

CUS-CHEC Seminar on Urban Solutions

Coastal Construction for Tackling Rising Sea Level

Date: 22 November 2022 (Tuesday)

Time: 1400 to 1700

Venue: Lecture Theatre 6 (LT6), NS2-02-05 [50 Nanyang Avenue, North Spine, Level 2, S639798] [Map \(LT6\)](#)

Organised By: Centre for Urban Solutions (CUS), School of Civil and Environmental Engineering (CEE),
Nanyang Technological University, Singapore

Co-Hosted By: China Harbour (Singapore) Engineering Company Pte. Ltd. (CHEC)

Registration: Please click [here](#) to register. Registration is free.

About the Seminar

Protection of coastal cities from adverse impacts of sea level rise is a major challenge facing engineers and decision makers. This seminar aims to bring researchers and practitioners together to discuss new ideas, new solutions, new technologies or any other issues that are relevant to the theme of this seminar. Our invited speakers will present their studies pertinent to Singapore as well as their experience from other countries including China and Australia.



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About CUS and CHEC

Centre for Urban Solutions (CUS)

CUS aims to provide leadership in research and development in innovative solutions for sustainable living and infrastructures for future cities. The research directions of CUS include (1) Waste for Urban Infrastructure; (2) Novel Construction Materials; (3) BIM and Construction Digitalization; (4) Underground Engineering; (5) Infrastructure System; and (6) Coastal and Usable Space.

China Harbour Engineering Company Limited (CHEC)

CHEC is leading a research project on key technologies for the construction of large-scale artificial islands along Belt and Road. Members of the research team include specialists and researchers from Department of Infrastructure Engineering, University of Melbourne, and Tianjin Research Institute for Water Transport Engineering, Ministry of Transport, China. CHEC Singapore has been in operation in Singapore since 1986.

Seminar Programme | 22 November 2022 (Tuesday)

Time	Speaker	Title of Presentation
1400 – 1405	Professor <u>Chu Jian</u> Chair, School of CEE; Director of CUS, NTU	Welcome and Opening Address by NTU
1405 – 1410	Mr <u>Lim Soo Kim</u> Deputy Managing Director, CHEC	Opening Address by CHEC
1410 – 1445	Er. David <u>Ng</u> Co-Founder of One Smart Engineering Pte Ltd	1. Circular Economy Approach to Combat Sea Level Rise – Illustration of Proposal for Singapore East Coast Area
1445 – 1520	Professor <u>Chu Jian</u> Chair, School of CEE; Director of CUS, NTU	2. Integrated Solutions to Tackle Rising Sea Level
1520 – 1550	Tea Break with Refreshment Sponsored by CHEC Singapore (Outside LT 6)	
1550 – 1625	Professor <u>Yinghui Tian</u> Technical Consultant, CHEC; Associate Professor, Department of Infrastructure Engineering, University of Melbourne	3. Integrated Modelling of Offshore Floating Wind Turbine Systems
1625 – 1700	Dr. <u>Chen Hanbao</u> Technical Consultant, CHEC; Director of the Marine Hydrodynamic Research Centre, Tianjin Research Institute of Water Transport Engineering	4. Experiment and Application on Sand Beach Enrichment by Pipe-Enrichment-Methodology
1700	End of Seminar	

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About the Presentations and Speakers

1. CIRCULAR ECONOMY APPROACH TO COMBAT SEA LEVEL RISE – ILLUSTRATION OF PROPOSAL FOR SINGAPORE EAST COAST AREA

Er. David Ng, Co-Founder of One Smart Engineering Pte Ltd

Abstract

Singapore, a small island state, has been addressing its existential issues such as its energy, food and water insecurity. Moreover, Singapore is a low-lying state that is becoming increasingly vulnerable to the threats of rising sea levels and flash floods, a consequence of global warming. Although technological solutions do exist to combat these threats, they fail to address the long-term issues these threats might bring to our society, economy and environment in time to come. With the current needs to protect Singapore from rising sea level due to climate change, and announcement by our Prime Minister Lee Hsien Long on the budget of 100 Billion Singapore Dollar over 100 Years to build infrastructure to protect Singapore against rising sea water level, it is therefore important for us to seize this opportunity to consider what is the right solution for Singapore and our subsequent generations. This presentation aims to provide a technically viable planning and engineering design solution for Singapore consideration in leading us to a brighter future. The focus of this presentation is on East Coast Park coastline, as East Coast Park is the most vulnerable and valuable coastline in Singapore. This planning strategy is proposed to be implemented from Marina Barrage to Tanah Merah Ferry Terminal at a length of 12km with an average width of 2.5km. The total development area is approximately 30km². This is the efforts of a teamwork consisting of Architects, Engineers, Chicken Farmers, Vegetable Farmers, Solar Specialists, and Black Soldier Flies (BSF) Farmers.

Speaker's Biography

Er. David Ng is a Professional Engineer (Civil), Specialist Professional Engineer (Geotechnical), Qualified Erosion Control Professional (QECP), ABC Water Professional and Competent Person (CP) for Periodic Facade Inspection (PFI) in Singapore. He has been involved in publication of more than 70 technical papers in the field of geotechnical and environmental engineering. He has more than 20 years of experience in management, planning, design and construction of major infrastructure, transportation and coastal projects in Singapore, Malaysia and India. He is co-founder of One Smart Engineering Pte Ltd which has offices and operations in Singapore, Malaysia and India. Er. David Ng is currently an Adjunct Lecturer for National University of Singapore (NUS) and The Institution of Engineers Singapore Academy (IESA). He has been appointed as CEE Mentor for the School of Civil and Environmental Engineering of Nanyang Technological University (NTU). Er. David Ng is currently the Honorary Secretary of The Institution of Engineers Singapore (IES). Er. David Ng is the co-author together with Ar. Leong Tatt Man for the article on "A Circular Economy Approach to Combat Sea Level Rise" published in the monthly IES Magazine – The Singapore Engineers.

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About the Presentations and Speakers

2. INTEGRATED SOLUTIONS TO TACKLE RISING SEA LEVEL

Professor Chu Jian, Chair, School of CEE; Director of CUS, NTU

Abstract

Protection of coastal cities from adverse impacts of sea level rise is a resource demanding task. Civil engineers can play a pivotal role by developing the most cost-effective solutions to reduce the cost involved and maximize the benefits on the resources used. One of the options to achieve a high cost-effectiveness is through an integrated design by Integrating coastal protection systems with other developments including space creation, flood control, clean water, infrastructures for transportation and marine ecosystem restoration. Some of the ideas on such integrated solutions developed at Nanyang Technological University and collaborators will be presented. Engineering challenges faced in these proposed developments and the proposed solutions such as seawall construction in deep water, long-term durability of marine concrete, beneficial use of waste materials, cultivation of coral reefs and nature-based solutions for mangroves and seagrass planting will also be discussed in this talk.

Speaker's Biography

Professor Chu Jian is Chair of the School of Civil and Environmental Engineering and founding Director of the Centre for Urban Solutions at Nanyang Technological University. He worked for Iowa State University, USA, from 2011 to 2014, as Professor and James M. Hoover Chair in Geotechnical Engineering. He is Editor for a high impact geotechnical journal, Acta Geotechnica, and Associate Editor for ASCE Journal of Materials in Civil Engineering. He has delivered more than 60 keynote and invited lectures at international conferences. Prof Chu also chairs the ISSMGE Technical Committee TC217 on Land Reclamation and was a past president of GeoSS and the past Chair of ISSMGE Technical Committee TC39 on Geotechnical Engineering for Coastal Disaster Mitigation and Rehabilitation. He received several awards including the R. M. Quigley Award from the Canadian Geotechnical Society in 2004 and the Outstanding Geotechnical Engineer Award from the Geotechnical Society of Singapore in 2018.

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About the Presentations and Speakers

3. INTEGRATED MODELLING OF OFFSHORE FLOATING WIND TURBINE SYSTEMS

Professor Yinghui Tian, Technical Consultant, CHEC; Department of Infrastructure Engineering, University of Melbourne

Abstract

As the world's energy needs increase unabated, securing long-term and clean energy sources is a major challenge for all nations. One solution is the abundance of renewable energy in the oceans where the winds are stronger in deeper waters that are currently inaccessible to our offshore energy sector.

Foundations for offshore developments, such as large diameter monopiles, have reached capacity and are expensive, contributing up to 35% of the cost (Byrne and Houlsby 2015). The next generation of wind turbines are becoming bigger and going deeper water. For example, the rotary diameter of modern ~8 MW turbines are the size of the Melbourne Cricket Ground (~160 m), which are primarily moored to the seabed as floating structures. Significant challenges remain for floating wind turbines to be confidently deployed to tap the enormous renewable energy from the ocean and thus mitigate the climate change impact.

This presentation will talk on the development of an integrated modelling approach for wind turbines, mooring lines, embedded anchors and environmental loading.

Speaker's Biography

Associate Professor Yinghui Tian is currently an Australian Research Council (ARC) Future Fellow, supported by ARC to carry out cutting-edge research in offshore geotechnical engineering. His current research interests mainly include (1) offshore mooring and anchoring system development, (2) offshore pipeline integrity and stability study, (3) advanced large deformation modelling and soil constitutive model development, (4) piling engineering and offshore renewable foundations, and (5) problematic carbonate soil behaviour and subsea hazard modelling. He is the Chief Investigator (CI) of three ARC Discovery Projects and two ARC Linkage Projects and has been developing strong engagement with industry to convert the innovative research outcomes to engineering practice and design, including his development of two suites of computer software (UWAINT and CASPA), which are licenced to leading offshore industry companies to support their offshore developments.

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4. EXPERIMENT AND APPLICATION ON SAND BEACH ENRICHMENT BY PIPE-ENRICHMENT-METHODOLOGY

Dr. **Chen Hanbao**, Technical Consultant, CHEC; Director of the Marine Hydrodynamic Research Centre, Tianjin Research Institute of Water Transport Engineering

Abstract

Sand beach erosion has become a common practical problem. Measures such as artificial sand supplement, construction of spur dikes or offshore submerged dikes, and plant vegetation have achieved some results. There are also many successful cases of beach maintenance with permeable pipes (PEM) in the world. The basic principle is to set up a series of hollow pipes with fine holes at the upper end of the intertidal zone and in the area where waves climb along the beach. When waves carrying sand pass through the permeable pipe, the water can quickly enter the permeable pipe, reducing the amount of water falling back, and the sand can be remained ashore under natural power. Through the flume physical model test, the reasonable pore size, layout location and density of permeable pipes are selected to verify the beach maintenance effect in the laboratory. A case study for Long Island in Bohai Sea, a natural uninhabited island with seriously eroded will be presented. After adopted the measures of permeable pipe to maintain the beach, the erosion was significantly reduced.

Speaker's Biography

Dr. **Chen Hanbao** graduated from Zhejiang University in 1993 and then received his Ph.D. in Port, Coastal and Offshore Engineering from Tianjin University, and is now working at the Tianjin Research Institute for Water Transport Engineering, Ministry of Transport (M.O.T.) as the Director of the Marine Hydrodynamic Research Centre, the Director of the International Science and Technology Cooperation Demonstration Base for Waterway Green Construction and Disaster Prevention, and the Visiting Professor of Hohai University and Changsha University of Science and Technology.

Dr. Chen has long been engaged in coastal engineering and ocean hydrodynamics research. He has completed more than 400 engineering research work in more than 20 large ports in China's coastal areas, takes charge of the construction of the world's largest wave flume, creates China-Indonesia port construction and disaster prevention research centre.

Dr. Chen has achieved more than 20 scientific research projects, obtained 1 National prize and 20+ provincial prizes of Science and Technology Progress Award. Published 9 standards, 200+ scientific research reports, 30+ papers, 40+ patents and software copyrights. He was awarded the title of Young Talents of M.O.T., the leader of the innovation team of ocean hydrodynamics of M.O.T., the leader of innovation team of port construction of Tianjin, the special award of merit from the Chinese Navigation Society.