Civil Engineering Seminar

The Department of Civil and Environmental Engineering presents

Dr. Gabriel Raviv
Lecturer, Technion Israel Institute of Technology

Date: March 19, 2018
Time: 3:00-4:00 pm
Place: RRI 101

Modeling of Near Misses Related to Crane Work at Construction Sites and Their Safety Risk Potential

A near miss can be explained in several ways, all of which lead up to the definition according to which an ongoing chain of events was interrupted and an accident was prevented, leaving the work environment unharmed, albeit with some release of hazard potential. The construction industry, too, tends to adopt near-miss management systems, but such procedures are relatively new and have not yet been fully explored or understood. The research reported here suggests a systematic approach to near-miss analysis, and concentrates on tower-crane-related near-miss events. This is due to the centrality of tower cranes in nowadays construction on the one hand, and the potential of tower cranes as hazard generators on construction sites on the other hand. The aim of the study was threefold: (1) to expand the existing knowledge on tower-crane safety-related incidents by establishing an extensive structured tower-crane-related incident database using unambiguous definitions that build upon the existing nomenclature; (2) to use the structured database definitions as categorical variables in applying statistical methods to obtain the risk potential of future safety incidents; and (3) to enable the analysis of clusters of high-risk potential incidents.

The study began with an extensive effort to collect stories of safety events, including near misses and accidents. Leading construction companies in Israel revealed data on near misses and accidents taken from existing files, and also provided the research team with the opportunity to proactively elicit incident stories during field interviews. Consequently, a database was formed, including 241 tower-crane safety incidents, of which 162 were near misses and 79 were full-scale accidents. An exploratory research method was then implemented in developing a comprehensive set of categories and variables to define crane-related accidents and near-miss events.

The next stage builds on the database definitions, and implements the analytic hierarchy process (AHP) to evaluate the quantitative outcome severity level values, thus computing each event's partial and total risk potential. The research outcomes reveal inter-relations between technical factors and human factors in the tower-crane domain. The most prominent finding of the analysis method offered is the contradiction of the common perception regarding the role of the human factor as a main contributor to occupational accidents. Introducing the risk potential idea, as well as its analysis method, contradicted this common perception by quantitatively assessing the incidence of failures that led to high risk potential incidents. Consequently, a hazard scale for technical and human factors was defined with the "pure" technical factors at the top of the scale, failures that combine technical and human factors at the interim level, and human-related factors, which are the least hazardous, at the bottom. Further application is demonstrated, using the risk potential values for construction company safety assessments.

About the Speaker

Gabriel Raviv received a B.Sc. in civil engineering in 1979. For the following 30 years worked as project engineer and project construction manager, managing large construction projects in Israel, including office, commercial, and residential buildings. From 2009 began an academic carrier and finished the M.Sc. and Ph.D. in construction management in 2012 and 2016 respectively. His research interests include construction safety with an emphasis on tower crane safety. He is currently a lecturer at the Faculty of Civil and Environmental Engineering at the Technion Israel Institute of Technology, teaching the courses of “Construction Methods”, “Mechanization in construction”, and instructing students through the final project in construction management. Moreover, he is the head of the Building System Evaluation Unit at the Israel National Building Research Institute.