Department of Civil Engineering
The University of Hong Kong

Structural Division
The Hong Kong Institution of Engineers

The Third Y.K. Cheung Lecture

VIBRATION AND PERFORMANCE OF A SUBWAY TRACK SYSTEM

Presented by
Emeritus Professor Lee Seng Lip
Department of Civil Engineering, National University of Singapore

6:30 p.m. November 9, 2009 (Monday)
Rayson Huang Theatre, The University of Hong Kong

Co-authors of the Presentation: Professor Koh Chan Ghee and Assoc. Prof. David Chua
Department of Civil Engineering, National University of Singapore

About the Speaker

Professor S. L. Lee obtained his Ph.D. at the University of California, Berkeley, in 1953. After working in Kaiser Engineers and Bechtel Corporation, he joined Northwestern University, Illinois, in 1955 as an assistant professor and was promoted to full professorship in 1960. In 1968, he joined the Asian Institute of Technology in Bangkok, Thailand, as professor and chairman of Division of Structural Engineering and Mechanics. In 1975, he became professor and head of the Department of Civil Engineering of the National University of Singapore. He is currently an Emeritus Professor of the National University of Singapore. His recent research areas cover structural engineering, geotechnical engineering and construction technology.

He has published more than 500 papers in international and regional journals and conferences and has delivered numerous keynote lectures in many countries. Professor Lee has served as a structural and geotechnical engineering consultant in more than 100 projects in several countries involving design and construction of infrastructure and is co-holder of a patent on Fibredrain for consolidation of clayey soils. He has received many honours and awards including A.P. Greensfelder Construction Prize (1982) of ASCE, Maurice P. van Buren Structural Engineering Award (1989) and University of California Berkeley Distinguished Engineering Alumnus Award (1991).

Synopsis

This lecture presents an integrated approach to study the performance of a floating slab track (FST) system, with emphasis on the effects of rail pads on the train-track vibrations. The study involves a comprehensive program comprising experimental investigation of rail pads, field measurements of a subway train-track system, analytical formulation and numerical study. Laboratory tests of rail pads are conducted to determine the dynamic characteristics and long-term performance of selected rail pads. Based on the experimental results, a simple yet accurate deterioration model is proposed to model the pad stiffening associated with ageing. The predictive model is validated with field measurements of pad deformations under train operations in a tunnel. Rainflow analysis is performed to compute equivalent ranges and cycle counts to account for non-periodicity of actual train operations. An analytical-numerical approach is developed to model the dynamic excitations induced by wheel/rail roughness. Finite element analysis is employed in both the back analysis to determine the roughness spectrum and the forward analysis to predict the train-track system response. The integrated approach and findings enable the subway operator to make quantitative assessment of the effects of rail pads on the performance of the track system in terms of vibration levels of rails and supporting slabs, and hence to establish an appropriate maintenance policy.

FREE ADMISSION – ALL ARE WELCOME

No prior registration is required. Attendance certificates will be available.

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