



You are cordially invited to the workshop organised by Japan Society of Civil Engineers (JSCE) and Protective Technology Research Centre.

One Day Workshop on Maintenance of Concrete Structures – Durability Assessment, Repair, New NDT Method Introduction, AI & i-Construction Application in Japan

Date: 28 March 2023 (Tuesday)

Time: 9:00am to 5:30pm

LT 4 (Morning)

09:00-09:10 Opening

09:10-10:00 Assessment of Concrete Structures Durability in Japan and Importance of Water on Durability (Dr. Asamoto)

10:00-10:20 Tea Break (at LT 4 foyer)

10:20-11:10 Issues for Patch Repair Method and Related Materials (Dr. Luan)

11:10-11:30 Panel Discussion

11:30-13:00 Lunch (at LT 4 foyer)

LT 20 (Afternoon)

13:00-13:50 New Materials for Reducing Shrinkage (Dr. Takahashi)

13:50-14:40 Application of Mid-Infrared Spectra to Measurement of Chloride on the Concrete Surface (Dr. Okazaki)

14:40-15:10 Tea Break (at LT 20 foyer)

15:10-16:00 Recent Application of AI & i-Construction to Infrastructure Maintenance in Japan (Dr. Chun)

16:00-16:50 Rapid Damage Assessment of Structures Using Smart IoT Systems and Edge Intelligence (Dr. Fu)

16:50-17:20 Panel Discussion

17:20-17:30 Closing

Venue: Nanyang Technological University, 50 Nanyang Avenue, Singapore 639798

Morning – LT 4 (NS4-02-34, North Spine, Level 2) [Map LT 4](#)

Afternoon – LT 20 (N2-B2A-04, North Spine, Block N2) [Map LT 20](#)

PDU: Pending from Professional Engineers Board Singapore

Abstract of Workshop:

In Japan, many infrastructures constructed in high-growth period of 1970s have deteriorated, their current performance and residual capacity have to be assessed for effective maintenance. In this connection, the public society is concerned about how to handle the numerous small infrastructures with shortage of experienced young engineers, and how to avoid any catastrophes with best cost-effective maintenance. This workshop will introduce various durability assessments for concrete structures, such as chloride ingress and carbonation. Since Japan has recently focused on the importance of water ingress for steel corrosion and carbonation, the workshop will also introduce assessment water penetration into concrete and the relationship among water supply, corrosion and cover depth, as well as repairing materials and methodologies for deterioration. In addition, state-of-the-art maintenance technologies such as Non-Destructive methods (NDT), Artificial Intelligence (AI) application in Japan & the development of smart IoT-based rapid damage assessment system in Singapore will be presented.

Registration Fee (with tea breaks & buffet lunch):

Early Bird By 28 Feb 2023: SGD\$108.00 (inclusive of 8% GST)

From 1 Mar 2023: SGD\$129.60 (inclusive of 8% GST)

Registration Link

https://wis.ntu.edu.sg/webexe88/owa/REGISTER_NTU.REGISTER?EVENT_ID=OA23012711325020

One Day Workshop on Maintenance of Concrete Structures – Durability Assessment, Repair, New NDT Method Introduction, AI & i-Construction Application in Japan

Presentation 1: Assessment of Concrete Structures Durability in Japan and Importance of Water on Durability

The presentation will introduce assessment of concrete structures durability in Japan focusing on corrosion of steel. The importance of water on durability will be discussed introducing field survey in Japan, Thailand and Vietnam as well as recent durability design method of corrosion due to water penetration in Japan. In addition, the issues and prevention on delayed ettringite formation will be presented comparing the situation in Japan, France and other Asian countries.



Speaker: Dr. Shingo ASAMOTO, D. Eng., Associate Professor, Saitama University, Japan

Dr. Shingo ASAMOTO obtained his bachelor, master and doctor degrees of engineering at The University of Tokyo, 2001, 2003 and 2006, respectively. His research interests are time-dependent deformation of cement based materials, coupling micro characteristics and macro performance of cement based materials, durability of concrete with mineral admixture, effect of high temperature from 60 to 80 °C on concrete.

Presentation 2: Issues for Patch Repair Method and Related Materials

Patch repair is a commonly-applied repair method for deteriorated reinforced concrete structures by removing the damaged or contaminated part of concrete from surface and recovering the cross section using new cementitious materials. This presentation introduces the current issues related to patch repair in Japan, including technical procedures, problems and challenges faced in practice and solutions, and recent research advance on patch repair materials and evaluation of the performance of repaired system.



Speaker: Dr. Yao LUAN, Assistant Professor, Saitama University, Japan

Dr. Yao LUAN received his B.S. and M.S. from Tsinghua University, China, in 2004 and 2007, and his PhD from the University of Tokyo in 2010. He is an Assistant Professor in the Department of Civil and Environmental Engineering at Saitama University from 2013. His research interests include hydration and microstructure of cementitious materials, numerical modeling of concrete materials, and deterioration and repair of reinforced concrete.

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Presentation 3: New Materials for Reducing Shrinkage

Shrinkage mechanism is explicable by irreversible changes of calcium silicate hydrate as well as recoverable phenomena as surface tension and disjoining pressure. Incorporating organic polymers with cement can mitigate the shrinkage but its action has not been fully understood. In this presentation, the influences of several organic polymers on early-age to long-term shrinkage are measured and the corresponding microstructural analysis, such as gas sorption isotherms, x-ray scattering and electron microscope, is investigated for the discussion of shrinkage mechanisms in cement-polymer composites.



Speaker: Dr. Keisuke TAKAHASHI, Professor, Kagawa University, Japan

Dr. Keisuke TAKAHASHI received his Ph.D. from Technische Universität Freiberg in 2014. He is a Specially Appointed Professor at Kagawa University from 2022 on a cross-appointment system. He is also working at Mitsubishi UBE Cement Corporation and Japan Agency for Marine-Earth Science and Technology. His research interests are new construction materials to enhance durability, microstructural analysis of polymer-cement composites and utilization of cement under extreme conditions such as deep seas.

Presentation 4: Application of Mid-Infrared Spectra to Measurement of Chloride on the Concrete Surface

A strategy based on infrared spectroscopy is prospected to be used as a novel nondestructive inspection method to assess the risk of chloride attack on reinforced concrete (RC) structures. The characteristics of the infrared spectra of bound chloride ions in cement in the mid-infrared region were investigated in this study to examine the concentration of chloride ions on the surface of the concrete using the mid-infrared spectroscopic camera. The reflection FTIR technique was used to measure the infrared spectra of cement paste samples with varying chloride ion concentrations. Furthermore, multivariate statistical methods were applied to the obtained mid-infrared spectra to critically examine the wavelength bands of the peaks with characteristic values reflecting differences in chloride ion concentrations.



Speaker: Dr. Shinichiro OKAZAKI, Associate Professor, Kagawa University, Japan

Dr. Shinichiro OKAZAKI received the B.S. degree from Kyoto University in 2003, and the Doctor of Engineering from the University of Tokyo in 2008. He entered Ehime University in 2008, and Port and Airport Research Institute in 2013. He is an Associate Professor of Faculty of Engineering and Design in Kagawa University from 2015. He has researched and developed a new non-destructive test method for concrete structure.

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Presentation 5: Recent Application of AI & i-Construction to Infrastructure Maintenance in Japan

In recent years, the declining number of workers in Japan's construction industry has become a problem, and the use of artificial intelligence technology is expected to solve the shortage of human resources and improve productivity. Various methods and use cases for infrastructure maintenance have been proposed and are being actively studied. In this presentation, an overview of artificial intelligence technologies including deep learning will be given first. Next, examples of the application of artificial intelligence to infrastructure maintenance will be presented. The presentation also introduces the technologies that have not yet been realized but could be realized in the near future, and shows what infrastructure maintenance in the new era will look like based on these technologies.



Speaker: Dr. Pang-jo CHUN, Associate Professor, The University of Tokyo, Japan

Dr. Pang-jo CHUN received his Ph.D. from Wayne State University in 2010. After his graduation, he was a postdoc at Yonsei University, an Assistant Professor and Associate Professor at Ehime University. Currently, he is an Associate Professor at the University of Tokyo from 2019. His research interest is maintenance engineering, particularly application of AI/IoT to the maintenance of infrastructure including bridge and tunnel.

Presentation 6: Rapid Damage Assessment of Structures Using Smart IoT Systems and Edge Intelligence

The presentation will introduce the development of wireless smart IoT system with edge computing for structural health monitoring under sudden events. With the innovation of hardware and software, the next-generation wireless IoT sensor can support on-demand sensing to capture unpredictable events of interests and data anomaly recovery to ensure high-quality data acquisition. In particular, two effective algorithms have been developed to enable rapid damage assessment of structures, including interstory drift estimation and sudden damage detection using advanced signal processing strategies and AI algorithms. Both strategies are deployed and executed on wireless smart sensors.



Speaker: Dr. Yu-Guang FU, Assistant Professor, Nanyang Technological University, Singapore

Dr. Yu-Guang FU received his B.Sc. and M.Sc. in civil engineering from Tongji University, China in 2012 and 2014, respectively. He earned his Ph.D. in civil engineering from the University of Illinois at Urbana-Champaign (UIUC) in 2019. Prior to joining NTU in 2021, he was a research scientist at Embedor Technologies to commercialize the sensor technology developed in the Ph.D. study, funded by NSF-SBIR. He then became a postdoctoral research associate in the Resilient Extra-Terrestrial Habitats Institute at Purdue University, funded by NASA. His research objective is to advance state-of-the-art smart sensing, digital twin and testbed technologies to make our built environment sustainable and resilient.