SUSTAINABLE STABILIZATION OF MARGINAL LATERITIC SOIL FOR PAVEMENT APPLICATIONS

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ABSTRACT: Due to high rainfall, temperature and humidity with alternative wet and dry period, nearly 60% of the soils in Thailand are lateritic soil with colors ranging from red to yellowish red. The lateritic soil is found in dry flat lands and plains, throughout Thailand. This lateritic soil with suitable mechanical properties is commonly used as subbase materials in roads. However, lateritic soils are increasingly becoming scarce to source for road projects. Thus, the usage of marginal lateritic soil as a pavement subbase material leads to some challenging issues. This paper presents sustainable stabilization of marginal lateritic soil by Melamine Debris (MD) replacement and by geopolymer binders as unbound and bound pavement materials, respectively. MD is an industrial waste resulting from plate and cup manufacture. This MD cannot be reformed or reused for manufacturing plates and cups. Two waste by-products: Fly Ash (FA) and Calcium Carbide Residue (CCR) are used a precursor to develop geopolymer binder. The test results on MD-lateritic soil blends shows that the MD replacement of lateritic soil reduces the fine content and increases the abrasion resistance of the soil particles, hence the reduction in liquid limit, plasticity index, LA abrasion and particle breakage. The physical and mechanical properties of the 20% MD replacement blend are found to meet the requirement of local road authority for engineering fill materials while the 50% MD replacement blend is found to be at the borderline for subbase course material. The test results on geopolymer stabilized lateritic soil shows that the soaked 7-day UCS of FA geopolymer stabilized soil with and without CCR at various Na_2SiO_3:NaOH ratios tested meets the strength requirement for both light and heavy traffic pavement specified by the local national authorities. For all Na_2SiO_3:NaOH ratios, the early 7-day UCS increases with increasing CCR replacement ratio whereby the cementitious products increase with CCR replacement ratio and the significant cementitious products are observed at CCR = 30% (the highest CCR replacement ratio tested). This research seeks to enable MD and CCR traditionally destined for landfill to be used in pavement applications, which are significant in addressing the sustainable usage of MD and CCR from engineering, economical and environmental perspectives.

Keywords: *marginal lateritic soil, geopolymer, melamine, calcium carbide residue, fly ash*

SHORT BIO OF PROFESSOR SUKSUN HORPIBULSUK

Prof. Suksun Horpibulsuk obtained a B.Eng. (Civil Engineering) with Honors Award from Khon Kaen University, Thailand in 1996. Prof. Suksun was subsequently granted a scholarship by the Royal Thailand Government to pursue a M.Eng. in Soil Engineering at Asian Institute of Technology and duly completed in 1998. He then received a prestigious MONBUSHO scholarship from the Japanese Government to pursue his Ph.D. in Geotechnical Engineering at Saga University in Japan that he duly completed in 2001. He joined Suranaree University of Technology (SUT) as a lecturer in 2002. His outstanding research, teaching and service for the university, community and profession over the years was duly recognized when he was promoted to the level of full professor in 2010. He is a professor and chair of School of Civil Engineering and a founder director of Center of Excellence in Innovation for Sustainable Infrastructure Development at SUT. He is presently the president of the International Geosynthetics Society (IGS) – Thailand Chapter, the president of the Engineering Institute of Thailand – Northeastern Thailand branch and a Distinguished Geotechnical Engineering Fellow at Swinburne University of Technology, Australia. His most significant contributions have been in the field of ground improvement techniques, specifically issues associated with compaction, vertical drains, earth reinforcement and chemical stabilization. He has been awarded a large number of competitive research grants totaling US$4.4 million. He has published extensively with over 300 technical publications, including over 120 in leading journals. Due to his outstanding contributions for the profession and community as well as his national and international recognition, he was nominated as a TRF Senior Scholar in 2013 and 2016 by the Thailand Research Fund.

ESTIMATION OF DYNAMIC BUCKLING STRENGTH OF CIRCULAR TUBE PILES WITH LIQUEFIED SOIL

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ABSTRACT: In the current design criteria, Possibility of dynamic buckling of piles foundation is not taken into account. Therefore, the design codes have no prescription about a limitation of slenderness ratio for piles. However, when slender steel piles beneath buildings experience high axial compression forces as a result of vertical loads increased by over turning moment of buildings, which generated by inertia forces of buildings, buckling of the piles occurred. With an accidental coincidence of liquefaction, the risk of buckling is most likely to be increased. In this study, to investigate dynamic buckling behavior of the circular tube piles with liquefied soil, centrifuge tests are conducted. Test parameters were a natural period of a superstructure-foundation system, an input wave, a slenderness ratio of the pile, and the material property of the pile. Dynamic buckling stress measured by the centrifuge test can be approximately evaluated with an equivalent slenderness ratio of the elastic buckling stress presented in Limit State Design of Steel Structures.

Keywords: *steel pile, dynamic bucking, buckling strength, liquefied soil, Centrifuge test*

SHORT BIO OF PROFESSOR YOSHIHIRO KIMURA

Prof. Yoshihiro Kimura obtained his Bachelor (1991) degree from Tohoku University, Master of Engineering (1993), and Doctor of Engineering (1995) degrees from Tokyo Institute of Technology, Japan. He joined Tokyo Institute of Technology in 1995 as a research associate, and was a visiting scholar of University of Washington in Seattle from 2000.9 -2001.6. He was an associate professor in 2004, and became a professor of Nagasaki University in 2009.
He is the author of more than 100 research publications on the lateral or local bucking of steel members including steel piles. He received the encouragement prize of Architecture Institute of Japan (AIJ) in 2004, the best paper awards of Japanese Society of Steel Construction in 2009 and 2014, and the best paper award of GEOMATE in 2012 and so on.
He has been involved in many committees such as managing committee on steel structure, stability of steel structure and subcommittees on passively-controlled steel structure, and seismic design of piles foundation of AIJ, and is American Institute of Steel Construction (AISC) International Structural Steel Research Group Advisor, etc.