

GLF-CEM newsletter

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welcome

GLF-CEM MEMBERS + FRIENDS

After returning from the 2017 GLF-CEM in Los Angeles, I was reminded once again of the tremendous breadth of experiences and knowledge that is contained within our organization. With 79 representatives from 61 institutions across 19 countries, the GLF-CEM is truly a global community of leaders.

In this issue of our newsletter, we are introducing a *Focus on Programs* section, which will highlight construction engineering and management programs from around the world. This section will describe how various construction engineering and management programs operate and, most importantly, will emphasize the important factors that have been instrumental in the success of these programs. I hope that this section will inspire our members to reflect upon the construction engineering and management programs at their own institution and to share their experiences and advice with other members of our community.

This issue also details information for the upcoming *2018 GLF-CEM in Stellenbosch, South Africa*, on May 16 – 19, 2018. This year's program will explore the teaching needs of academic programs as well as the effect of disruptive technologies on the future of construction. In addition to the core program, this year's forum will also include lectures from invited GLF-CEM members to students, to which all 2018 registrants are welcome, as well as a field trip to Chapman's Peak Drive, a Public-Private Partnership Project that has been awarded numerous awards for engineering excellence. I look forward to joining many of you at this event in May.

Sincerely,

Simaan AbouRizk
GLF-CEM Chair
Distinguished University Professor
University of Alberta, Canada

Los Angeles, California

GLOBAL LEADERSHIP FORUM FOR CEM PROGRAMS

2017



Dr. Lucio Soibelman
GLF-CEM Secretary

Professor, Civil and Environmental Engineering
University of Southern California
United States

The 2017 GLF-CEM meeting was hosted at the University of Southern California by the Sonny Astani Department of Civil and Environmental Engineering from the Viterbi School of Engineering. The event was attended by 32 delegates from 11 countries representing 27 organizations. The Forum began with opening remarks from the organizing chair, Dr. Lucio Soibelman, and



the GLF-CEM chairman, Dr. Simaan AbouRizk, and was followed by the introduction of new GLF-CEM members. The following day began with a presentation from the KPI and Trends Committee. Dr. Thomas Ng detailed the international data sources and the subsequent benchmarking work that is being carried out by the committee, and Dr. Makarand Hastak spoke about the committee's work in India. Following the presentation, a panel discussion focusing on the committee's priorities and future leadership was held. The GLF-CEM Collaborations Committee also reviewed their future objectives, which included an expansion of dual and exchange programs, online courses, and of the importance of maintaining ongoing collaborations.



In the third session of the morning, Dr. Lucio Soibelman discussed the Construction Engineering and Management Program at the University of Southern California. His presentation focused on the changes that he has tried to implement since his appointment as Chair of the Sonny Astani Department of Civil and Environmental Engineering. In particular, Dr. Soibelman discussed his emphasis on the dismantling of traditional research silos to motivate interdisciplinary research within the department. A panel discussion on leadership was held in the afternoon. Panel members, namely Mr. Phil Stassi (Executive Advisor to the CEO and Chairman at Jacobs Engineering Group Inc.), Dr. Jim Rowings (Chief Learning



Officer and Vice President at Kiewit Corporation), Dr. Feniosky Pena-Mora (Commissioner at the NYC Department of Design and Construction), and Dr. Simaan AbouRizk (Distinguished University Professor at the University of Alberta), presented their thoughts on whether or not leadership can be taught. Presentations were followed by an interactive panel discussion moderated by Dr. David Ashley. The workshop was concluded with a dinner at the Shangri-La Hotel in Santa Monica, California. Thanks to the good weather and wonderful hospitality, the members had a chance to mingle and reflect on this year's successful event.



An Update of The Key Performance Indicators Initiative

A comparison of international key performance indicators related to industry, research, programs, and education.

One of the key objectives of the Global Leadership Forum for Construction Engineering Management Programs (GLF-CEM) is to be at the forefront of developments in CEM and—through engagement with future leaders—to ensure the global consideration of CEM-related issues within CEM educational programs, academic research, and industrial collaboration. The KPI Committee has a mandate from the GLF-CEM to “report and articulate Construction/Built Environment industry, educational, and research trends that have the potential to or are already impacting Construction Engineering and Management and Construction Management graduate programs.” ►

AN UPDATE FROM THE KPI COMMITTEE

After considerable deliberations, the committee has shortlisted the key performance indicators (KPI), listed in Table 1, under two of the four categories (e.g., Industry and Program). These KPIs were specially selected because the required data are publicly available in the countries represented by each committee member (e.g., Hong Kong, India, South Africa, United Kingdom, and USA). The committee is of the opinion that, for the longevity of this effort, the data required should be publicly available to all participating GLF-CEM members in their respective countries. Currently, the committee is deliberating the design of a database that would capture (and subsequently analyze) the data identified for Industry- and Program-related KPIs as well as assist in identifying additional KPIs under the Education and Research categories (see Table 1). The committee intends to identify the KPIs under Education and Research categories by early 2018.

GLF-CEM members are encouraged to identify and recommend KPIs that would be of value to the membership at the global level and for which the data are readily available within their countries.

The committee is also identifying research gaps in the academic literature and through discussions with other researchers and with industry. A sample list of research questions is provided in Table 2. The committee intends to categorize the research questions as candidates for Masters- or PhD-level research and to disseminate the list to the GLF-CEM members for potential research collaboration in early 2018. It is expected that GLF-CEM members interested in the KPI research would decide to take on one or more of these questions and would collaborate with other members engaged in similar research. The GLF-CEM newsletter will disseminate the outcomes of these research initiatives to the entire membership. We encourage all GLF-CEM members to share their research questions and interests in this domain with the KPI Committee to help us populate the list of research questions detailed in Table 2.

Table 1. Selected KPIs

	Industry	Program	Education	Research
Data Availability	Yes	Yes	<i>In Progress</i>	<i>In Progress</i>
Data Selection	1. Productivity ¹ 2. Safety ²	1. No. student applications (CEM or Eng.) ³ 2. Employment rate of students by country ³	<i>In Progress</i>	<i>In Progress</i>

¹Data available at the U.S. Department of Labor, U.S. Bureau of Labor Statistics, Bureau of Economic Research (BER), and South African Forum of Civil Engineering Contractors

²Data available at U.S. Bureau of Labor Statistics, United Nations Statistics Division

³Data available at CEM Department in University of Hong Kong, Purdue University, IIT Madras, Stellenbosch University, and Hong Kong Polytechnic University

Table 2. Examples of Research Questions and Ideas Related to KPIs

Research Questions
1. Feasibility of data analytic methods for construction?
2. How to gather international KPI data in a uniform format that would be useful for data analytics?
3. What type of KPIs, data, data analytics, and results would be useful for construction decision making?
4. What type of data can be collected from normal project documentation through data mining efforts?
5. What type of KPIs, data, data analytics, and results would be useful for identifying industry needs [training, software, documentation (contracts)]?
6. What technologies or capabilities must be developed to gather big data for construction?
7. Can all aspects of construction project performance, including design, construction, and post-construction evaluations, be captured by a comprehensive framework of KPIs that can facilitate performance improvements? <ul style="list-style-type: none"> • If not, what are the aspects of construction project performances that cannot be appropriately evaluated by KPIs, and how may these be addressed? • How best can a viable and useful system of KPIs be developed in a country where KPIs are not used routinely? For example, can a base/core methodology template be developed as a starting point? • Which KPIs are particularly useful to compare across countries; what benefits may be derived; how? • Can we collect, compare, and extract any common, hence potentially replicable success factors, from case studies that demonstrate performance improvements after monitoring certain sets of KPIs?

AN UPDATE ON THE KPI EXERCISE IN INDIA Led by Professor Mohan Kumaraswamy

A 'Construction Industry Development Initiative in India (Ci3 India)' was launched at the first Construction Clients' Roundtable at IIT Madras in October 2015. Having identified and validated critical issues in the Indian construction industry, Action Teams were set up to formulate strategies to address these issues following the second Construction Clients Roundtable in Mumbai in February 2016. Specifically, Action Team 1 was set up for the "identification and formulation of KPIs," which was identified as a critical imperative for industry improvement. One of the key outputs of Ci3 India is, therefore, a core set of KPIs. These outputs are presented in a template of relevant KPIs to be developed and deployed for evaluating and empowering construction industry improvements in India. Notably, these have resonated well with the GLF-CEM initiative.

Objectives of Ci3 India Action Team 1 on KPIs are:

1. To first formulate *project-level* KPIs in stages, for 'building construction' clients, for their own internal use, as well as for use by a 'Benchmarking Club' of leading building construction clients; then, having proven their value through pilot-testing with the above, to formulate complementary sets of KPIs for other industry stakeholders, such as contractors, and other industry sub-sectors, such as highways;
2. To facilitate focused sharing of project information and KPIs to continuously improve *project-level* performance *vis-à-vis* industry averages; and
3. To further extend the above *project-level* KPIs and

formulate, if considered useful after or during the exercises in (2) above:

- *Organizational KPIs* for various types of construction organizations so they may benchmark against organizations of the same type;
- *Overall Industry-Level KPIs* for the Indian Construction Industry to compare with other countries.

Objective 1 has been approached by developing a set of relevant and useful KPIs through a combination of literature review and brainstorming conference-calls. This has been followed by iterative drafts of KPI templates that have been improved with intensive industry feedback for each interim output. Validation of the 'Working Paper' on KPIs was undertaken at a 'Consolidation Roundtable' of construction clients and their consultants in October 2016. Following further fine-tuning and refinements, the final outputs were incorporated into a Draft White Paper on KPIs.

The Draft White Paper on KPIs is available on the Construction Industry Institute India website: www.ci3.in.

Drafts of the White Papers of all Ci3 Action Teams are available at the following web-page: http://www.ci3.in/draft_whitepapers.html.

Clicking on 'Action Team 1 Draft White Paper' will open a zip file containing the main text document and appendices, including one on the 'methodology' (that could be useful for comparative exercises), two versions of the templates (including the base KPI template and a simplified version with less 'fields'), and an additional appendix of overseas examples.

The principal interim output of Action Team 1 is the base suite of 'Suggested KPIs' for Building Clients in India' (Ci3, 2017). Organizations can choose, from this suite, KPIs;

1. For three different types: design phase, construction phase, or business outcomes;

2. For three different stakeholder sets: clients, consultants, and contractors; and
3. From three different levels/categories (i.e. for organizations at a(n):
 - Project/organization-level;
 - Benchmarking club-level to benchmark 'internally' over time or across projects; with other organizations; or with other countries in columns C or D of the KPIs base template; and
 - Industry-level in column E.

This suite is expected to provide a base set of KPIs from which each organization can not only choose the most appropriate form but that could also be modified (i.e., selection of a KPI sub-set that suits specific objectives and priorities).

Columns I and J of the KPIs template will be populated in the next phase by developing realistic 'weighting indicators' in column I that will accommodate special conditions by adjusting a typical KPI value accordingly. Additional 'industry participation' will be sought to collect data for and determine typical (e.g., average) value range under 'normal' conditions for column J.

More information on the development of these KPIs and the draft Construction Clients' Charter developed by another Action Team in this Indian industry improvement initiative is detailed in Kumaraswamy et al. (2017).

REFERENCES

Ci3 (2017). Action Team 1 Draft White Paper, in *Draft White Papers*, Construction Industry Institute India, http://www.ci3.in/draft_whitepapers.html (accessed, 28 Feb. 2017).

Kumaraswamy, M., Mahesh, G., Mahalingam, A. Loganathan, S. and Kalidindi S.N. (2017). "Developing a Clients' Charter and Construction Project KPIs to Direct and Drive Industry Improvements," *Built Environment Project and Asset Management*, Special Issue on "Securing Clients' Objectives throughout Construction Project Life Cycles," edited by Chamila Ramanayaka and Monty Sutrisna, vol. 7, issue 3, pp. 253-270.

CONTACT US:

Professor Thomas Ng
The University of Hong Kong
Honk Kong
tstng@hku.hk

Professor Makarand (Mark) Hastak
Purdue University
United States
hastak@purdue.edu

Professor Mohan Kumaraswamy
The University of Hong Kong
Hong Kong
University of Moratuwa
Sri Lanka
mohan@hku.hk

Professor Jan Wium
Stellenbosch University
South Africa
janw@sun.ac.za

Professor Michail Kagioglou
University of Huddersfield
United Kingdom
M.Kagioglou@hud.ac.uk

Professor Geoffrey Shen
Hong Kong Polytechnic University
Hong Kong
bsqpshen@polyu.edu.hk

2018 GLF-CEM

Stellenbosch, South Africa
MAY 16 - 19



Registration + Fees:

The 2018 Global Leadership Forum for Construction Engineering and Management Programs will be held at the Stellenbosch Institute for Advanced Study in South Africa from May 16 to 19, 2018.

Detailed registration information and fees will be available on the conference webpage in early 2018.

Please visit <http://civeng.sun.ac.za/cpd-courses/> for more information.

2018 Event Program

Wednesday, May 16, 2018

13:30 - 17:00 Lectures by Invited GLF-CEM Members to Students
**All 2018 GLF-CEM registrants are welcome to attend*

Thursday, May 17, 2018

12:00 - 13:30 Registration and Lunch

13:45 - 15:30 Introduction of New Members

15:30 - 17:00 Academic Programs and Teaching Needs:
Can Construction and Project Management be Learned on the Job?

17:30 Welcome Reception

Friday, May 18, 2018

08:00 - 13:00 An Industrial Perspective:
The Effect of Disruptive Technologies on the Future of Construction

- GLF-CEM Members
- Industry Leaders
- Industrial Participants




13:00 - 14:00 Lunch

14:00 - 17:00 GLF-CEM Task Groups Feedback

18:30 Closing Dinner at Stellenbosch Wine Farm

Saturday, May 19, 2018

09:00 - 16:30 Optional Field Trip
**Registrants may bring an accompanied guest for an additional fee*

-  Cape Point via Signal Hill in Cape Town
-  Chapman's Peak Drive: A Public-Private Partnership Project
-  Simon's Town Penguin Colony

WHAT TO EXPECT: Stellenbosch, South Africa

Jan Wium, Ph.D.
Executive Committee Member, GLF-CEM

Professor, Chair in Construction Engineering and Management
Stellenbosch University
South Africa

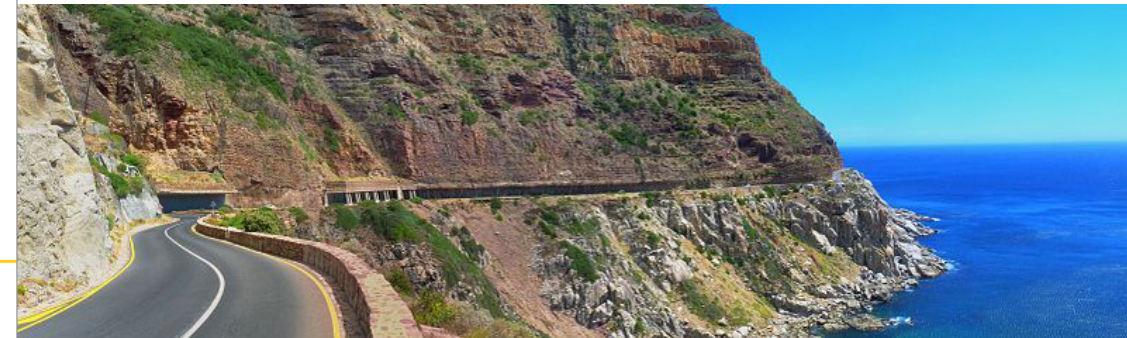
The town of Stellenbosch is located 50 km from Cape Town, easily accessible from worldwide destinations through Cape Town International Airport. It is located at the foot of beautiful mountains and is the ideal location from where to explore the Stellenbosch wine route, in the heart of the Cape Winelands. Stellenbosch and the bordering Jonkershoek Valley are renowned for hiking and cycling routes. It is an ideal location from where to explore the picturesque town of Franschhoek as well as the lovely False Bay beaches.

Stellenbosch is also known as Oak City, named after the oak trees planted by Dutch settlers in the 17th century, which line the streets of the village. The typical Cape Dutch architecture of historic buildings is a special feature of the town.

Stellenbosch University is a leading university in South Africa and forms the heart of the town with a population of 29 000 students and 10 faculties, including Engineering, Science, Law, Arts, and Commerce. The Engineering Faculty has 5 departments of which Civil and Mechanical and Mechatronic Engineering are the largest. Apart from programmes in Structural, Transportation and Water Engineering, the Civil Engineering Department offers a post-graduate programme in Construction Engineering and Management.

The largest percentage of students at Stellenbosch University is South African. There is also a strong international student population, especially in post-graduate programmes. Many students are from Africa, but there are also smaller numbers from other continents. The University sport clubs are among the best in the country, and the town and sporting facilities are popular training venues for international athletes.

Visitors can find accommodation in guest houses and boutique hotels where they are warmly welcomed. These are within close proximity of amenities, the university, and the town centre.



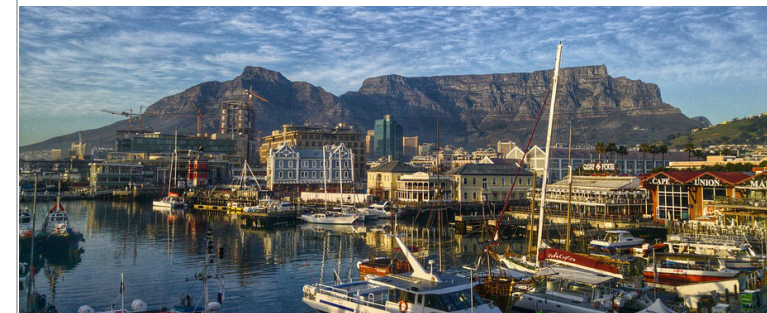
Top Left:
Chapman's Peak Drive
Image by Mwguelink [CC BY-SA 3.0] via Wikimedia Commons.



Middle Left:
Simon's Town Penguin Colony
Image by Bgabel [CC BY-SA 3.0] via Wikimedia Commons.



Middle Right:
Stellenbosch Vineyard
Image by Deon Maritz [CC BY 2.0] via Wikimedia Commons.



Bottom Left:
Cape Town
Image by HPBotha via pixabay.



Bottom Right:
Stellenbosch University

For more information visit <http://www.stellenbosch.travel/>.

Meet Our New Members

GLF-CEM 2017



Carlos T. Formoso
Professor

Civil Engineering
Universidade Federal do Rio Grande do Sul
Porto Alegre, Brazil
formoso@ufrgs.br

Carlos T. Formoso is a Professor in Construction Management at the Federal University of Rio Grande do Sul (UFRGS), Brazil. Currently, he is the head of the Graduate Program in Construction and Infrastructure at UFRGS. He has been a senior advisor of the Brazilian Ministry of the Cities for the National Program for Quality and Productivity in the Habitat for eleven years. Also, Professor Formoso is a member of the editorial boards of seven academic journals and has been an active member of the International Group for Lean Construction for more than 20 years. His main research interests are production planning and control, performance measurement, safety management, social housing and value management.

First Attendance: 2017 GLF-CEM in Los Angeles, USA



Eric Scheepbouwer
Senior Lecturer

Civil Engineering and Natural Resources
University of Canterbury
Christchurch, New Zealand
eric.scheepbouwer@canterbury.ac.nz

Dr. Eric Scheepbouwer is a senior lecturer from the Department of Civil and Natural Resources Engineering at the University of Canterbury in New Zealand. He leads the Construction Management postgraduate program, which is at present the largest endorsed specialization in the College of Engineering. He spent 15 years working as a professional

First Attendance: 2017 GLF-CEM in Los Angeles, USA

Kristen MacAskill
Senior Programme Manager
Department of Engineering
University of Cambridge
Cambridge, United Kingdom
cem.director@cam.ac.uk



Dr. Kristen MacAskill leads the Construction Engineering Masters programme at the Laing O'Rourke Centre for Construction Engineering and Technology. She originally trained as a civil engineer and then completed a Masters degree in Engineering Management in New Zealand. She has also obtained an MPhil in Engineering for Sustainable Development and a PhD from Cambridge University's Engineering Department. Before returning to a role in academia, Kristen has worked as a consulting engineer in both the water and transport sectors. Her experience covers various areas of infrastructure development, including: strategic level options assessment, post-earthquake damage assessment, infrastructure design, project management and sustainability assessment. She teaches sustainable development and her core research focus is in the areas of infrastructure resilience, disaster risk reduction and post-disaster recovery.

First Attendance: 2017 GLF-CEM in Los Angeles, USA

engineer with MWH (now part of Stantec) and as a project manager with Ernst & Young in the Netherlands. He teaches risk management, cost engineering and procurement at the postgraduate level and coordinates the project and asset management course that is part of the civil and natural resources engineering undergraduate program. His research is focused on asset management, costing, cost management, lifecycle analysis and project management. He collaborates with academics and professionals from the construction industry worldwide. He has participated in funded research into complex project management, infrastructure asset management issues, and collaborative contractual agreements like partnering and alliancing.



Dehzi Li
Associate Professor, Head
Dept. of Construction and Real Estate
Southeast University
Nanjing City, China
njldz@seu.edu.cn

Dr. Li Dezhi has research interests and expertise in sustainable construction, smart city, urban renewal, and affordable housing. As a principal investigator, he has led several research projects funded by a variety of organizations, such as the National Natural Science Foundation of China and the Chinese Ministry of Education. He has published over 60 scholarly papers in Chinese and international journals, such as the ASCE's Journal of Management in Engineering, Building and Environment, Ecological Indicators, and Habitat International. He also contributes reviews of leading international journals, such as Land Use Policy, Urban Studies, Social Indicators Research, Environmental Engineering Science and Resources, Conservation and Recycling.

First Attendance: 2016 GLF-CEM in Beijing, China



Wilson W.S. Lu
Associate Professor
Real Estate and Construction
University of Hong Kong
Hong Kong
wilsonlu@hku.hk

Dr. Wilson Lu has a computer science background and shifted to construction management in 1999. His research is mainly focused on construction management with three clear directions: Construction Informatics, International Construction, and Construction Waste Management. He is the winner of the HKU Outstanding Young Researcher Award (2014-2015) for his excellence achievement of scholarship. He is the Associate Dean of Research in the FoA. Dr Lu is also steering the development of iLab, which is an urban big data hub under the umbrella of the HKUrbanLab, the research arm of the FoA at HKU. iLab facilitates multi-dimensional and multi-disciplinary urban big data collection, storage, analysis, and presentation to inform all sorts of decision-making throughout the lifecycle of urban development. His recent research and consultancy projects fostered in iLab include how Building Information Modelling (BIM) can be used for construction cost management, smart construction, logistic and supply chain management, and facility management.

First Attendance: 2016 GLF-CEM in Beijing, China

Interested in GLF-CEM MEMBERSHIP?

Individual membership is open to persons who are involved in construction engineering and management programs. Institutional and practitioner memberships are also available.

Applicants for membership must have demonstrated a record of involvement in a construction engineering management educational program, preferably as a full professor or as an administrator.

Click here to begin your membership application today.

For additional information or questions, please contact:

Simaan M. AbouRizk
Distinguished University Professor
GLF-CEM Chair
abourizk@ualberta.ca

Our Members



Since 2011, the GLF-CEM has been open to persons involved in construction engineering and management programs around the world. To date, our membership is comprised of

79 members from 61 institutions in 19 countries.

AUSTRALIA

- Curtin University
Xiangyu Wang
- Queensland University of Technology
Martin Skitmore

BRAZIL

- Universidade Federal do Rio Grande do Sul
Carlos Formoso

CANADA

- Concordia University
Osama Moselhi

- École de Technologie Supérieure
Adel Francis

CHINA

- University of Alberta
Mohamed Al-Hussein
Aminah Robinson Fayek
Simaan AbouRizk

- University of British Columbia
Thomas Froese

- University of Calgary
Janaka Ruwanpura

- University of Waterloo
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CHILE

- Universidad Técnica Federico Santa María
Leonhard Bernold

CHINA

- Chongqing University
Guiwen Liu
Liyin Shen

- Dalian University of Technology
Zhongfu Li

- Harbin Institute of Technology
Xiaolong Xue

- Shanghai Jiao Tong University
Saixing Zeng

- Shenzhen University
Jiayuan Wang

- Southeast University
Dezhi Li

- Tianjin University
Junna Meng

- Tongji University
Guangbin Wang

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- University of Stuttgart
Fritz Berner

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- University of Hong Kong
Mohan Kumaraswamy
Thomas Ng
Wilson Lu

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- Indian Institute of Technology, Delhi
K.C. Iyer

- Indian Institute of Technology, Madras
Satyanarayana Kalidindi
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NETHERLANDS

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Andreas Hartmann

NEW ZEALAND

- University of Canterbury
Eric Scheepbouwer

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- Warsaw University of Technology
Aleksander Nicał

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- Stellenbosch University
Jan Wium

SOUTH KOREA

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William J. Rasdorf

- Pennsylvania State University
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- Polytechnic Institute of NYU
Fletcher Griffis

- Purdue University
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- University of Cincinnati
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- University of Colorado Boulder
Keith Molenaar
Paul Goodrum

- University of Dayton
Eddy Rojas

- University of Hawaii
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- University of Illinois
Khaled A. El-Rayes

- University of Nevada
David Ashley

- University of Southern California
Lucio Soibelman

- University of Texas at Austin
Carlos Caldas
Wayne A. Crew
William O'Brien

- University of Wisconsin-Madison
Awad Hanna
Jeffrey Russell

- Vanderbilt University
Sanjiv Gokhale

- Virginia Polytechnic Institute and State University
Jesus M. de la Garza
Mike Vorster

Focus on Programs

HOLE SCHOOL OF CONSTRUCTION ENGINEERING AT THE UNIVERSITY OF ALBERTA

Since its establishment in 1990, the Hole School of Construction Engineering (HSCE; known at the time as the Construction Engineering and Management Group) has helped the construction industry in Alberta improve its project performance and enhance its competitive position by delivering cutting-edge tools and practices to construction owners, contractors, and tradespeople. This synergy between research and implementation, recognized as a defining characteristic of the HSCE, has been made possible by 5 essential factors:

Knowledge and technology translation for industry. The thrust of the research at the HSCE has been toward the practical application of theoretical knowledge to address the needs of industry. Key to the successful delivery of this research has been the ability to strike the appropriate balance between industry need and academic requirements through the integration of practical and theoretical knowledge.

Effective dissemination of research findings. The HSCE has created a number of venues for knowledge exchange and dissemination of timely research findings. In particular, the HSCE is host to the Innovation in Construction Forum (established in 1994) and the Modular and Offsite Construction Summit (established in 2012). These annual conferences bring together a diverse group of key stakeholders from across the construction industry to highlight the latest advances in construction research and practice. The HSCE has also contributed to the Construction Owners Association of Alberta Best Practices Conference, which fosters the exchange of information and ideas to achieve safe, effective, timely, and productive project execution in Alberta.

FACULTY

Dr. Simaan AbouRizk is a Distinguished University Professor and Tier 1 Canada Research Chair in Operations Simulation.

Dr. Aminah Robinson Fayek is an Industrial Research Chair in Strategic Construction Modeling and Delivery and a Ledcor Professor in Construction Engineering.

Dr. Mohamed Al-Hussein is a Professor and an Industrial Research Chair in the Industrialization of Building Construction.

Dr. Yasser Mohamed is a Professor in Construction Engineering and Management.

Dr. Ming Lu is an Associate Professor in Construction Engineering and Management.

Robust partnerships with supporting institutions. The HSCE has been defined by the strong relationships linking the Natural Sciences and Engineering Research Council of Canada (NSERC; funding agency), the University of Alberta, and the over 80 industry partners that support this work. NSERC's unique approach leverages industry funding to support collaborative research through the Industrial Research Chair and the Collaborative Research and Development programs. Notably, the HSCE has hosted three IRC programs jointly funded by NSERC and the construction industry. The University of Alberta and the Faculty of Engineering have also demonstrated commitment to research, reinvesting the overhead costs deducted from incoming research funding and providing additional financial and administrative support.

Culture of openness to academic–industry collaboration. HSCE researchers have found in Alberta a progressive construction industry defined by openness to collaboration with academia. Industry partner representatives serve on advisory boards and provide learning opportunities through guest lectures, panels, and site visits. They also mentor graduate students, champion the development of research activities at partner companies, and oversee the transfer of the research results into company operations. Uptake of the research results by industry partners, in turn, provides HSCE faculty members with invaluable opportunities for the testing and validation of developed tools and methods. The vitality and strength of the academia–industry collaboration are also

evidenced by the large number of publications arising from HSCE research that are coauthored by industry partner personnel.

Talent training. Through its advanced, industrially relevant research and training programs for graduate students, the HSCE produces highly qualified personnel who go on to fill high-level positions in both academia and industry. To date, the HSCE has graduated well over 200 thesis-based graduate students. In addition to receiving instruction from internationally-renowned experts in the field of construction engineering and management, these students are afforded the opportunity to actively engage with industry to solve real-world problems. These experiences allow the students to directly observe organization processes and collect and analyze data, implement and validate their designed methods in case studies, and forge relationships that lead to career opportunities and avenues for future collaboration.

The success and distinctiveness of the HSCE's research and educational programs are a consequence of a development of strong industrial research partnerships focused on advancing research, student education, and overall practice. This collaborative approach has garnered widespread support from numerous funding agencies, policy makers, and industrial practitioners and remains a primary example of the achievements that can arise from effective partnerships with industry.

This article is adapted from "The University of Alberta's Hole School of Construction Engineering: 25 Years of Impact and Innovation" by Simaan M. AbouRizk, Aminah Robinson Fayek, and Mohamed Al-Hussein published in the *Journal of Construction Engineering and Management*, volume 4, issue 9 (September 2017). It is reprinted with permission from the American Society of Civil Engineers.

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