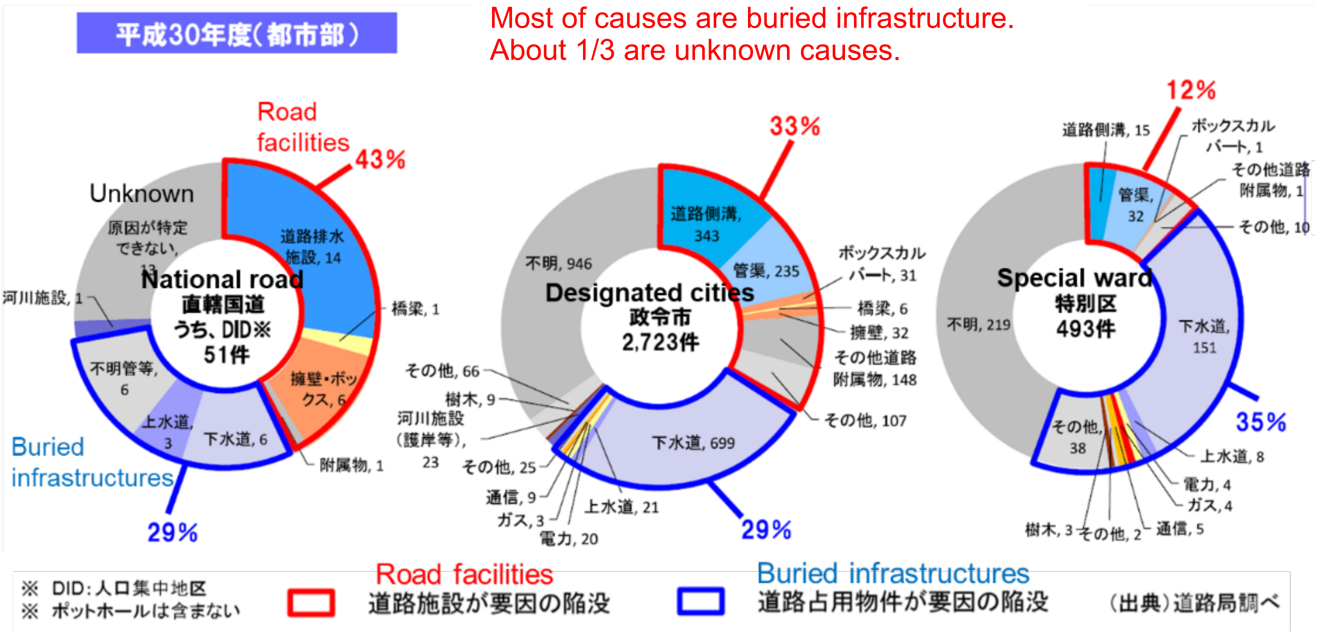


Fig. 3. The number of road cave-ins in urban area and their causes in 2018 (from MILT website)

When the sewer pipe is damaged, the soil with groundwater above the broken point flows into the pipe and a cavity forms in the ground. Fig. 4 schematically shows the process of cavity formation and expansion in the case of leakage of unbound soil through a hole. Using the soil chamber having an opening in the base, this phenomenon was simulated in a series of model tests. Even though a hole is small, if the leakage of soil continues, a cavity can grow and expand. It is only the last moment that the deformation on the ground surface is recognized. Change of water level, or high water level are one of main factors for cavity expansion.

Soil below the ground water level flows with water through the hole. A cavity can expand.

Ceiling of the cavity reaches near the ground surface.

Collapse of the soil above the cavity

Fig. 4. Process of cavity formation/expansion

According to the survey conducted by Kuwano et al. (2010) in seven cities enquiring the relationship between the state of sewer pipe and road cave-in situation, following facts were revealed.

- Although the life time for sewer pipes is considered to be 50 years, the damage and failure of underground pipes causing cave-in's in the road distinctively increase after 30 years from the construction.
- Even small gaps or cracks of pipes could lead to road cave-ins.
- Rainfall appears to be one of the most important factors.

The size of subsurface cavities caused by damaged buried pipes is generally small and the location is shallow. The shallow subsurface cavities of less than 1.5m deep from the surface can be detected using the ground penetrating radar (GPR) technique. The road managers regularly carry out the GPR surveys as the road maintenance operation. The frequency of the subsurface cavities (the number of cavities found in the road of 1km) is shown in Table 1. The depth of cavity ceiling is typically just under the pavement, 0.3 to 0.6m deep. The thickness of cavity is less than 0.6m for the most cases.

Table 1. Frequency of cavity generation in roads

Administrative area	The number of subsurface cavities in unit length of road (/km)
National, prefectural	0.59
Tokyo, designated city	2.06
Tokyo 23 ward	2.09
Other municipality	1.37

From the data Geo Search Co. investigated in 2014 and 2015
(road length: 10,091km, the number of cavities: 9984)

Factors of the cavity formation and expansion are shown in Fig. 5. The contribution of each parameter for pre-existing factors was estimated from the actual data for the distribution of subsurface cavities in Fukuoka and Fujisawa city respectively. Then, cavity potential, the likeliness of cavity formation, was evaluated and presented as a cavity potential map, as shown in Fig. 6. For both Fukuoka and Fujisawa cities, one of the most important factors in the cavity potential was found to be the age of sewer pipes.

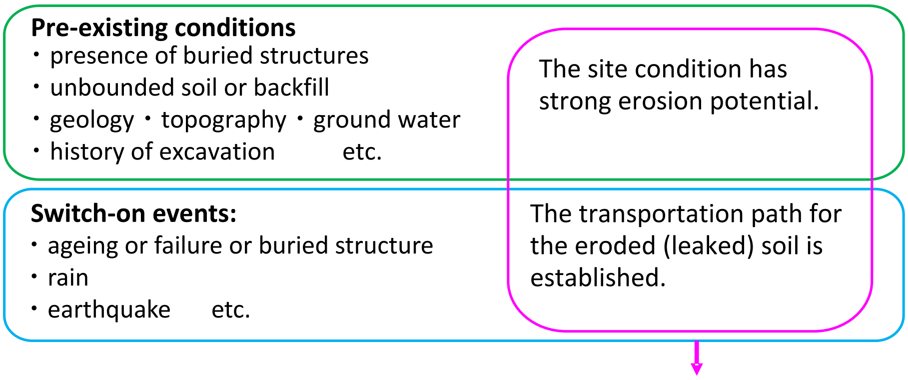
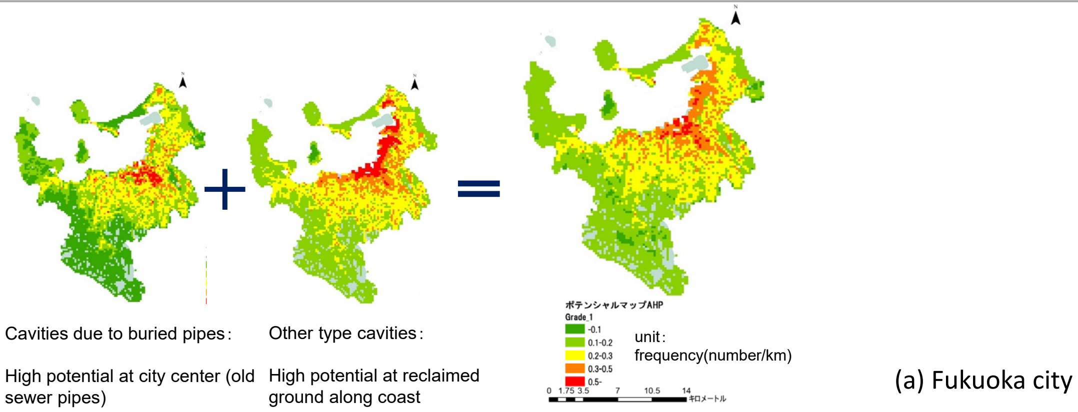
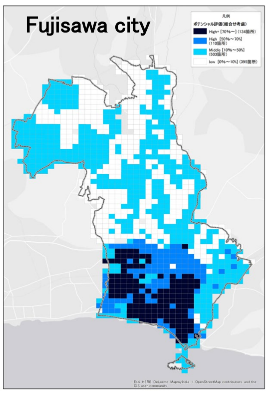


Fig. 5. Factors of cavity formation/expansion





4 major factors
・confluent type sewerage
・connections of branch pipes
・sandy soil
・shallow ground water level

potential	factors	Frequency (/km) Cave-in	Cavity
High+	More than 3	1.2	4.6
High	Sewerage・Sand	0.7	2.4
Middle	Other than above	0.4	0.4
Low	None	0.1	0.3

(b) Fujisawa city

Fig. 6. Cavity potential map

The most important factor of the trigger for the cavity expansion is rainfall. In fact, the number of road cave-in reported in the newspaper increased in June, July and August, when there are a lot of rain in Japan, as shown in Fig. 7. Earthquake is another major factor for the cavity expansion. According to the survey analysis before and after Niigata-ken Chuetsu earthquake (2007), Great east Japan earthquake (2011), and Kumamoto earthquake (2016), it is revealed that the number of cavities increased at the locations where the seismic intensity exceeded 5 (Fig. 8).

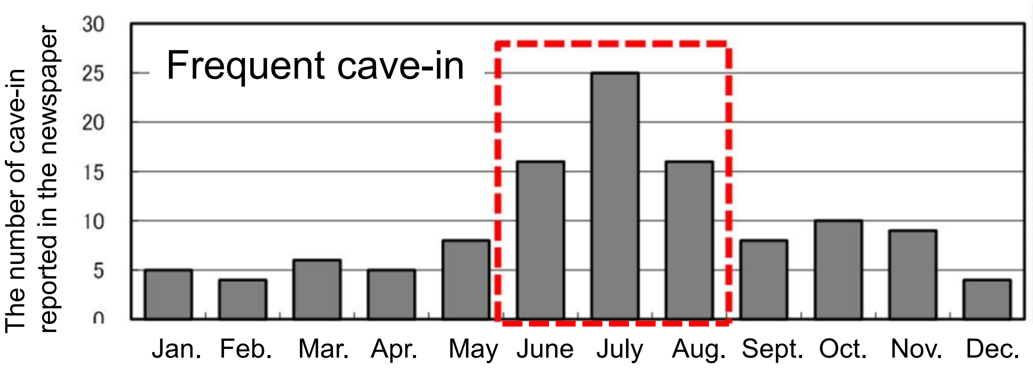


Fig. 7. The number of road cave-in in Japan reported in the newspaper (1988-2006)

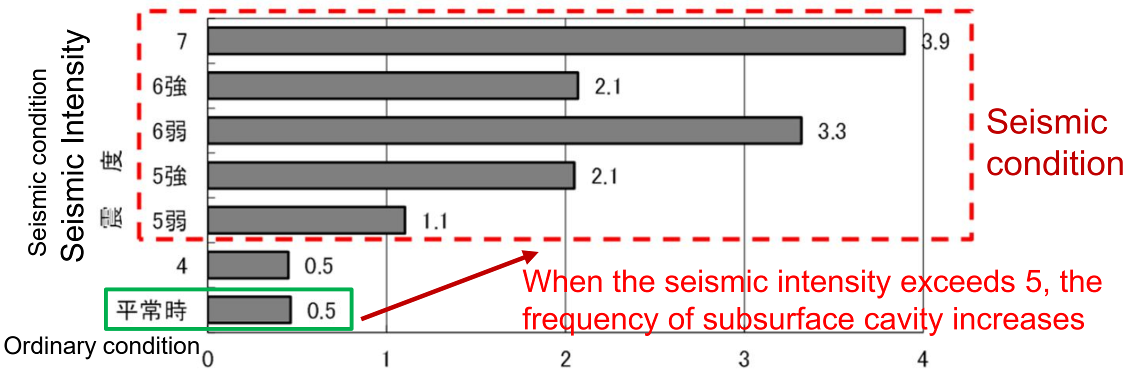


Fig. 8. Frequency of underground cavities according to seismic intensity due to Niigata-ken Chuetsu earthquake

3. Evaluation of collapsing risk

From the practical point of view, the risk evaluation of road cave-in is quite important. Fig. 9 shows the process of cavity formation, expansion and surface collapse observed in the model test. Soil with water drained from the opening in the center of base plate in a soil chamber and the vertically elongated chimney-like cavity was initially formed. When the water was supplied again, the soil below the water level flown out and the width of the cavity became larger. The soil above the cavity was kept stable by the apparent cohesion in unsaturated sand and arching action while the depth/width of cavity was large enough. When it becomes less than the threshold value (0.2-0.3), the soil above the cavity lost the stability and collapsed into the cavity. In Fig. 9, the plot of cavity depth versus cavity width moved rightward as the cavity expand, and finally reached on the line that the inclination was -0.2 to -0.3 just before the collapse. It means that wet uniform sand above a cavity collapses due to its self-weight, when the ratio of depth and cavity width becomes below 0.2 to 0.3.

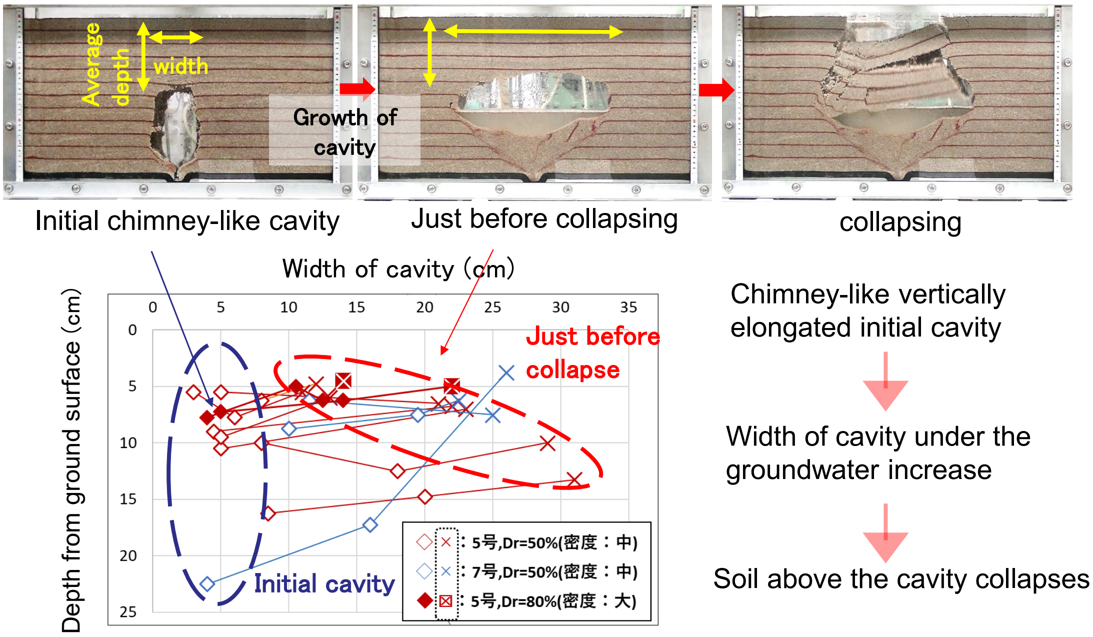


Fig. 9. Process of cavity formation, expansion and surface collapse

Using the data of subsurface cavities and road cave-ins in national road, the depths of cavities are plotted against the widths of cavities in Fig. 10. Most collapsed cases are found to be the area that the depth/width is less than 0.2 to 0.3. It can be stated that the phenomenon observed in a series of model tests can be extended to the practice. The threshold value of collapse can be dependent on properties of pavement, ground condition, water level and so on. Further investigation is needed on this issue.

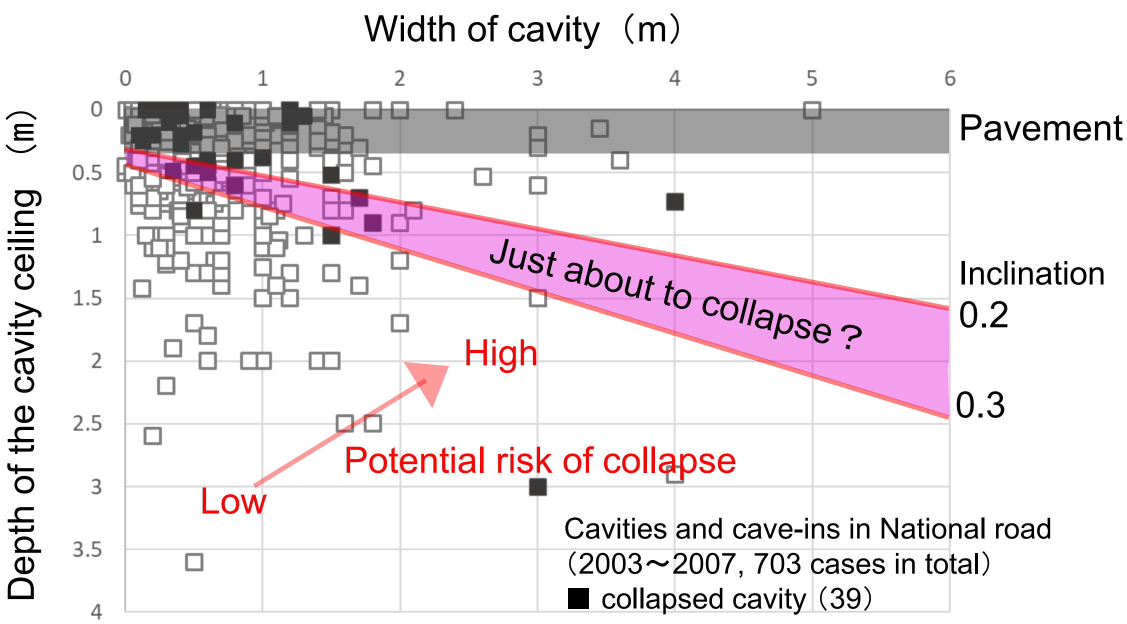


Fig. 10. Cases of real cavities and collapses in national road

In practice, the growth rate of cavity, how fast the point moves from lower left to upper right in Fig. 10, is also important. In the model tests, in the particular condition, the rate of cavity growth is observed to be very fast. In the monitoring survey of subsurface cavities in Fujisawa city, there is the case that a deep small cavity due to the failure of the sewer pipe moved up to shallow ground within a couple of months. On the other hand, most of the cavities in national roads are reported to be stable in several years. The growth rate observed for the cavities in national roads are shown in Fig.11. We should further collect this type of data from the monitoring practice to analyse the growth rate of cavities.

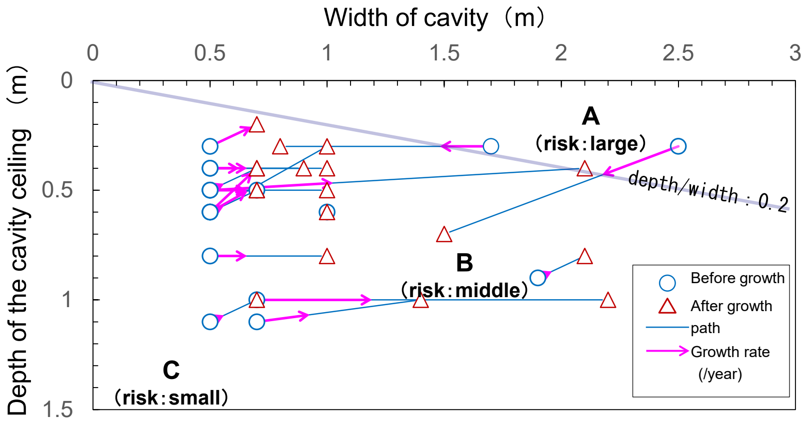


Fig. 11. Growth rate of 19 subsurface cavities monitored in national roads detected in 2012-2016

4. Repairment of subsurface cavity

The detected cavities by the ground penetrating radar technique should be appropriately repaired according to their potential risk of collapse. Generally, a cavity is filled by the open-cut method. Recently the injection of air mortar into a cavity is also applied. If the potential risk of collapse is low, it is possible to keep monitoring the cavity. It is preferable to accumulate and utilize the cavity data to update the knowledge and share the experience among infrastructure managers and engineers.

5. For road policy quality improvement

Current standard practice against a subsurface cavity is “finding a cavity and backfilling it by open excavation before its collapse”. It works well and contributes to the mitigation of cave-in accidents. For more rational and effective measures, following are considered important; appropriate survey planning considering regional trend and cavity formation potential, the evaluation of collapsing risk for a cavity, and choice of repairing methods according to cavity properties.

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◆ A brief CV of Prof. Reiko Kuwano

Reiko Kuwano is a professor of Institute of Industrial Science, the University of Tokyo, Japan. She graduated from the University of Tokyo, Japan, in 1988, with a Master degree in Civil Engineering. After practical work experience as an engineer in Taisei Corporation for five years, she obtained a PhD degree at Imperial College, London in 1999. Then she worked at Public Work Research Institute as a senior researcher before she moved to the University of Tokyo in 2006. Her major interest includes laboratory soil testing, mechanical behaviour of soil, internal erosion, subsurface cavity and ground cave-in, long-term behaviour of buried/earth structure, and so on.

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Director's research and development activities

Peat Fire and Muar Living Laboratory Initiative

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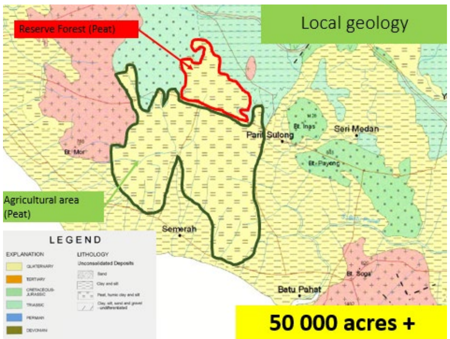
Early this year, Universiti Tun Hussein Onn, Malaysia (UTHM) reached an agreement with The Muar District in materializing the concept of 'UTHM@Muar Living Laboratory'. In general, a living laboratory is a research concept, defined as user-centered, operating in a territorial context, integrating concurrent research and innovation processes within a public-private-people partnership. Several joint research and innovations had been successfully initiated. In addition, the city had been awarded The ASEAN Clean Tourist City Standard (ACTCS) (2018-2020). Incidences of peat fire at the Ayer Hitam peatland is one of the prime concerns of the city causing significant carbon emissions and economic loss. This short article will highlight some of our latest R&D efforts concerning this initiative.

The 'peat initiative' is the extension of Muar's clean city agenda to create awareness on environmental issues, reduce emissions, and promote sustainable development. The Ayer Hitam, Muar peat land comprises more than 50 000 acres. Apart from this area, the largest virgin peat area in Johore is located at the same place. The total area of this forest is 3797 hectares and it is the last remaining peat swamp forest in the state of Johore. This peatland is a fragile yet unique ecosystem that plays a crucial role in stabilizing the ecosystem, regulating water, soil formation, and most importantly as carbon storage and sequestration. The Ayer Hitam peatland is also home to unique flora and fauna such as the endangered endemic Betta persephone. In response to the city's needs, UTHM established The Regional Peat Fire Research Station for peat fire management.



(a) Peat area at the reserve forest and agricultural area

(b) Forest-village boundary at Ayer Hitam, Muar District

(c) Peat fire issues

(d) Structural integrity issues on peat

Fig. 1. Peatland at Ayer Hitam, Muar and related issues

Based on the engineering perspective, peatland normally triggered several engineering problems such as a peat fire, structural crack, undulating road surface, interruption into a pipeline, high acidic water source, and many more (Fig. 1).

Smoke from burning peat can reduce air quality, particularly within 1km of the fire, as the smoke contains fine particles, water vapor, gases including carbon monoxide, carbon dioxide, and nitrogen oxides. It may also contain sulfur compounds which are odorous. From an economic perspective, peat fire may disrupt the agricultural land, affecting the farmer's revenue, damaging the crops, and incurring additional management costs for the local authority. Several research clusters had been initiated thru the initiatives as listed below.

1. Initial geotechnical and geological survey at Ayer Hitam Utara Reserve Forest, Muar, Johore (Fig. 2)

Our research team is working closely with Johore State Forestry Department, Muar Municipal Council, Muar District Office, and other local partners in protecting the forest. The research team is actively involved in several expeditions and activities. Since 2019, relevant data were collected in order to understand the probability of peat fire at a certain designated area (Maznan Ismon, 2021).

(a) A group of researchers at the peat forest

(b) Visual inspection of peat slope

Fig. 2. Initial geotechnical and geological survey at the peat forest

2. Structural assessment on a building (Fig. 3)

Peat, in its natural state, is considered unsuitable soil for supporting building foundations. It is mainly due to the presence of high organic matter, high moisture content, high compressibility, and low shear strength. In addition, vibration may cause damage or reduce the serviceability of a building (Tuan Norhayati *et al.,* 2021). This study focuses on an existing building in Muar District with the aim of assessing the vibration response of the building and whether the vibration is within the vibration limits as determined by the Department of Environment. A Finite Element Modelling is produced to simulate the building's displacement and deformation under natural frequency and a series of tests consisting of walking test and heel-drop test was performed on-site to obtain the vibration response of the building in terms of acceleration, velocity and frequency (Nursyahirah (2021); Yeoh (2021).

(a) Ultrasonic sounding equipment

(b) Structural health assessment on building

Fig. 3. Structural health assessment at Ayer Hitam, Muar

3. Geotechnical assessment on structure (Fig. 4)

Bridges are essential components of road networks and reflect an important investment in the resources of most countries around the world. This study is initiated in order to determine the condition rating of the bridge structure in Malaysia where it focuses on the bridges in Ayer Hitam, Muar. The aim of this study is to assess the structural condition of the bridge and describe defects observed in bridge members. The assessment was carried out based on the method practiced by the Road Engineering Association of Malaysia (REAM). The bridge condition rating was presented in assessment form where both quantitative and qualitative methods visualized the performance of this study. The quantitative approach is where bridge parameter data is obtained, while the qualitative method when the data is processed and rated all bridges. In general, the bridge approach was found as the most common defect in most bridges compared to the other components (Ahmed Abdi, 2021).

(a) Bridge assessment at Ayer Hitam, Muar

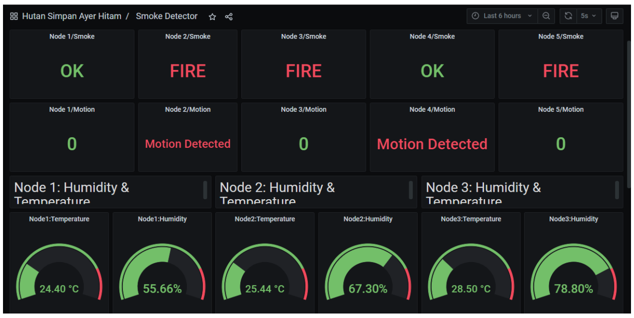
(b) Assessment of a peat settlement

Fig. 4. Structural and visual assessment

4. Development of peat fire monitoring system (Fig. 5)

The prototype kit developed in this research project successfully works to detect smoke, motion, measure temperature, and humidity readings that meet the study's objective in detecting early peat forest fires using automation features equipped in the system. The test results show the presence of smoke and objects under good supervision because it is proven that the prototype kit can send notification messages to the users through Telegram applications. At the same time, data readings from the sensors can be displayed on the GUI in real-time. Moreover, the temperature and humidity readings obtained are accurate, stable, and easy to read. Therefore, the developed system can be used as an early detection tool for peat forest fires (Anuar Hamzah *et al.,* 2021).

(a) Research presentation at the reserve forest



(b) Graphical user interface for the prototype kit using Grafana software

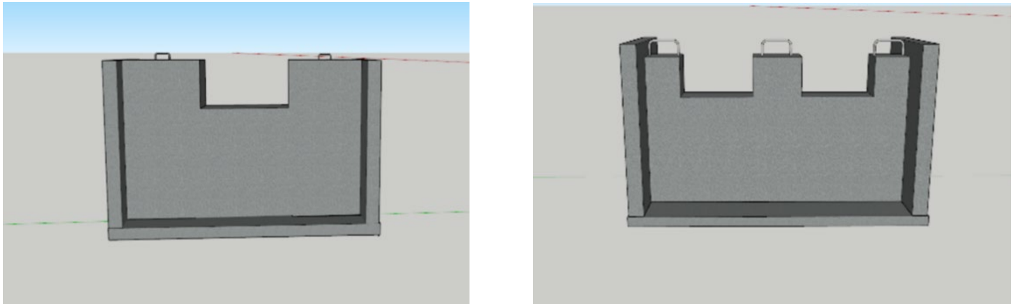
Fig. 5. Peat fire monitoring system

5. Check dam design (Fig. 6)

The most fundamental need for the conservation of degraded peatlands is to restore their hydrological functions and restore a hydrological system that is appropriate/optimal for the restoration of the ecosystem. Optimized (stabilized) water levels are important for the regeneration of peatlands to ensure that the correct conditions are generated for peatlands' ecological role and conservation of peatland biodiversity.

Usually, the use of natural peat will easily block narrower ditches with a depth of up to about 2 meters. Peat with a low water column pressure can also be effectively used for damming large ditches. The peat must be well moisturized in such a way that it is properly waterproof. However, peat dams in 2 m width ditches are likely to collapse on sloping land, and it might be appropriate to use other materials along with peat to block anything above 1 m width.

Based on the requirement of Ayer Hitam peatland, two design options had been proposed for the check dam to suit with the local situation. The first option of the check dam has one rectangular notch in the middle of the check dam while the second design option has two rectangular notches in the middle of the check dam. Both check dam options are made of reinforced concrete. A portable wooden notch could be used to control the water catchment and water flow. It is important to help the villages in the event of emergency and maintenance (Muhammad Faris, 2021).



(a) Check dam (Design 1) (b) Check dam (Design 2)

Fig. 6. Proposed check dam design for Ayer Hitam peatland (Muhammad Faris, 2021).

6. Further research and development work

Further research is in progress in studying the corrosion rate of buried steel piles at Ayer Hitam peatland. The objectives of the research are to analyze the composition of Ayer Hitam Utara peat soil and unburied metal sheet pile using several laboratories and in-situ testing. Later, the performance of metal sheet pile condition before and after embedded in Ayer Hitam peat soil and feasible approach could be drawn to reduce the corrosion effect. In general, the corrosion rate below the water table fluctuation zone decreased significantly as oxygen was depleted. The most critical zone for steel pile corrosion was typically located within the groundwater fluctuation zone. The research may enhance the applicability of steel sheet piles on peat areas. Steel sheet piles may normally be considered in trenches/canals wider than 2 meters where water flow would cease. Preliminary to the sheet piles' construction is important to ensure that the water does not flood beneath the stable earth's piles. In addition, due to the presence of high organic matter, high moisture content, high compressibility, and low shear strength in peat, the Press-in technology could be adopted for future construction. For example, by having a GRB System, Press-in machines utilize reaction force from installed piles integrated with the Earth and carry out piling work while self-moving on top of installed piles. The process will eliminate the need for temporary structure and minimize the biodiversity effect on the reserve forest. Lastly, thank you for the opportunity to share some of my research activities and hopefully, I will be able to update the progress in the future publication.

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Case-History

Steel Sheet Pile Cofferdam in China (Hubei Province)

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Hongjuan He

Secretariate, IPA

In China, since they had to rely on expensive imported steel sheet piles before, the scope of application of steel sheet piles was limited to emergency projects such as disaster recoveries. In recent years, however, Chinese domestic production and mass production of steel sheet piles have progressed, and the price of steel sheet piles has become significantly lower than that of imported products, so the scope of application of constructions using steel sheet piles has been expanding. Recently, with the increase in infrastructure development such as high-speed railways and expressways, the number of steel sheet pile cofferdam has rapidly been increasing. Under such circumstances, cases of adopting the press-in piling method are increasing, especially for projects overcoming high construction difficulties. In this article, a case of cofferdam for construction of expressway bridge piers over a river is introduced.

1. Construction Outline

1.1 Construction Location

The construction site is the highway bridge (official name: Hegu Han River Highway Bridge) over the Han River in Xiangyang City, Hubei Province, China (Fig. 1). Xiangyang is a prefecture-level city located in the northwestern part of Hubei Province, China, and is the second largest city in Hubei Province. As shown in Fig. 2, the cofferdam by the press-in piling method was installed to construct the 23rd and 24th piers of this highway bridge.

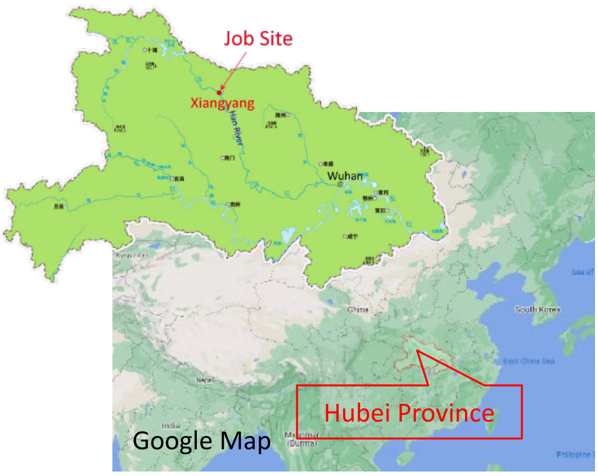


Fig. 1. Project location

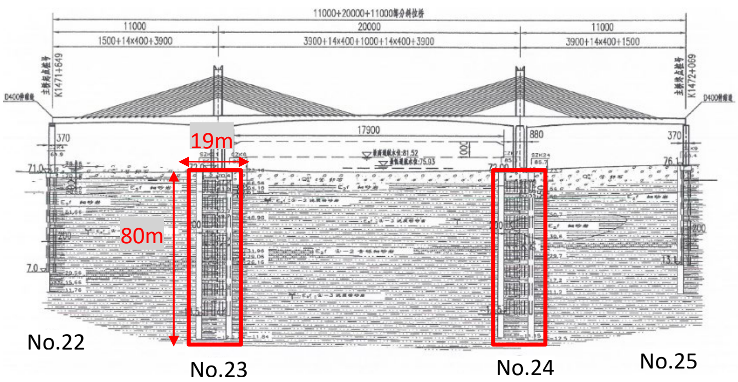


Fig. 2. Longitudinal section of the highway bridge

1.2 Background and objectives of the project

The name of this project is "G316 Hegu Han River Highway Bridge and Connection Project". G316 is an important highway in Hubei Province, which runs through Xiangyang from east to west and plays an important role in the economic development of the region. However, some sections of the G316 Highway are winding narrow routes with limited traffic capacity. To optimize the local road transportation network, Xiangyang City authorities have decided to implement this project.

Since the 23rd and 24th piers of this highway bridge were to be constructed in the river, construction of a cofferdam was a premise. Initially, in consideration of hard ground conditions, pre-drilling with an earth drill plus steel sheet pile driving by the vibratory hammer method was adopted. However, due to the fact that the ground was mixed with boulders and the ground loosened by predrilling was reconsolidated when the steel sheet pile was driven by a vibratory hammer, the construction became difficult. As a result, the design was changed to the press-in piling method with an auger that enables more reliable construction. The press-in work on the 23rd pier was carried out from December 2019 to April 2020, and the 24th pier from April to May 2020, and 182 cofferdam steel sheet piles were pressed in respectively.

2. Site condition and piling method

2.1 Site condition

At this site, there were two challenges that had to be overcome. The first was the construction period. In this project, all work was required to be completed within the dry season (December-February). The Han River, which flows through the construction site of Xiangyang City, is the largest tributary of the Yangtze River in China, and there is a danger of flooding in summer. As mentioned in 1.2, the predrilling plus vibrohammer method was initially adopted. This method required two steps, predrilling and steel sheet pile driving, which might slow down the progress of the work. On the other hand, in the press-in piling method with an auger, augering and pile installation could be performed in one process, therefore, more reliable and rapid construction was possible. The project was able to be successfully completed within the planned construction period. The second was the hard ground condition. The ground condition at the site, as shown in the borehole log in Fig. 3, was hard ground formed of cobbles and weathered siltstones. At the actual site, boulders (200 mm to 300 mm) were found as shown in Fig. 4.

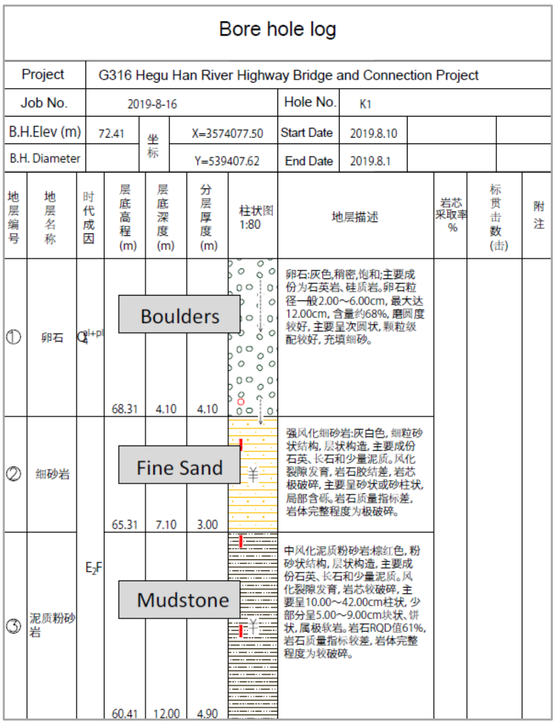


Fig. 3. Bore hole log

By using the press-in piling method with an auger, steel sheet piles were able to be installed without problems in spite of such hard ground conditions. Unfortunately, due to the spread of the new coronavirus infection in January 2020, we were compelled to close the site for two months, but in order to catch up on the construction period, we introduced two press-in piling machines, and we were able to make it (Fig. 5). Since the press-in piling machines were small and it was easy to construct with multiple units, the construction was able to be completed within the planned period, and this effect of shortening the construction period was highly evaluated by the principal contractor.

Fig. 4. Boulders found at the site

Fig. 5. Shortening of the construction period by using two press-in piling machines.

2.2 Piling method

Fig. 6 shows the view of during the construction. At this site, the press-in piling method with an auger was adopted, in which the press-in resistance was reduced and the steel sheet piles were pressed in by excavating the ground using an auger as an auxiliary construction method. As illustrated in the process of Fig. 7, the ground at the tip of steel sheet pile being pressed in was excavated by the auger to create a state where the core was hollowed out in the ground, and the steel sheet pile was pressed in while pulling out the auger. In this construction, used steel sheet piles were pressed in with the press-in piling machine F201-C600. At construction sites in China, temporary steel sheet piles are often reused, so damage or deformation of steel sheet piles due to improper construction can be a problem. The press-in piling method with an auger not only made it possible to press-in the steel sheet piles with the minimum required press-in pressure, but also it was possible to install steel sheet piles with high accuracy, thus, we were able to minimize the wear of the steel sheet piles.

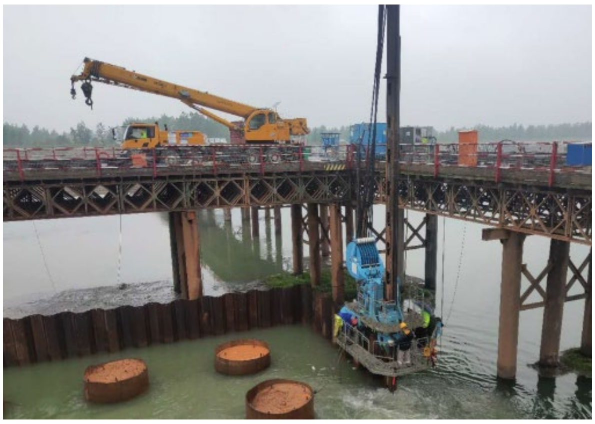
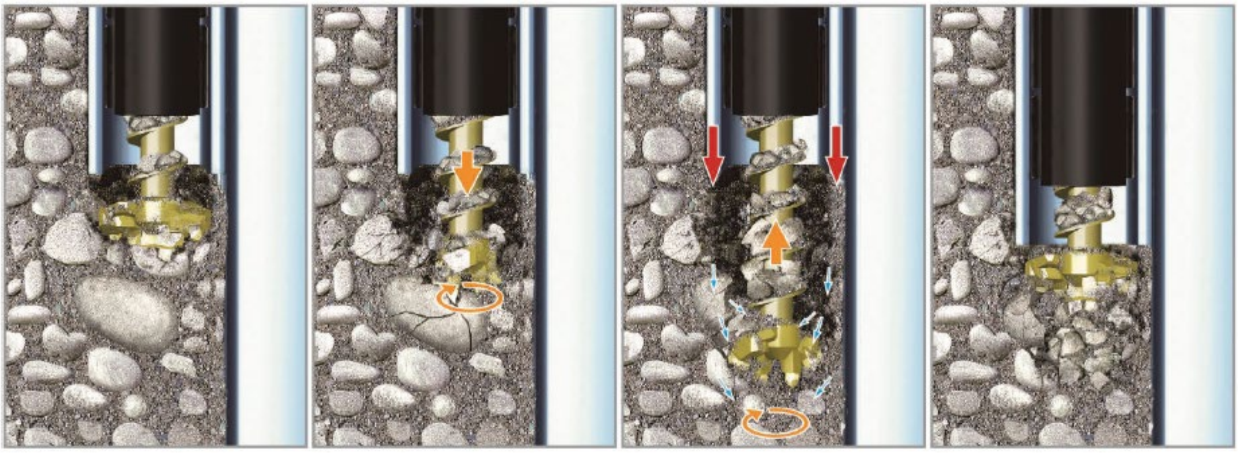


Fig. 6. A view of during construction



1. Start the operation
2. Augering at the pile toe
3. Press-in the pile while extracting the auger.
4. Repeat 1 to 3.

Fig. 7. Press-in process (extracted from the Press-in Retaining Structures: A Handbook Second Edition, 2021)

3. Concluding Remarks

In this work, we faced various problems such as the unpredictable impact of the new coronavirus and harder ground conditions than expected. But we were able to complete the construction as planned. In the future, we will continue to promote the press-in piling method so that it may be adopted not only for temporary constructions but also for permanent constructions of bridge piers. This case study was published as one of the activities of TC6 (Technical Committee on Investigation and analysis of the development status of Press-in technology in China), which is a technical committee newly established by the International Press-in Association. From now on we will continue to introduce you construction cases in China.

We would also like to take this opportunity to thank Horizon Construction Development Ltd. for providing materials and photographs for the construction of this work.

Report from USA

Geotechnical and Foundation Engineering Societies and Industry Associations in the United States (Part1)

Takefumi Takuma

GIKEN LTD., c/o Giken America Corporation

There are multiple geotechnical and foundation engineering societies/associations based in the United States. Giken America Corp. and some of its employees, including the author, have joined these societies and have been participating in some committee activities. As the first of the series articles on these societies, let us look at the Geo-Institute of American Society of Civil Engineers (G-I of ASCE) and Deep Foundations Institute (DFI).

◆ Geo-Institute of American Society of Civil Engineers (G-I of ASCE)

According to its homepage, ASCE is the oldest engineering society in the United States, founded back in 1852. This non-profit organization is headquartered at Reston, Virginia; a suburb of Washington, D.C. The current size of membership is estimated at about 170,000 from more than 170 countries worldwide although the majority of them are in North America, especially the United States.

One of its 9 Institutes (technical discipline-based groups of the members) is the Geo-Institute (G-I), which is "a specialty membership organization focused on geo-professionals and the geo-industry". The G-I was established in 1996 and is celebrating its 25th anniversary with over 13,000 current members. (https://www.asce.org/communities/institutes-and-technical-groups/geo-institute/about)

The G-I organizes and holds an annual GeoCongress Conference and other geotechnical engineering conferences, such as the GeoExtreme Conference held in Savannah, Georgia in November 2021, where the author and his colleague exhibited and presented a couple of papers. ASCE publishes the proceedings of these conferences in the name of G-I in addition to peer-reviewed the Journal of Geotechnical and Geoenvironmental Engineering and the Journal of Geomechanics. They are available online at the "ASCE Library" and also in a print format.

The bi-monthly "GeoStrata" magazine is edited and distributed by G-I for its members. See Fig. 1 for the cover of a recent issue of "GeoStrata" along with "Civil Engineering", an ASCE monthly magazine.

G-I has 20 technical committees on various aspects of foundation and geotechnical engineering such as computational geotechnics, deep foundations, earth retaining, soil improvement, unsaturated soil, and so on.

Fig. 1. Covers of Civil Engineering and GeoStrata

◆ Deep Foundations Institute (DFI)

DFI was established in 1976 as a non-profit organization; representing as "bringing together contractors, specifications writers, soils design and construction engineers, material suppliers, and equipment developers to provide a common forum for all concerned with deep foundations" (https://dfi.org/about-dfi/history/).

Headquartered at Hawthorne, New Jersey, DFI has more than 4,000 members worldwide from a wide range of the geotechnical/foundation engineering design and construction industry as originally envisioned. Geographically speaking, about two thirds of the members are in the U.S. with the balance from the rest of the world. In terms of the business sector representation, contractors, consulting engineers, suppliers, and owners make up 26%, 23%, 18%, and 5% of the membership respectively, while students and professors constitute 28% (https://dfi.org/members/). There are three types of memberships offered; corporate, student, and individual. Giken America Corp. is a corporate member.

The DFI Europe, DFI Middle East and DFI India chapters have been established and active as the chapters outside of the U.S.

DFI hosts an annual conference as well as theme-focused conferences/seminars throughout each year at various locations in North America. For example, the author and his colleagues exhibited and presented papers at the SuperPile'21 Conference in Philadelphia in June and also at the 2021 Annual Conference in Las Vegas in October.

Besides the conference proceedings and foundation engineering guidance/manuals, DFI publishes the DFI Journal which is "an international peer-reviewed publication that supports authors whose research and practice covers a broad range of subjects on deep foundation engineering and construction" (https://dfi.org/publications/). They are available online at the "DFI Publication Store". Also published is the bi-monthly "Deep Foundations" magazine distributed to its members. Fig. 2 shows the cover of its recent issue.

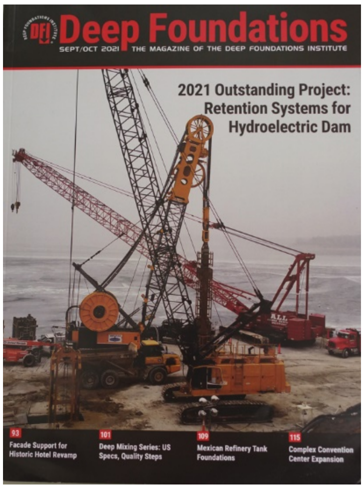


Fig. 2. Cover of Deep Foundations

DFI currently has 28 technical committees. The author and his colleagues have joined and are active in the following committees: Driven Pile, Marine Foundations, Manufacturers, Suppliers, and Service Providers, and Women in Deep Foundations. DFI is governed by a board of trustees who are elected by DFI members and run by a group of staff headed by an executive director. One of the author's colleagues at Giken America Corp. has recently been elected as a DFI trustee (Srilakshmi "Lucky" Nagarajan).

In the article in the next newsletter, the author plans to discuss the Pile Driving Contractors Association (PDCA) and the United States Society on Dams (USSD).

The author appreciates the assistance provided by Ian Vaz of Giken America Corp.

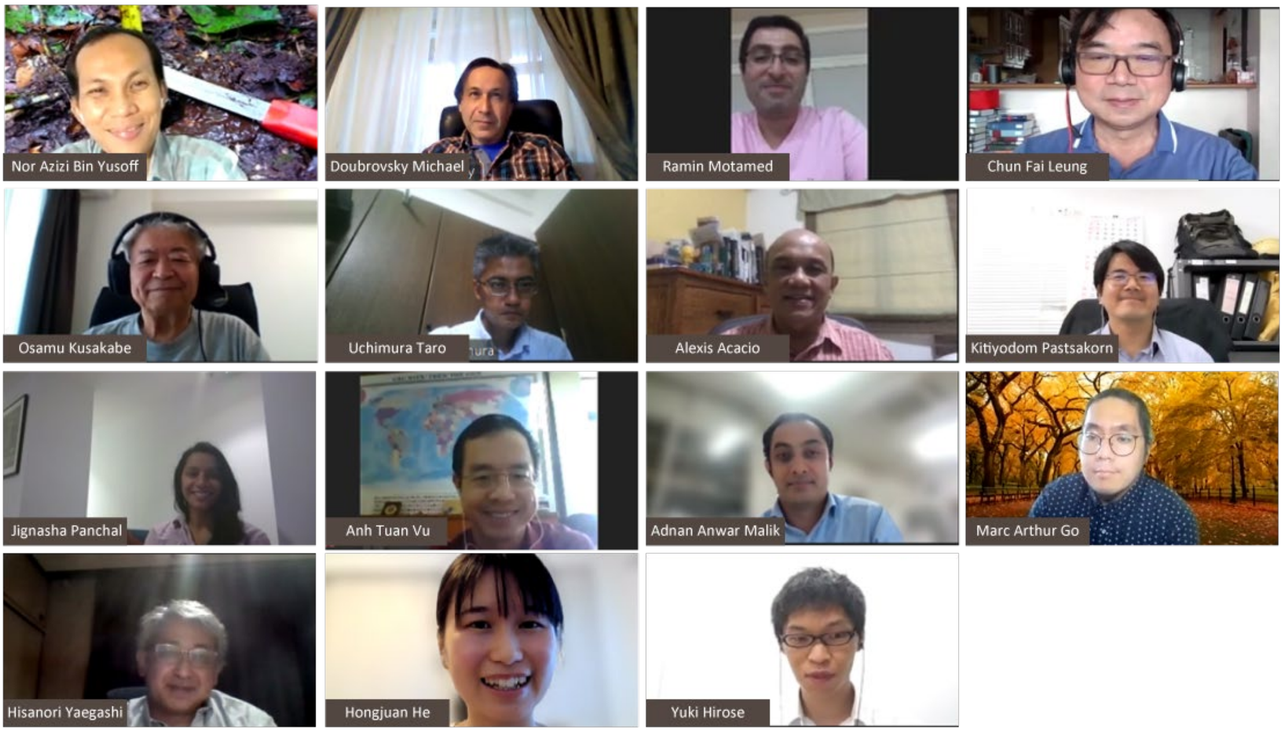
Report

IPA Newsletter Editorial Board Meeting in 2021

The Editorial Board Committee has decided to start holding regular meetings this year in order to share information and exchange ideas among the committee members. Due to the Covid-19, we could not meet in person, so the meetings were held online. It was difficult to adjust the meeting time because of the different time zones of each committee member, but thanks to the cooperation of the committee members, we were able to hold four meetings successfully, shown below.

1) At the first meeting on 18 May 2021, we shared the progress of June, September and December issue to be published in 2021 and discussed the primary contents of IPA 15th anniversary special issue to be published in March 2022.
2) At the second meeting on 5 August 2021, each chief member in charge of editing September, December and the next March issue, Prof. Acacio, Prof. Uchimura and Prof. Doubrovsky respectively, updated the progress. The member in charge of the next June issue was also decided.
3) At the third meeting on 5 October, the discussion focused on the contents of IPA 15th Anniversary special issue, adding some new contents related to "The Future Vision of Press-in Piling". This special issue will be planned to publish both in English and Japanese versions.
4) At the final meeting on 16 November. Mr. Yaegashi, Prof. Doubrovsky and Dr. Azizi updated the status of December, March as well as June issue respectively. Dr. Wang and Mr. Nozaki were nominated to be a new editorial board member and they will join the committee from January 2022.

We are currently formulating the special issue for IPA 15th Anniversary, and the June issue 2022 is being planned. We will try our best to provide much more useful information for our readers, and we look forward to working with you next year.



Group photo of Editorial Board Meeting

Young Members Column

Fahim Mashroor Bhuiyan

Ph.D. Student, Department of Civil and Environmental Engineering
University of Nevada Reno (USA)

I am Fahim Mashroor Bhuiyan, a fourth-year Ph.D. Student at the University of Nevada Reno (UNR) in the U.S., and I am from Bangladesh. At the start of my undergraduate journey at Bangladesh University of Engineering and Technology (BUET), I chose Civil Engineering as my major. In my final year at BUET, I did my undergraduate thesis on numerical analysis on the raft foundation using Plaxis. To make scrupulous analysis for my thesis, I had to acquire a thorough knowledge of soil and foundation behavior; and concurrently found my passion for geotechnical engineering. I soon realized that the mercurial, erratic, and unpredictable behavior of soil makes this subject more challenging and more fun to learn and work with.

After my graduation, I got a job in a geotechnical engineering firm in Bangladesh. During my brief work experience, I learned to implement load cell technology in static pile load tests. I worked alongside field engineers and learned a lot about implementing engineering knowledge in the geological context of my country. I started my journey at UNR in Fall 2017 under the supervision of Dr. Ramin Motamed who is one of the International Press-in Association's Directors. I started as a master's student in my first semester and helped my colleague in performing shake table experiments to study shallow foundation response due to liquefaction. In Spring 2018, I switched to the Ph.D. program and started working on my current research project. Apart from geotechnical engineering, I have got a keen interest in computer programming and numerical analysis tools. Implementing and refining my programming skills in geotechnical applications have added great flavors to the research project I'm currently working on.

The project I am working on is entitled "Lateral Analysis Guidelines for Drilled Shafts in Nevada Based on LRFD Framework". The project, which is funded by the Nevada Department of Transportation (NDOT), aims at developing a unique, economic, accurate, and validated tool to define LRFD (Load and Resistance Factor Design) based design guidelines for large diameter drilled shaft under lateral loading. Currently, I am trying to implement advanced MATLAB programming to develop a finite-difference tool, NVShaft, to improve the current methodology for numerical lateral load (p-y) analysis of large diameter drilled shafts. NVShaft can perform a more sophisticated, unified p-y analysis by considering additional side shear and tip resistance components more relevant to large diameter drilled shaft. Measured data from several field and centrifuge load tests have been used to validate the new program. Aside from unified p-y analysis, like other commercial numerical tools, NVShaft can perform axial load (t-z) analysis, lateral stability analysis, pushover analysis, and buckling analysis of shaft-column. As of date, a total of 20 lateral resistance (p-y) models have been added to the NVShaft library. Several axial side shear (t-z), end bearing (q-z), tip shear (v_b-y_b), and tip moment (m_b-θ_b) resistant models have also been included. Another important goal of our project is to provide a robust definition of shaft point-of-fixity, a parameter that is required for the structural design of bridge pier. By providing the means to perform a more realistic numerical lateral load analysis, the outcome of this research project will result in a more

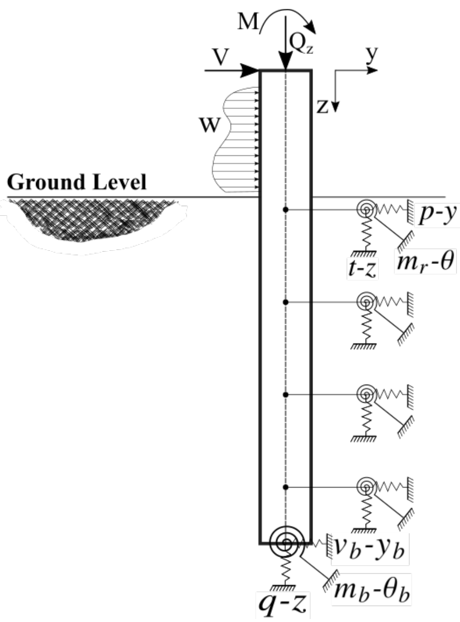


Fig. 1 Numerical Winkler's spring models of major lateral resistance components in large-diameter drilled shaft.

homogeneous design practice and acceptable lateral performance across the state. The project is expected to increase the savings in drilled shafts construction cost as well as improved safety due to more refined analysis and design to be used by foundation engineers.

Hoang Thi Lua

Lecturer, Thuyloi University (Vietnam)

I am Hoang Thi Lua from Vietnam. I am delighted to write this message for the IPA Newsletter to share about myself and my main research areas. After receiving master's degree in Geotechnical Engineering at Thuyloi University – Vietnam, in Sept. 2017, I went to Japan to start my Ph.D. journey. Among many research areas on Geotechnical engineering field, I decided to follow "pile foundation engineering" area because pile foundation is always a reliable and preferred foundation for heavy structures on various types of ground, but also a foundation type with many aspects to investigate. I started doctoral course at Kanazawa University under the supervision of Prof. Matsumoto Tatsunori – one expert in the area of piled raft foundation as well as a Director of IPA. My Ph.D. research topic, therefore, focuses on piled-raft foundations supported by displacement piles - which will be one of the economical and promising foundation solutions for the future construction industry.

In 2020, when I was the last year Ph.D student, Prof. Matsumoto introduced me about IPA. Searching from the internet, I found helpful information related to the IPA and understood how important the Press-in technologies is in the construction industry. Since that time, I registered and became "a student member" of IPA. I also got information about the ICPE 2021, and the topics of ICPE 2021 really attracted me. I decided to submit a paper to the ICPE 2021, and lucky me, my paper was accepted. Thanks to the ICPE 2021, I was kept up with new information on the area of foundations in general and displacement piles in particular. Additionally, I was awarded "The Best research paper of ICPE 2021", this such a great honor for me.

Currently, I graduated Ph.D. course and am now a young lecture at Thuyloi university. I am very interested in researching the application of Press-in technologies on the area of deep foundation in particular as well as in other areas of geotechnical engineering because I strongly believe on prospects of press-in piling in the future. IPA and ICPE are always reliable addresses for me to expand my knowledge, and I think that IPA is the ideal destination for all those interested in Press-in technologies.

Announcement

Establishment of Technical Committee (TC6): Investigation and analysis of the development status of Press-in technology in China

Technical Committee 6 on “Investigation and analysis of the development status of Press-in technology in China” (TC6 hereafter) was approved by the General Assembly in June this year and has started its activities with three years term, chaired by Prof. Xiaoduo Ou (Professor of Guangxi University), working with Prof. Chun Fai Leung, IPA President, as advisor and Mr. Guozhu Chen as Secretary. The objectives of TC6 and activity plan are as follows.

➢ Objectives

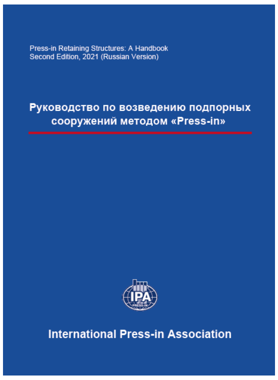
It has been 10 years since Press-in technology was introduced into China, and there are nearly 300 construction cases. However, the collection and analysis of the construction cases are not systematic. Moreover, problems in the construction and the training of mechanical operators have become one of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

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

➢ Activities Plan

Activities	Activity results (planned)
Case collection and analysis of Press-in Technology in China	・Publishing a series of case studies in the Newsletter; ・Building the database of construction cases with Press-in technology; ・Updating "Chinese version of「Press-in retaining structures: a handbook」"; ・Holding seminars in China
Investigation and solution of problems in constructions	Preparing the investigation report and the manual how to solve these construction problems

Russian Version of “Press-in Retaining Structures: A Handbook” was published



Press-in Retaining Structures: A Handbook (Second Edition, 2021) was translated into Russian and published in October 2021.

The International Press-in Association (IPA) is proceeding vigorously to translate the handbook into multiple languages in order to make it available in as many language zones as possible. The Russian version is part of this activity. The handbook is currently also being translated into Portuguese, Spanish, French, German, Thai, Vietnamese and Arabic. All over the world, the construction of infrastructures is a common activity to facilitate the development of countries and regions. To meet the global challenges, the contents of the handbook are kept universal.

We had a great contribution from an IPA Board member, Professor Michael Doubrovsky of Odessa National Maritime University (Ukraine**)** in the supervision and translation of the Russian version.
Details of Handbook and order: https://www.press-in.org/en/publication/index/1

The Next International Conference on Press-in Engineering (ICPE 2024)

The First International Press-in Engineering Conference (ICPE) was held face to face in September 2018 in Kochi, Japan. Then the second conference was held on-line in June 2021. Both conferences were highly successful attracting over 400 participants worldwide. In November 2021 the Board of Directors of the IPA made decision that the Third International Conference on Press-in Engineering (ICPE) would take place in Singapore in 2024.

Singapore is one of the active countries in adopting the press-in engineering technology for its infrastructure development projects. Its neighboring countries Malaysia, Thailand, Vietnam, and Philippines have started using the technology with further large numbers of potential applications. The densely populated Indonesia is also full of potential for the press-in technology. In addition, Singapore is not far from China, Hong Kong, Macau, Taiwan, and India which also have potential expansions on the use of the technology.

The IPA hopes that the conferences reach people who are interested in the press-in technology worldwide with emphasis on the promotion and further development of the technology in Southeast Asia and other Asian countries.

It is expected that the Organizing Committee of the third ICPE will be established in 2022. Early notice of the third ICPE will be sent to interested people in later part of 2022 so that they are aware of the conference and dates (if fixed). Also, the Conference Advisory Committee will be formed in 2022. Conference brochures with details will be prepared and distributed by the end of 2022.

New Members

Members who joined IPA from June to October 2021.

■ New Individual Members (48)

Xiaoduo Ou	Takumu Matsuyama	Wei Lun Lin	Fumitaka Shinya	Taichi Naruse
Azuki Masuda	Mikumo Nakata	So Inaba	Yoshio Obayashi	Sayaka Hamada
Maki Kato	Emiri Matsufuji	Mana Taniguchi	Eri Okamune	Yusei Horikawa
Kazuma Nishimoto	Junya Nishigawa	Asami Shogase	Kaito Suzuta	Ryuya Horikawa
Taisei Ichikawa	Naoya Tamaki	Kaho Sawada	Yujin Kakemizu	Mami Sawada
Yuto Sasaoka	Ryota Naito	Yukika Yamamura	Yoshitatsu Ike	Tomohiro Ikegawa
Taisei Tashima	Shu Okamura	Takumi Ichikawa	Yudai Hisakawa	Mizuki Akesaka
Mihiro Nagano	Rin Morita	Reiya Wada	Kokoro Yokogawa	Risa Ochi
Tomoyuki Yasuoka	Kazuki Matsubara	Yuya Nishio	Keito Oryu	Koya Hisatake
Hiyori Miyawaki	Yoshihiro Horii	Benjamin III Buensuceso		

■ New Student Members (9)

KU NURUL SYAMIMI KU BAHARIN	Emad Abdullah Musleh Albaadani	Hanisah Mustafa
Nur Fatin Amira Zianal	Nor Suhaila Ismail	Kasbi Basri
Siti Farhanah S.M Johan	Masafumi Oka	Yasutaka Honda

■ The number of Members (as of 30 November 2021)

Individual Members: 714 Student Members: 74 Corporate Members: 53

Event Dairy

Title	Date	Venue
■ **IPA Events** https://www.press-in.org/en/event		
The Third International Conference on Press-in Engineering (ICPE 2024)	TBD	Singapore
International Society for Soil Mechanics and Geotechnical Engineering http://www.issmge.org/events		
Fourth African Regional Conference on Geosynthetics	February 21, 2022	Cairo, Egypt
The 60th Rankine Lecture: The Unusual and the Unexpected in Geotechnical Engineering: Observation – Analogy – Experiment	March 16, 2022	London, United Kingdom
6th International Symposium on Tunnels and Shafts in Soils and Rocks	March 29 & 31, 2022 April 5 & 7, 2022	Mexico City, Mexico
2nd International Conference on Energy Geotechnics	April 10, 2022	San Diego, USA
7th International Young Geotechnical Engineers Conference	April 29, 2022	Sydney, Australia
■ **Deep Foundations Institute** http://www.dfi.org/dfievents.asp		
6th International Conference on Grouting & Deep Mixing	February 13-16, 2022	New Orleans, USA
DFI-PFSF Piling & Ground Improvement Conference	February 23-25, 2022	Sydney, Australia
DFI-SMIG-GI-ISSMGE 5th International Conference on Deep Foundations	March 3-4, 2022	Mexico City, Mexico
HPW-DFI Helical Piles-Tiebacks-Anchors Tradeshow and Educational Seminar	April 27-28, 2022	Bonner Springs (KS), USA

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Editorial Remarks

Welcome to the IPA Newsletter, Volume 6 Issue 4. Thank you for giving me an opportunity to work in the editorial group for this issue. While working from home and hearing the news about the omicron variant of Covid-9, I hope this issue may offer you something for academic exploration.

As Message from the Director, Dr. Koda introduces an enlightening example of R&D "Sheet Pile Reinforcement Method for existing railway structure foundations". The Special Contribution titled “Subsurface cavities and road cave-ins” was presented by Prof. Kuwano of the University of Tokyo. It is indeed a great honor of IPA to have her valuable knowledge in her expertise field. Dr. Azizi who is the vice president of IPA introduces “Peat Fire and Muar Living Laboratory Initiative”. We have a case history from China as well as reports from USA and Newsletter Editorial Committee.

In the section of Announcements, it is reported that the first country-wise Technical Committee 6 on “Investigation and analysis of the development status of Press-in technology in China” was approved by the General Assembly. You also find the further multilingualization of the Press-in Handbook. Press-in Retaining Structures: A Handbook (Second Edition, 2021) was translated into Russian and published in October 2021. You may be excited to hear that the Board of Directors of the IPA made decision that the Third International Conference on Press-in Engineering (ICPE) would take place in Singapore in 2024. Please enjoy your findings in this issue.

As last, the Editorial board wants to thank you for your kind support through this year and hopes that you continue to pay attention to our Newsletter in the next year.

Hisanori Yaegashi
Secretary general, IPA