Development of A Single Measurement Device Unit for Monitoring Railway Ballast Behavior

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Abstract

In the past, ballast behavior was analyzed and evaluated upon the estimation of stress and strain of material through a numerical method of empirical formulas in which calculated results have not existed to real material behavior. Consequently, The measurement of ballast behaviors was developed for in-field monitoring based on the electrical and wire measurement technologies. However, These in-field monitoring had a limitation about data collection and transmission of data system following such wire technologies were not precise and persistent due to the degree of freedom of installed measuring device was incompatible with ballast movement characteristics. This study aimed to create a single measurement device unit with a sensor system capable of capturing the stress, ballast movement, and data transmission following wireless technology under the in-service rail condition. This wireless measuring device had a flex sensor (RP-S40-ST), the gyro module (GY-521), and the Microcontroller of Wemos D1 mini for stress, strain, and data transmission and processing, respectively. For an accurate wireless measuring device, the measuring validation by Hook's law for stress measurement that acts on the external surface of the device and Newton's Law for movement measurement is needed. This single unit of the accurate wireless measuring device could be used functionally to measure stress and movement and is capable of data transmission based on wireless technology as expected

Keywords: Sensor, Ballast, Ballast Behavior

Biography

Dr. Peerapong is now an associate professor and the director of Chiang Mai University- advanced railway civil and foundation engineering center (CMU-RailCFC). He joined the Department of

Civil Engineering at Chiang Mai University in 2016. After graduating with a BEng (Civil Engineering) from Chiang Mai University (CMU), Thailand, in 1996, he was trained as a geotechnical engineer. He completed an MEng from Chiang Mai University Thailand in 2001. In 2005, Dr. Peerapong moved to Australia to pursue his Ph.D. in civil engineering at Curtin University of Technology. After his Ph.D., Dr. Peerapong worked as an academic staff at Curtin University before joining Chiang Mai University.

Dr. Peerapong's research effort is demonstrated predominantly through establishing the Curtin Pavement Research Group (Curtin-PRG). He has initiated a research program in pavement structure and materials engineering through this group, including building solid associations and working collaboratively with road pavement designers, researchers, field staff, and the wider pavement construction industry. As a result of these efforts, he has been awarded three prestigious national competitive research grants within the ARC-Linkage scheme, one State-based grant with the Strategic Waste Initiative Scheme (SWIS) through Western Australia's Water Authority, and three grants from Western Australia Pavement Asset Research Centre (WAPARC) with WA Main roads.

For the research establishment in Thailand since Dr peerapong joined Chiang Mai University in 2016, more than 45 successful research projects with Thai research funding agencies and industry partners with around 60 million Thai Baht of research budgets were achieved. His research interest is in line with advanced road pavement materials, transportation geotechnics, and waste utilization in road construction. He has published more than 100 research papers in peer-reviewed national and international journals and conferences.