

## **SEMINAR**

jointly organised by Department of Civil Engineering and CICID, HKU

### **Optimization, Costs, Emissions and Production in Surface Mining and Earthmoving**

by

Professor David G. Carmichael  
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Date: November 5, 2013 (Tuesday)

Time: 4:00 - 5:00 p.m.

Venue: Room 6-12B, Haking Wong Building  
The University of Hong Kong

#### **ABSTRACT**

Earthmoving and surface mining typically involve the use of large equipment that cycles repeatedly. Typically, operations involving such equipment are designed to minimise unit costs (cost per production). However, with an increasing emphasis on climate and environmental issues, such operations are now being examined in terms of unit emissions (emissions per production).

The seminar explores the relationship between the optimum unit cost and optimum unit emission solutions for surface mining and earthmoving operations. For operations involving excavators and trucks, it is demonstrated that for truck numbers as the control variable, that the optimum unit cost and optimum unit emissions solution are the same. An argument based on finite source queuing analysis and the gradients of the objective functions is used. The result extends to the case involving multiple excavators and dump points, where an additional control variable of truck allocation is introduced and trucks are dispatched optimally between excavators and servers. An argument based on finite source queuing analysis and linear programming is used. For operations involving scrapers, because of nonlinear load growth curves of scrapers, the coincident unit cost and unit emissions result changes, but still the optimum unit cost and optimum unit emissions solutions do not differ by much. Collectively, these results show that surface mining and earthmoving configurations traditionally designed on unit cost also impact the environment the least or are close to lowest impact on the environment.

## **ABOUT THE SPEAKER**

David G. Carmichael is Professor of Civil Engineering at the University of New South Wales, Australia. He is a graduate of the Universities of Sydney and Canterbury. He publishes, teaches, and consults widely in most aspects of construction, project management, systems, and problem solving. He is known for his leftfield thinking on project and risk management (Project Management Framework, A. A. Balkema, Rotterdam, 2004), project planning (Project Planning, and Control, Taylor and Francis, London, 2006), and problem solving (Problem Solving for Engineers, CRC Press, London, 2013)