NUS National University of Singapore | Department of Civil and Environmental Engineering
College of Design and Engineering

Pavement Engineering Research Seminar

You are cordially invited to the seminar jointly organized by
Centre for Transportation Research (CTR) and
Department of Civil and Environmental Engineering (CEE)

Date: **2 October 2023 (Monday)**
Time: **10 am to 12 noon**
Venue: **Block EA #06-04**
College of Design and Engineering
National University of Singapore

Scan code to register

General Enquiry/Registration: Ms Asmidah, Tel: 6516 4314, email: asmidah1@nus.edu.sg
Professional Enquiry: Assoc Prof Ong Ghim Ping Raymond; email: ceeongr@nus.edu.sg

Please register early. All are welcome and admission is free

Abstract on the Pavement Engineering Research Seminar

The Pavement Engineering Research Seminar is a seminar series started since 2019 to explore the complex nature of modern pavement engineering and management for highways, airports, seaports, and industrial floors; especially in the light of rapid advancement in material science, construction, sensing and structural monitoring, data analytics, and optimization methods for a future transportation system (with advanced vehicle technologies and automation).

In this seminar, we have Dr Su Yu-Min, Dr Lin Yen-Yu from National Kaohsiung University of Science and Tehcnology, and Associate Prof Peerapong Jitsangsiam from Chiang Mai University to share with us their experiences in pavement research in Taiwan and Thailand. Through the seminar, audience will get to learn more about the effect of climate change especially temperature rise on asphalt pavement properties and vehicle operation safety, carbon footprint computation for pavements and net zero emission goal in Taiwan, and future road base materials that are targeted to reduce construction cost and greenhouse gas emissions.

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Study of Skid Resistance and Temperature Effect in Dense-Graded Asphalt Concrete

by

Dr Su Yu-Min
National Kaohsiung University of Science and Technology, Taiwan

Abstract

The objective of this research was to investigate the skid resistance and temperature effect in dense-graded asphalt concrete. The research scope was to evaluate the skid resistance of various AC that are commonly used for roadways in Taiwan. In this research dense-graded asphalt concrete, stone matrix asphalt, gap-graded crumb rubber modified asphalt concrete were sampled from asphalt plants, compacted into testing slabs, and utilized polishing and frictional tests to facilitate the assessment. The research outcomes are concluded as follows: it was found that BPN measurements decreased when the temperatures of the testing surface increased; meanwhile, it was found that MPD measurements were not affected by the temperatures; DFT20 also decreased but only a little when the temperatures increased; it is suggested that more repeated evaluations may be required to assert the correlations. In terms of accelerated polishing, after 150000 of polishing rounds, BPN and DFT20 lost measurements of 8.2~15.6 and 9.7-13-%; MPD of most of the asphalt concrete mixture increased textures of 13.4~47.6-%, but MPD of gap-graded type of asphalt concrete mixture lost measurements of 8.5~33.4-%. Furthermore, when thin film moist increased from 0 to 3-mm, BPN and DFT20 decreased 13.1 and 26-%. It has to be noted that blending high frictional aggregates such as slag does help improve dynamic friction. The future work suggests correlating the indoor polishing efforts with the real-world traffic flow, evaluating more asphalt mixtures that are used on the surface layer, and repeating more slabs to be tested.

Speaker Biography

Dr. Yu-Min Su is an assistant professor at the Department of Civil Engineering of the National Kaohsiung University of Science and Technology in Kaohsiung, Taiwan. Dr. Su received his Ph.D. from the Department of Civil Engineering at the University of Florida, Gainesville, Florida, United States, and was awarded the fellowship of International Road Federation (IRF). Dr. Su's research interests cover highway and pavement engineering, asset management, and smart technologies and applications.

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2050 Net Zero Goal and Challenges for Pavement Engineering

by

Dr Lin Yen-Yu
National Kaohsiung University of Science and Technology, Taiwan

Abstract

To achieve net-zero emissions by 2050, Taiwan aims to increase the share of renewables and natural gas in its energy mix to 20 per cent and 50 per cent respectively, while reducing the share of coal to 30 per cent by 2025. Implementing this pathway can contribute to sustainable growth and development. In this presentation, Dr Lin will be sharing the 2050 net zero goal in emission in Taiwan and the significance of pavement carbon footprint in achieving this net zero goal. Current asphalt concrete product carbon footprint and emissions during construction and their computational methodologies shall be discussed and the different scenarios of emission reduction considering materials, equipment, and management strategies are explained.

Speaker Biography

Yen-Yu Lin serves as assistant professor at Department of Construction Engineering, National Kaohsiung University of Science and Technology. He earned his Ph.D. degree at University of Washington in 2012. His research interests include performance evaluation of pavement materials, sustainable roadway design and construction, and life cycle assessment of infrastructure. He has helped the roadway agencies to quantify the GHG emissions for major projects and kept contributing to establish the GHG management scheme for infrastructure for Taiwan.

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Development of Future Road Base Materials based on The Multi-Function Material Concept and Sustainability

by

Associate Professor Peerapong Jitsangiam
Chiang Mai University, Thailand

Abstract

This research introduces Future Road Base Material (FROBM), a groundbreaking and environmentally conscious solution designed to address the pressing sustainability concerns in road construction. In stark contrast to traditional road base materials that heavily rely on natural aggregates and Ordinary Portland Cement (OPC), often via the cement-treated base (CTB) method, FROBM presents a revolutionary approach that eliminates cement consumption while promoting eco-friendliness and cost-effectiveness. FROBM leverages a novel formulation, primarily centered on modifying fine crushed rock (FCR) with a specially engineered binder, comprising 4% of the FCR's total weight. This innovative non-OPC binder incorporates fly ash and hydrated limestone as essential pozzolanic components and sodium hydroxide as an alkali additive. Additionally, an asphalt emulsion (AE) is introduced as a multifaceted admixture to enhance pavement properties. The environmental implications of FROBM are thoroughly evaluated through a comprehensive Life Cycle Assessment (LCA). This assessment meticulously examines the carbon footprint associated with material acquisition, product transportation, and construction. The results of the LCA underscore the remarkable potential of FROBM in mitigating environmental impact. Notably, the non-OPC binder ensures the requisite compressive strength, while the inclusion of AE substantially elevates pavement performance, surpassing that of conventional CTB mixtures. This enhancement translates into significant reductions in construction costs and greenhouse gas emissions, with FROBM achieving a remarkable 30% reduction compared to CTB mixtures. Furthermore, FROBM diminishes the demand for natural aggregates and streamlines operational processes, promoting efficiency and sustainability. In essence, FROBM, with its non-OPC binder and AE-based road base stabilization, represents a pioneering, sustainable solution that simultaneously addresses waste generated by coal mining and power plant industries. This research not only advances the field of eco-conscious pavement materials but also serves as a guiding beacon for future sustainable construction practices, underlining the importance of environmental responsibility and resource efficiency in the realm of infrastructure development.

Speaker Biography

Dr. Peerapong is an Associate Professor and Director of the Chiang Mai University-Advanced Railway Civil and Foundation Engineering Center (CMU-RailCFC). His academic journey began in 1996 when he earned his BEng in Civil Engineering from Chiang Mai University (CMU), Thailand. Dr. Peerapong's passion for geotechnical engineering led him to pursue an MEng from CMU in 2001. In 2005, Dr. Peerapong embarked on an academic odyssey to Australia, where he obtained his Ph.D. in Civil Engineering from Curtin University of Technology. After completing his doctorate, he

dedicated his expertise to academia and held a faculty position at Curtin University before returning to Chiang Mai University in 2016.

Dr. Peerapong's scholarly impact is vividly demonstrated by his pivotal role in establishing the Curtin Pavement Research Group (Curtin-PRG). Through this initiative, he has spearheaded cutting-edge pavement structure and materials engineering research. Dr. Peerapong has fostered robust collaborations with road pavement designers, fellow researchers, field professionals, and the broader pavement construction industry. His relentless commitment to research excellence has earned him three prestigious national competitive research grants within the ARC-Linkage scheme and a State-based grant from the Strategic Waste Initiative Scheme (SWIS) through Western Australia's Water Authority. Furthermore, he has secured three grants from the Western Australia Pavement Asset Research Centre (WAPARC) in partnership with WA Main Roads.

Since joining Chiang Mai University in 2016, Dr. Peerapong's tireless efforts have culminated in the successful execution of over 45 research projects in collaboration with Thai research funding agencies and industry partners, amounting to approximately 60 million Thai Baht in research funding. His research interests are deeply rooted in advanced road pavement materials, transportation geotechnics, and sustainable waste utilization in road construction. Dr. Peerapong's contributions to the field are underscored by his extensive publication record, which boasts over 100 research papers in peer-reviewed national and international journals and conferences. His dedication to advancing knowledge and solving real-world engineering challenges continues to profoundly impact academia and the transportation industry.