

CURRICULUM VITAE

S. M. ABOURIZK, PhD, PEng, FRSC, FCAE, NAC

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With the goal of optimizing construction processes, Dr. AbouRizk's research has refined theoretical advancements to simulation science, developing innovative information technologies to model, analyze, and enhance decision-making.

CURRENT POSITION

- University of Alberta, Department of Civil & Environmental Engineering (1990)
- Distinguished University Professor, Hole School of Construction Engineering (2015)
 - Professor, Hole School of Construction Engineering (1996)
 - Canada Research Chair (Tier 1) in Operations Simulation (2002-2016)
 - NSERC Senior Industrial Research Chair in Construction Engineering & Management (1997–2016)

PROFESSIONAL HONOURS

- Canadian Academy of Engineering Member (2015)
- Royal Society of Canada Fellow (2013)
- National Academy of Construction Member (2012)
- Canadian Society for Civil Engineering Fellow (2010)

PROFESSIONAL SOCIETIES

- Canadian Society for Civil Engineering (CSCE)
- American Society of Civil Engineers (ASCE)
- The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

EDUCATION

- **Doctorate of Philosophy in Civil Engineering - Construction Engineering and Management**
Purdue University, West Lafayette, Indiana; 1990
Thesis: Input Modeling for Construction Simulation
- **Master of Science in Civil Engineering - Construction Engineering and Management**
Georgia Institute of Technology, Atlanta, Georgia; 1985
Thesis: Sensitivity Analysis of Construction Operations
- **Bachelor of Civil Engineering (Honours)**
Georgia Institute of Technology, Atlanta, Georgia; 1984

SUMMARY OF ACADEMIC ACHIEVEMENTS

- Publications
 - ♦ Journal Publications: **133** (Appendix I)
 - ♦ Conference Publications: **229** (Appendix II)
- Books, Theses, Reports, Guides & Manuals: **32** (Appendix III)
- Graduate Students (Appendix IV)
 - ♦ **PhD: 36**
 - ♦ **MSc: 67**
- Invited Presentations/Panels/Keynotes: **61**
- Computer Programs: **12**
- Technologies & Patents: **1**
- Conferences & Conference Sessions Organized & Chaired: **17**

SUMMARY OF QUALIFICATIONS

Dr. Simaan AbouRizk has significantly advanced the field of construction engineering, particularly construction simulation modeling and analysis. He is internationally acknowledged as a leader in project planning, productivity improvement, constructability, risk analysis and uncertainty modeling. His research represents a critical touchstone in the discipline, and he is a leader in his ability to transfer research and development into construction practice.

Dr. AbouRizk is active in consulting projects and is a registered professional engineer in the province of Alberta and is active in many professional organizations.

He received his PhD in construction engineering and management from Purdue University in 1990, and joined the University of Alberta as an Assistant Professor in November of that year. He was appointed to the Alberta Construction Industry Professorship as a tenured Associate Professor in January 1994 and promoted to a full Professor in July 1996.

Dr. AbouRizk is currently in his 2nd consecutive term as a Tier 1 Canada Research Chair in Operation Simulation at the Department of Civil and Environmental Engineering at the University of Alberta. Canada Research Chairs are awarded to *“experienced researchers whose peers acknowledge them as world leaders in their field.”* He is currently in his 4th term as an NSERC Industrial Research Chair in Construction Engineering and Management. NSERC Industrial Research Chairs are awarded to *“researchers of international stature who can bring an innovative perspective to the university in carrying out and managing research, and training researchers. They should be recognized experts in their field, and have extensive research experience in universities, industry or government.”*

Dr. AbouRizk's research accomplishments have been recognized through numerous awards including the prestigious Peurifoy Construction Research Award presented by the American Society of Civil Engineers for his *“contribution to construction simulation theory and practice”*; the E.W.R. Steacie Memorial Fellowship, awarded *“to outstanding scientists and engineers who [...] enjoy a reputation for original research”* from the Natural Sciences and Engineering Research Council in recognition of *“the quality of his research in the field of civil engineering”*; the Killam Annual Professorship *“in recognition of outstanding scholarship and significant contributions to the community and the University of Alberta”*; the Walter Shanley Award presented by the Canadian Society for Civil Engineering for his *“outstanding contributions to the field of construction engineering in Canada”*; the E. Whitman Wright Award *“in recognition of his outstanding contributions to the development of computer applications in civil engineering”*; and the Thomas Fitch Rowland Prize for *“best paper in the Journal of Construction Engineering and Management in 2003.”* Dr. AbouRizk was also elected as Fellow of the Canadian Society for Civil Engineering (CSCE), and inducted into the National Academy of Construction (USA) as the first Canadian member, followed by induction as a Fellow of the Royal Society of Canada, and the Canadian Academy of Engineering.

Dr. AbouRizk has authored nearly three hundred publications in the area of construction engineering and management, and is also the co-author of two textbooks (Project Management –Techniques in Planning and Control of Construction Projects, and Productivity in Construction).

He has supervised thirty-five doctoral students and sixty-six masters students (thesis-based) who currently work in Canada, the USA, and internationally. He was Chair of the Construction Research Council of the American Society of Civil Engineers in 2000, and serves on numerous professional boards. He was the specialty editor for “quantitative methods” for the Journal of Construction Engineering and Management of ASCE and an associate editor (construction) of the Canadian Journal of Civil Engineering.

ACADEMIC POSITIONS

- **Distinguished University Professor in Construction Engineering and Management**, Department of Civil and Environmental Engineering, University of Alberta (July 2015).
- **Professor in Construction Engineering and Management**, Department of Civil and Environmental Engineering, University of Alberta. July 1996 – to date (received tenure July 1994)
- **Associate Professor**, Department of Civil and Environmental Engineering, University of Alberta (July 1993 - June 1996)
- **Assistant Professor**, Department of Civil and Environmental Engineering, University of Alberta (Nov. 1990 - July 1993)
- **Research and Teaching Assistant**, Division of Construction Engineering and Management, Purdue University. (Aug. 1988 - Nov. 1990)
- **Part-time Instructor**, Civil Engineering Department, American University of Beirut (Sep. 1985 - Dec. 1987)
- **Research Assistant**, Georgia Institute of Technology, Atlanta Georgia (May 1984 -April 1985)

RESEARCH AWARDS

- **NSERC Industrial Research Chair in Construction Engineering and Management**. Currently in 4th Term (2012-2016) Industrial Research Chairs are awarded for a term of 5 years. (Term 1 (1997-2001), Term 2 (2002-2006), Term 3 (2007-2011).)
- **Canada Research Chair in Operations Simulation**. Currently in 2nd Term (2009-2016). Canada Research Chairs are awarded for a term of 7 years (Term 1 2002-2009).

ACADEMIC AWARDS

- **Peurifoy Construction Research Award** (2008) American Society of Civil Engineers
- **ASCE Thomas Fitch Rowland Prize** (2003) Construction Institute of ASCE
- **E. Whitman Wright Award** (2002) Canadian Society for Civil Engineering
- **E.W.R. Steacie Fellowship** (2001) Natural Sciences and Engineering Research Council
- **Walter Shanly Award** (2001) Canadian Society for Civil Engineering
- **Killam Award for Excellence and Scholarship** (1998) University of Alberta
- **Alberta Construction Industry Professorship** (1994-1997) University of Alberta
- **Magoon Teaching Award** (1990) Purdue University

EDITORIAL and COMMITTEE MEMBERSHIP

- **Editorial Board Member** for the International Journal of Architecture, Engineering and Construction
- **Editorial Board Member** for the Visualization in Engineering Journal
- **Associate Editor**, Construction, for the Canadian Journal of Civil Engineering (2002- 2007)
- **Specialty Area Editor**, Quantitative Methods, for the Journal of Construction Engineering and Management (2004- 2007)
- **Co-Director** of the Construction Research Institute of Canada, Edmonton, Alberta (June 1999 – August 2000) Member of the CRIC executive board (1998-2004).
- **Chair, Construction Research Council** (CRC) (2000-2001). Elected to the executive committee in October 98 as secretary 98-99 and served as a Vice Chair in 99-00. CRC is a working committee of the Construction Institute of ASCE.
- **Co-Chair**, Third Construction Specialty Conference of the CSCE, June 99.

NATIONAL PROFESSIONAL COMMITTEES

- Canadian Society of Civil Engineering - Construction Division Executive Committee
- Canadian Society of Civil Engineering - Computer Applications in Construction Sub-Committee
- Canadian Society of Civil Engineering - Research Sub-Committee
- American Society of Civil Engineering - Construction Research Council

INDUSTRY EXPERIENCE

- **Co-Director of Draxware Inc.** (2008-to date) www.draxware.com. Co-founder of the UofA spin-off company. A software development and implementation firm.
- **Co-Director of I.C.E.S. Inc.** Edmonton, Alberta (Jan 1994 – Dec. 1997). I.C.E.S. provided construction consulting services and engaged in the development of portable aggregate production equipment. Dr. AbouRizk was a founder, co-director and secretary/treasurer at I.C.E.S.
- **Honorary President and Senior Advisor** of SMA Consulting Ltd. (Jan 1997 – to date) www.smaconsulting.ca. Co-founder of the company. Samples of projects Dr. AbouRizk was directly responsible for are detailed in the section titled “Industry Experience”.

The following are samples of projects completed by Dr. AbouRizk over the past 10 years.

- 1) **Risk Analysis and Management for Construction Projects.** Dr. AbouRizk has applied a risk analysis and management process, which he developed, to a number of capital projects in Canada. The following is a sample of projects which have been recently completed:
 - a) North LRT expansion (approximate project value \$750 million). AECOM and City of Edmonton. 2007-2013. Risk analysis, value analysis, constructability, project delivery, project control.
 - b) Calgary Trail. 23rd Avenue Interchange (approximate project value \$100 million). ISL and City of Edmonton. 2004-2005. Risk analysis and constructability reviews.
 - c) Water Treatment Plant. City of Winnipeg (approximate project value \$200 million).UMA Engineering and the City of Winnipeg. 2004-2005. Risk Analysis.
 - d) Enhanced Primary Treatment Facility. Goldbar Wastewater Treatment Plant (approximate project value \$40 million). Stantec and City of Edmonton. 2004.
 - e) West Edmonton Sanitary Servicing Sewer W12 (Project includes a Siphon, tunnels through the North Saskatchewan River, pumpstations, and Real Time Control --Approx. value \$40 Million). Associated Engineering and the City of Edmonton. 2003-2005. Risk Analysis, Constructability Reviews and Production Planning.
 - f) South Light Rail Transit expansion project (Phase 1A). Stantec/ City of Edmonton Transportation Department (approximate project value \$100 Million). 2002. Risk Analysis.
 - g) South East Sanitary Trunk tunnel construction (approximate project value \$10 million). City of Edmonton Design Construction Unit. 2001. Risk Analysis and Production Planning.
 - h) North East Sanitary Trunk tunnel construction (approximate project value \$10 million). City of Edmonton Design Construction Unit 2001. Risk Analysis and Production Planning.
 - i) Tertiary Treatment Facility – Bioreactor upgrade (approximate project value \$20 million). Goldbar Wastewater Treatment Plant. 2000. Risk Analysis.
 - j) Yellowhead – 156 Street Interchange (approximate project value \$50 million). Transportation and Streets – City of Edmonton. 2000. Risk Analysis.
- 2) **City of Edmonton - Office of the Infrastructure.** Development of tools and techniques for assessing risk associated with the infrastructure gap. The approach utilized feeds directly into the Infrastructure Strategy developed by the City of Edmonton. 2003-2005.
- 3) **City of Edmonton - Drainage and Construction Branches.** Rossdale Tunnel claim for deficient design and productivity loss on behalf of the owner (City of Edmonton). Project value approx. \$10 million. Dr.

AbouRizk co-designed the strategy for the claim with P. Dozzi, led the quantification of the damages, managed the project and represented the City in negotiations with the surety company. 1996 - 1997.

- 4) **City of Edmonton - Solid Waste Management Branch.** Material Recovery Facility, consultant to the advisory committee for the tendering and selection process. Introduced the use of the Analytical Hierarchy Process for evaluation of potential bidders given a defined set of criteria and objectives. 1996-1997.
 - 5) **Waiward Steel Fabricators Ltd.** Delay Claim for the “Elmendorf Medical Facility” in Anchorage Alaska. Dr. AbouRizk worked on this claim with Peter Dozzi, work included quantification of the damages preparation of the claim for WSF. 1995 - 1996.
 - 6) **Office of the Auditor General - City of Edmonton.** Project Management and Cost Estimating Audit of the City of Edmonton Building, Drainage, Waste Management, and Transportation departments for the Auditor General. Over \$250 million of annual capital expenditure programs were reviewed. A complete assessment and audit of the practices and results of the various departments in project management and cost estimation was done. The project involved review of common acceptable practices, review of existing ones, derivation of accuracy being achieved, productivity planning and comparison to acceptable standards. 1997-1998.
 - 7) **Syncrude Mining Division.** Designing and implementing models for planning the maintenance infrastructure for a proposed expansion –Aurora Mine. Simulation models were developed to aid in decision-making regarding the maintenance facilities for the Aurora Mine. 1997.
 - 8) **Construction Branch - City of Edmonton.** Evaluation of the Information and Data Management Systems for the Construction Branch, Public Works. An in-depth evaluation of an implemented computer information system for project costing, planning and control was undertaken both from a business process perspective and a technical database management implementation perspective. 1996 - 1997.
 - 9) **PCL Constructors Inc.** Productivity assessment and prediction of labour productivity for future projects with PCL Construction Management Inc., Edmonton Alberta. 1996.
 - 10) **Department of Asset Management and Public Works - City of Edmonton.** Implementation of a risk analysis methodology for Design Construction unit, Drainage Branch. 1999.
 - 11) **Miscellaneous Claims:** A number of claims stemming from complexity (Peace River Bridge – Alberta), delay and changed conditions (Forest Tunnel – City of Edmonton, and inflation adjustment (El-Halabi Contracting Co –Beirut Lebanon) 1990-1999.
 - 12) **Waiward Steel Fabricators Ltd.** Assessment and evaluation of a scheduling framework for the fabrication shop. 1996.
 - 13) **National Research Council - Institute for Research in Construction.** Developed methods for productivity assessment, analysis and improvement. Documented in a professional publication titled “productivity in Construction” which is directed towards the professional construction community. 1994.
 - 14) **Transportation and Streets Engineering Department - City of Edmonton.** Development of risk analysis framework, contingency strategy and cost estimating accuracy benchmarks. 1998 –1999.
- **Quantity Surveyor & Construction Engineer.** June 1985 - December 1987. Worked for an electrical subcontractor in the Beirut area. Responsibilities included supervising and directing estimating and pricing procedures, assisting in the bidding process, preparing requests for change orders, scheduling, and cost control.

ACADEMIC RESEARCH CONTRIBUTIONS (Appendix I, II & III)

The author of nearly three hundred publications in the area of construction engineering and management, Dr. AbouRizk is also the co-author of two textbooks (Project Management –Techniques in Planning and Control of Construction Projects, and Productivity in Construction). He is widely known in the academic construction community for his research in computer simulation and its applications in construction productivity improvement, and risk analysis. His contributions include a number of modeling and simulation methods, which have been implemented in several construction companies.

- **Papers Published in Refereed Journals** –Appendix I
- **Papers Published in Conference Proceedings** - Appendix II
- **Book/Book Chapters, Theses, Reports, Guides and Manuals** - Appendix III
- **Computer Programs (completed to date):**

Dr. AbouRizk has developed a number of computer software solutions that are in use in academia and industry. His two research labs in simulation, and integrated software system for construction are credited with the simulation software Symphony, COSYE, BetaFit and SuperBid in use by many researchers worldwide. The integrated software systems lab is responsible for complete information systems for a number of major construction firms such as Waiward Steel. Those developments are in daily use for decision support at the firms providing improved productivity for the company and a medium for experimentation for the research team. The following is a sample of those developments:

1. **Simphony** (and Simphony.NET, August 2006-to date) - A platform for creating special purpose simulation tools and for developing complex simulation models. (Completed under the NSERC Chair with S. Hague). The platform is used by over 50 organizations and institutions worldwide and has over 200 users.
2. **COSYE** (Release 1, August 2006-to date)–a new generation platform that is based on the High Level Architecture combining the abilities of Simphony with modular, hierarchical and parallel simulation. This new generation toolkit will provide a venue for building large scale and complex simulation models with ability for distributed simulation, real-time interface, advanced discrete-event, continuous and other analytical simulations in a package that is optimized for construction applications.
3. **SuperBid** (educational) - A Stochastic Bidding Game for Construction Management.
4. **CRUISER** – A program for the simulation and analysis of gravel pit mines (Completed under the NSERC Chair with Mr. D. Hajjar).
5. **CSD** – Construction Site Dewatering System for Decision Support, (completed under the NSERC Chair with Mr. Xu).
6. **AP2-Earth** - a simulation program for the analysis of heavy earth-moving operations in construction and surface mining. (Completed under the NSERC Chair with Mr. D. Hajjar).
7. **SIDES, BetaFit, and VIBES** – a collection of programs in the public domain that enable the fitting of beta distributions using traditional and new techniques including non-linear optimization, fuzzy set theory and interactive graphics.
8. **Smartest** - an estimating system for construction projects (completed under the NSERC Chair with Mr. S. Hague).
9. **MTrack** – (Inland Construction) An equipment maintenance tracking program.
10. **SimFit** – A software program for fitting unimodal statistical distributions (completed under the NSERC Chair with M. Allouche).
11. Waiward Steel information system, with three areas of focus:

- a) **Human Resource Management** – (Human resource manager, office timesheet system, safety record system, shop supervisor, and shop timesheet system programs) These programs track employee hours, provide payroll with a forum to leave messages for employees, facilitate shop safety record management, and collect data for productivity studies.
 - b) **Document Management** – (Job quality reports and MTR manager programs) Used for data entry of welding inspection, fitting inspection, and mill test reports and the generation of various other reports and cross-referencing.
 - c) **Steel Tracking** – (Barcode generator, division management system, shipping bill manager, drawing tracking system, and steel tracking system programs) Barcodes are printed and used to track steel and generate shipping bills. Drawings and changes to the drawings are also tracked.
12. **ICMS** – (Inland Construction) An integrated construction management system, made up of the following three components: estimating, cost control, and data acquisition.

▪ **Technologies and Patents:**

1. Rashwan M.M. and AbouRizk, S. "Reclamation of Leftover Concrete." U.S. Patent No 5766524 issue 6/16/98.

▪ **Conferences and Conference Sessions Organized and Chaired:**

1. Annual Canadian Construction Research Forum/Innovation in Construction FORUM. University of Alberta. 1994-2014. Overall Chair and Organizer.
2. CONVR (Construction Applications of Virtual Reality) 2015. Organizing Committee and International Advisory Committee Member.
3. Global Leadership Forum for Construction Engineering and Management 2014. Chair and Organizer.
4. ISARC 2013 (30th International Symposium on Automation and Robotics in Construction and Mining).
5. Winter Simulation Conference Dec 2012. "New Methods in Manufacturing Simulation: Simulation for Manufacturing Control Support Track"
6. Third Canadian Construction Specialty Conference, CSCE 1999 - Regina. Technical program Co-Chair.
7. Winter Simulation Conference Dec. 1999. "Construction Engineering and Project Management". Organized the first full track in construction composed of 5 sessions and 15 papers.
8. Winter Simulation Conference Dec. 1998. "Construction Engineering" Mini Track composed of 3 sessions and 9 papers.
9. Winter Simulation Conference Dec. 1997. "Simulation in Construction".
10. Canadian Construction Research Foundation Workshop, July 1997. Organized and Chaired.
11. Winter Simulation Conference Dec. 1996. "Construction Simulation".
12. Alberta Roadbuilders and Heavy Construction Association Annual Conference 1996 - "Current Research in Construction".
13. Second Congress on Computing in Civil Engineering - ASCE - June 1995 "Simulation Applications in Construction".
14. Winter Simulation Conference Dec. 1995. "Modeling and Simulating Complex Systems".
15. First Canadian Construction Congress CSCE - June 1995 "Simulation in Construction".
16. Winter Simulation Conference Dec. 1994. "Construction Simulation Methodologies" Two sessions.
17. Winter Simulation Conference Dec. 1992. "Simulation Applications in Construction".

RESEARCH PROJECT SUMMARY

Dr. AbouRizk has been successful on over 10 major research grants totaling more than \$11 Million the majority of which come from the main federal granting agency in Canada (NSERC). Those awards included prestigious grants including the E.W.R. Steacie award, the NSERC Industrial Research Chairs, and the Canada Research Chairs programs.

- **“Enhancing the Competitiveness of the Construction Industry in Alberta”**. NSERC Industrial Research Chair Program for a 5 year term 2012-2016. NSERC and a consortium of construction companies (\$2,000,000 total funding). In this project Dr. AbouRizk leads a major research effort in construction engineering and management in collaboration with 16 major construction organizations whose volume of work ranges from \$25 million per year to over \$2.5 billion per year. During its 4th term, the IRC research program will focus on enhancing the competitiveness of partner companies and the Alberta construction industry at large, through research that utilizes simulation models for studying and understanding issues related to competitiveness, and through deployment of tools that can support improvement.
- **“Synthetic Environments for Construction”**. NSERC Industrial Research Chair Program for a 5 year term 2007-2011. NSERC and a consortium of construction companies (\$1,500,000 total funding). In this project Dr. AbouRizk leads a major research effort in construction engineering and management in collaboration with 20 major construction organizations whose volume of work ranges from \$25 million per year to over \$2.5 billion per year. The project involves the investigation and development of a new generation of planning tools for the construction industry based on distributed simulation framework.
- **“Development of Synthetic Environments for Specific Construction Applications”**. Collaborative Research and Development Grant for a 5 year term 2007-2011. NSERC and a consortium of construction companies (\$1,600,000 total funding). In this project Dr. AbouRizk leads a major research effort in construction engineering and management with Drs. Al-Hussein and Mohamed to investigate methods for applying a new generation of simulation models called synthetic environments to industrial construction, tunneling, and steel erection.
- **“Advancements in Operation Simulation”**. Canada Research Chair (\$1,400,000 spread over 7 years; 2003-2008). In this project, Dr. AbouRizk is exploring innovative information technologies for modeling, analyzing and optimizing operations related to construction, mining and other associated industries. His team will develop powerful and flexible simulation software tools that allow engineers to study underlying system behavior and experiment with various approaches to improve or radically change system performance without interfering in its ongoing operation. Additionally, the team will identify where, and which, process changes are needed and collaborate with a consortium of regional, national and international firms to determine how best to transfer this knowledge to industry.
- **“Production-based Framework for Construction Planning and Execution”**. NSERC/Alberta Construction Industry Chair and a collaborative research and development project. NSERC Industrial Research Chair Program for a 5 year term. NSERC and Consortium of Construction Companies (\$3,200,000 total funding), University of Alberta (\$300,000 –overhead reinvested in program) equally spread over 5 years (2002-2006). In this project Dr. AbouRizk leads a major research effort in construction engineering and management in collaboration with 20 major construction organizations whose volume of work ranges from \$25 million per year to over \$2.5 billion per year. The research program undertaken by the Chair includes research into new technologies for productivity improvement, simulation modeling and analysis, project planning and control, research and technology transfer, and construction information systems implementations.
- **“Virtual Environment for Experimentation and Control”**, NSERC, and Waiward Steel. August 2005-August 2008. \$360,000. In this project Dr. AbouRizk undertakes the development of a virtual environment for steel fabrication where production control is monitored and controlled through simulation models and intelligent agents. A Co-generation facility at the company serves as a corner stone for exploring simulation-based fully automated control systems.
- **“Modelling uncertainty in construction processes”** (\$40,000 per year) NSERC Discovery Grant 2002-2006.

- **“Modelling uncertainty in construction processes”** (\$48,000 per year) NSERC Discovery Grant 2007-2011.
- **“An integrated hybrid modelling framework for construction project delivery”** (\$54,000 per year) NSERC Discovery Grant 2012-2017.
- **“Productivity improvement in drainage operations”** with Dr. M. Al-Hussein (\$160,000 2005 - 2006). Contract with the City of Edmonton.
- **“Framework for Production Optimization”** (\$180,000). NSERC Steacie Award, April 2002 – March 2004
- **Life-Cycle Costs Analysis and Decision Support System for City of Edmonton Building Facilities.** City of Edmonton. Jan 2001 – Dec 2003 (\$245,813)
- **Construction Simulation. NSERC/Alberta Construction Industry Chair.** NSERC, Consortium of Construction Companies, University of Alberta (\$1,000,000) 1997-2001. The research program was the corner stone of the current research activity of Dr. AbouRizk. It was instrumental in building the critical mass required for a major endeavor in the area of computer simulation in construction, and in developing new technologies to enhance construction productivity.
- **Productivity Improvement for Construction.** NSERC Collaborative Research and Development Grant, Consortium of Construction Companies (\$400,000 spread over a 3-year period 1994-1997).
- **Labour productivity modeling for steel fabrication and erection projects.** NSERC Collaborative Research and Development Grant (\$140,000 spread over a 2-year period 1999-2001), Waiward Steel Fabricators Ltd. (\$60,000 spread over a 2-year period 1999-2001).
- **Design and Development of an Integrated Decision Support System for Planning, Scheduling and Control of Steel Projects.** Waiward Steel Fabricators Ltd. Research Grant (\$32,700, and one full-time engineer, 1996-1997).
- **An Investigation of the Usability of Artificial Intelligence and Statistical Modeling in Productivity Analysis.** PCL Constructors Inc. (\$50,500, 1995-1996)
- **Analysis of Quality Assurance Testing Methods.** Alberta Transportation and Utilities (\$10,000; 1997)
- **Development of a Concrete Reclamation System. Lafarge Canada, (39,500, 1996).**
- **Hierarchical Simulation Modeling for Construction Planning. Application of Advanced Decision Support Systems in Construction.** NSERC research grant (\$80,000, 1994-1997).
- **An Investigation of the Use of Systems Simulation in Planning and Controlling Construction Projects.** NSERC. (\$51,000, 1990-1993).
- **Application of Systems Simulation and Expert Systems in Resolving Construction Disputes.** Central Research Fund, \$10,000.
- **Investigating the Effects of Grouting Masonry Concrete Blocks with Recycled Aggregate Concrete on the Thermal Resistance of Wall Assemblies.** (With Dr. S. Rashwan and Prof. P. Dozzi). University of Alberta, R. M. Hardy Engineering Enrichment Fund. \$11,000.
- **Surface Condition Indices, Road Segmentation, Chip Sealing Analysis.** Alberta Transportation and Utilities (with Dr. A. El Assaly) 1999. \$34,448.
- **Deterioration Prediction Models,** (with Drs. El Assaly and Ariaratnam). Alberta Transportation and Utilities. 1999, \$39,540.
- **Other Projects:**
 - ♦ Equipment Grant. NSERC (2003) \$70,000
 - ♦ Equipment Management System. Inland Construction. \$12,000, 1999.
 - ♦ Decision Support for Project Control. North American Construction Group, \$10,000, 1999.
 - ♦ Computerized Analysis of Construction Data For Productivity Improvement. U of A Central Research Fund \$14,500.
 - ♦ Computer Simulation of Construction Bidding. Endowed Fund for Research and Education in Construction Engineering and Management \$6,000.

- ♦ An Investigation of the Use of NN in Estimating Pipeline Productivity. O.J. Pipelines (\$7,800. Period of May 95-Aug. 95)
- ♦ Silicon Graphics Workstation Equipment. NSERC equipment grant (\$22,968 -April 1994). This grant covered the computer infrastructure required for advanced computer modeling and other projects.
- ♦ JSpace Software. Awarded by Jacobs Technologies Inc. \$30,000 (March 1995). This gift was provided by the company to enhance the computing infrastructure available in the program.
- ♦ An Investigation of the Applicability of Object Oriented Modeling and Rule-Based Expert System in the Inspection of Houses. Alberta Municipal Affairs \$29,800.
- ♦ An Expert System for the Diagnosis of Roofing Systems. Funding Agency, IRAP/ Becker Engineering Group \$8,200.

CURRENT INDUSTRIAL COLLABORATORS

Alberco Construction Ltd.	Mr. Ron Simonsmeier
E Construction Ltd.	Mr. Douglas Ellett
Finning (Canada)	Mr. Drew Godley
Flint Energy Services Ltd.	Ms. Candice Davies
Graham Group	Mr. William Koehn
JV Driver Projects Inc.	Mr. Joel Lukaseder
KBR Canada	Mr. Hal Williams
Ledcor Group	Mr. Rod Wales
North American Construction Group	Mr. Michael Freeman
PCL Industrial Constructors Inc.	Mr. Ian Johnston / Mr. Rick Hermann
PME Inc.	Mr. Gil Brulotte
Standard General Inc.	Mr. Chris Greenwood
The City of Edmonton - Infrastructure Services	Mr. Siri Fernando
The City of Edmonton - Transportation Services	Mr. Wayne Mandryk
Waiward Steel Fabricators Ltd.	Mr. Jim Kanerva

TRAINING OF HIGHLY QUALIFIED PERSONNEL (*Appendix IV*)

The University of Alberta graduate program in Construction Engineering and Management commenced in September of 1991. Dr. AbouRizk was instrumental in initiating the program, which is now comprised of hundreds of PhD, MSc and MEng students and a number of part-time and special students. Please refer to Appendix IV for a selective list of students who received training in the program under the supervision of Dr. AbouRizk as research assistants.

SAMPLE EXERNAL PHD EXAMINATIONS

- Concordia University, Department of Building, Civil and Environmental Engineering, Hani S.H. Alzraiee, PhD, "Hybrid Simulation for Construction Operations", August 2013
- University of Waterloo, Department of Civil Engineering, Mahdi Safa, PhD, "An Advanced Construction Supply Nexus Model", April 2013
- The Hong Kong Polytechnic University, Xuesong Shen, PhD, Surveying-Computing Integrated Approach to Tracking a Tunnel Boring Machine During Microtunneling, 2010
- Concordia University, Department of Civil and Building Engineering (Name Withheld) 2009
- Concordia University, Department of Civil and Building Engineering. (Name withheld). 2004
- University of Calgary, Department of Civil Engineering. (Name withheld) 2003
- Concordia University, Centre for Building Studies. Khaled El Rayes, PhD. "Optimized Scheduling for Repetitive Construction Projects" Sept 1997.
- University of Waterloo, Department of Civil Engineering, Tony Kiani, PhD. March 1998.
- University of British Columbia, Department of Civil Engineering, M. Battikha, PhD. "A Computer-Based System for Construction Quality Management with Application to Highway Pavements", February 2000.

INVITED KEYNOTE ADDRESSES

1. EURO: Tun 2013—3rd International Conference on Computational Methods in Tunneling and Subsurface Engineering, April 17-19, 2013, Bochum Germany
2. 11th Annual International Conference on Construction Applications of Virtual Reality 2011, Bauhaus-Universität Weimar, Germany, November 3-4, 2011
3. "The Role of Simulation in Construction Engineering and Management", Peurifoy Construction Research Address, ASCE Annual Civil Engineering Conference, Nov 6-8, 2009.
4. "Construction Synthetic Environments." 9th International Conference on Construction Application of Virtual Reality 2009, Sydney, Australia, November 5-6, 2009
5. "The NSERC Industrial Research Chair Program: A University-Industry Collaborative Model." International Conference on Construction Research Funding in the XXI Century, University of Illinois at Urbana-Champaign, July 9, 2009.
6. "The COSYE Model for Construction Synthetic Environments: A Framework for Highly Integrated Simulation Development." International Conference on Construction Engineering and Management/Project Management, Jeju, South Korea, May 27-30, 2009
7. "Simulation in Construction." The 4th Tsinghua International Forum for Doctoral Candidates. Tsinghua University, Beijing, China, October 16, 2008.
8. "Modeling and Simulating Construction Operations – Theory and Practice." CSCE Annual Conference, Yellowknife, NWT, June 7-8, 2007.
9. "Simulation-based Innovation, Research and Technology Transfer in Construction." 11 ASIM Conferences on Simulation in Production and Logistics, Kassel, Germany, September 26, 2006.

INVITED PRESENTATIONS AND PANELS

1. Invited Presentation, "Overview of Research in Construction Engineering and Management at the University of Alberta." Canadian Society for Senior Engineers Lunch Meeting on October 16, 2014.
2. Invited Presentation, "Risk Evaluation for Underground Construction." Consortium for Engineered Trenchless Technologies, University of Alberta's Pilot-tube and Guided Boring Workshop on October 7, 2014.
3. Invited Presentation, "Evolution of Simulation Tools and Methods at the University of Alberta," University of Michigan, April 2014.
4. Invited Presentation, "Successful Collaboration with Industry," New Faculty Forum, University of Alberta, December 2013.
5. Invited Panelist, "Shaping the Future of the Professional Workforce," Engineering and Construction Contracting Association Conference, September 2013.
6. Invited Presentation, University of Waterloo April 2013.
7. Invited Panelist, Construction Research Congress 2010, Young Faculty Panel, Banff, Alberta, May 8-10, 2010.
8. Invited Address: "Simulation in Construction: Past, Present and Future." Department of Civil Engineering, University of New South Wales, November 6, 2009.
9. Invited Address: Yonsei University, Seoul, South Korea, May 25, 2009.
10. Invited Address. "Simulation in Construction Engineering and Management" CSCE-HKB, The Hong Kong Polytechnic University, The Hong Kong University of Science and Technology, Oct 21-24, 2008.
11. Invited Presentation: "Developing a Municipal Infrastructure Risk Assessment Methodology," with Konrad Siu. Western Canada - INFRASTRUCTURE MANAGEMENT. INSIGHT conference. Hyatt Regency Calgary Hotel, Dec. 5, 2005, Calgary Alberta.
12. Invited Presentation: "Challenges facing the construction industry in Alberta –design consultants issues." Consulting Engineers of Alberta. Ramada Inn June 13, 2005.
13. "Challenges Facing the Construction Industry in Alberta –Constructors Issues". Alberta Road Builders and Heavy Construction Association. Ramada Inn June 21, 2005.
14. "Creating a Roadmap for success" Construction Research Retreat, Jasper Park Lodge, AB, August 2005.

15. "Best practices for procuring construction services". Asset Management and Public Works Annual Retreat. February 23, 2005.
16. "Best practices for procuring construction services". City of Edmonton –Engineering Services. Dec., 2005.
17. "Modelling and Simulation in Construction and Mining" Urban Infrastructure Expert Panel. Caterpillar Inc. Peoria Illinois, Oct. 13, 2004.
18. "Overview of Research in the Hole School of Construction Engineering", Construction Owners Association of Alberta, June 2005.
19. "Industry Leader Panel", Managing Risk in a Changing Mining Environment, June 27, 2005. University of Alberta. Edmonton Alberta.
20. Alberta Association of Colleges and Technical Institutes Innovation Workshop, "A Pragmatic Approach to Achieving Academic Goals". Calgary, AB, March 2004.
21. 11th Annual Canadian Construction Research Forum, "Risk Assessment for Capital Construction Projects: What Engineers Should Know." Edmonton, AB, August 2004.
22. Interdisciplinary Environmental Lecture Series. "The Role of the Construction Industry in Greenhouse Gas Emissions Reduction." University of Alberta, February 12, 2004
23. University of Calgary "Simulation in Construction - Vision and Realities", Calgary Alberta Feb 6, 2003.
24. University of British Columbia "Optimal Construction Project Planning". Vancouver, B.C. Feb 25, 2003
25. University of Bath/ BCIT Residential workshop for the MSc Construction Management program "Simulation in Construction –Practice and Theory". Campus. B.C. Feb 25, 2003.
26. ISL Staff Development Seminar. "Risk Analysis for Projects" Dalton Conference Centre, Greenwood Inn. February 20, 2003
27. American Association of Cost Engineers (AACE) Edmonton Chapter "Risk and Uncertainty in Construction" Inaugural Presentation. Edmonton Alberta.
28. Engineering Frameworks Workshop. U.S. Construction Engineering Laboratory and the University of British Columbia. "Process Simulation in Construction". June 2001. Vancouver B.C.
29. City of Edmonton, Department of Transportation and Streets. "An overview of Risk Identification and Management". January 2000. Edmonton, Alberta.
30. City of Edmonton, Office of the Infrastructure. "Risk associated with the Infrastructure in Edmonton", May 2000. Edmonton, Alberta.
31. 6th Canadian Construction Research Forum. "Simulation". Oct. 1999, Edmonton.
32. City of Edmonton, Department of Public Works.
"Risk Analysis in Drainage Construction". June 1998. Edmonton, Alberta.
33. 5th Canadian Construction Research Forum.
"Construction Research Collaborations: Experiences at the University of Alberta". Oct. 1998, Edmonton.
34. City of Edmonton, Department of Public Works.
"Computer Applications in Construction Estimating". November 1996. Edmonton.
35. Lafarge Canada.
"Research in the Concrete Production Industry". March 1997, Edmonton.
36. Lafarge Canada. "Simulation of Aggregate production Using CRUISER". September 1996, Edmonton.
37. Center for Building Studies, Concordia University. "Framework for Applying Simulation in Construction". Sept 25, 1997. Montreal, Quebec.
38. Ontario Construction Users Council. "Research in Construction Engineering and Management. Toronto Ontario. October 24, 1997.
39. Canadian Society for Engineering Management, Edmonton Chapter. "Managing Projects in the Computer Age". Edmonton Alberta. October 28, 1997.
40. Alberta Road builders and Heavy Construction Association. "Research Needs in Road Construction", Banff, Alberta. Nov. 22, 1997.
41. Canadian Society for Engineering Management, Edmonton Chapter. "Managing Projects in the Information Age". October 28, 1997.
42. Association of Professional Engineers, Geologists and Geophysicists of Alberta. "Excellence in Education Address", November 7, 1996.
43. City of Edmonton Public Works Construction Branch. "Estimating Systems and Processes", Sept. 1996.

44. Association of Professional Engineers, Geologists and Geophysicists of Alberta. "Knowledge-Based Systems in Engineering", Mar. 19, 1996.
45. University of British Columbia. "Advanced Project Analysis using Simulation". October 5, 1995.
46. Project Management Institute - Alberta Section. "Simulation and Project Management". May 22, 1996.
47. Construction Owners Association of Alberta, "An Overview of Research Activity in Construction". Dec. 1994.
48. Canadian Society of Civil Engineers (CSCE), Edmonton Chapter. "Applications of Simulation in Construction". September 23, 1993.
49. Canadian Bar Association, Construction Law Sub-section - Northern. "Risk Analysis and Contingency Planning in Construction". May 25, 1993.
50. University of Michigan, Civil Engineering Department. "Probabilistic Simulation Studies of Construction Processes". Presented to the faculty and graduate students of the Civil Engineering Department. September 26, 1990.
51. University of Alberta, Civil Engineering Department. "Simulation of Construction Operations". Presented to the faculty and graduate students of the Civil Engineering Department. May 23, 1990.
52. Louisiana Tech. University. "Statistical Aspects of Simulation". Presented to the faculty and graduate students of the Civil Engineering Department. May 17, 1990.

TEACHING EXPERIENCE

University of Alberta

Department of Civil & Environmental Engineering

Edmonton, Alberta, Canada

Courses taught for the period: November 1, 1990 - to date

- **CIV.E. 303: *Project Management*.** Covers basic topics of project management including contractual agreements and contract administration, estimating, planning, control, claims and dispute resolution.
- **CIV.E. 401/391: *Construction Material*.** Covers the properties of materials used in construction. Concrete mix design, properties of fresh and hardened concrete, lab testing of concrete and cement specimens.
- **CIV.E. 403: *Planning, Scheduling and Control*.** Covers planning construction projects, CPM, PERT, precedence scheduling, cost control, time-cost integration, resource leveling, time-cost tradeoff procedures, using the computer for scheduling and control. Programs such as PRIMAVERA are introduced.
- **CIV.E. 409: *Construction Methods*.** Principles of building, heavy and bridge construction, wood and formwork design, stability during construction, economics of equipment selection, movement of material on construction sites, safety, and constructability issues. Students work in teams on a design project.
- **CIV.E. 503: *Operation Research*.** An introductory course to operations research techniques as applied to Civil Engineering.
- **CIV.E. 506: *Project Estimating and Cost Control*.** Covers a wide array of project management topics including estimating, cost and schedule control and integrated systems. The course was revised in 1994 to "Project estimating, planning and control."
- **CIV.E. 601: *Project Management for Construction*.** Introduction to project management, value engineering, constructability reviews, and risk analysis.
- **CIV.E. 603: *Computer Applications and Information Management in Construction*.** Application of computers to the planning, organization, and control of construction projects; computer aided process control; strategies for software and hardware organization; computer aided information management in construction projects.
- **CIV.E. 605: *Advanced Project Planning and Control*.** Advanced techniques used for project planning and control, applications of operations research to construction management, case studies and applications.
- **CIV.E. 606: *Design and Analysis of Construction Operations*.** Application of discrete event process simulation to the design and analysis of construction systems; introduction to CYCLONE and SLAM II simulation languages; emphasis

on modeling construction technologies including heavy and highway construction, building construction and underground tunneling and trenchless excavation.

- **CIV.E. 609: *Project Management.*** Covers broad areas in construction management including decision and risk analysis, scheduling, planning and control, range estimating, integrated project management systems, constructability and human factors.
- **CIV.E. 653: *Readings in Project Management.*** Covers decision support systems and their applications in construction.
- **CIV.E. 709: *Advanced Topics in Construction.***

Purdue University

Department of Civil Engineering, Division of Construction Engineering and Management

West Lafayette, Indiana

January 1989 - May 1990

Part-time Instructor at the Division of Construction Engineering and Management. Courses taught:

- **CE 597Z: *Design of Construction Operations.***
- **CE 497A: *Construction Management.***
- **CE 597O: *Computer Applications in Construction.***
- **CNE 190: *Introduction to Construction Management.***

August 1988 - December 1988

Teaching Assistant at the Division of Construction Engineering and Management for:

- **CE 521: *Analysis of Construction Management Systems.***
- **CE 221: *Construction Plans and Estimates.***

American University of Beirut (AUB)

Department of Civil Engineering, Faculty of Engineering and Architecture, Beirut, Lebanon

Instructor, September 1985 - December 1987. Courses Taught:

- **CE 109: *Specifications and Quantity Surveying.***
- **CE 118: *Computer Applications in Engineering.***
- **ME 107: *Engineering Management I.***
- **ME 117: *Engineering Management II.***
- **AS 036: *Introduction to Numerical Analysis.***
- **CE 011: *Statics.***
- **CE 053: *Materials of Construction.***

Contribution to Course Development

Dr. AbouRizk designed and developed the contents and outlines for all of the first versions of the courses in the Construction Engineering and Management discipline at the inception of the program at the University of Alberta. Some of them have been redeveloped following the addition of new faculty to the group. Below is a listing of those he developed and those he has redesigned.

- CIV.E. 303: Project Management
- CIV.E. 406: Construction Estimating, Planning and Control
- CIV.E. 409: Construction Methods
- CIV.E. 601: Project Management for Construction
- CIV.E. 602: Construction Administration
- CIV.E. 603: Computer Applications and Information Management in Construction
- CIV.E. 604: Construction Law
- CIV.E. 605: Advanced Project Planning and Control

- CIV.E. 606: Design and Analysis of Construction Operations
- CIV.E. 607: Work Improvement Studies
- CIV.E. 608: Construction Engineering
- CIV.E. 653: Readings in Project Management
- CIV.E. 654: Expert Systems and Automation in Construction
- CIV.E. 709: Advanced Topics in Construction

Fellowships and Assistantships

- Research Assistantship at Purdue University; January 1988 - September 1988.
- Teaching Assistantship at Purdue University; August 1988 - November 1990.
- Recipient of the 1989 David Ross Summer Grant, School of Civil Engineering, Purdue University.

APPENDIX I

PAPERS PUBLISHED IN REFEREED JOURNALS

1. Li, D., Petre, C., Kerr, C., Joseph, T., AbouRizk, S., and Mohmaed, Y. (Accepted Jan. 11, 2016). "Modelling hauler movement in a distributed simulation of earthmoving operations." *International Journal of Service and Computing Oriented Manufacturing*.
2. Nassar, N., and AbouRizk, S. (Accepted Dec. 8, 2015). "Introduction to techniques for resolving project performance contradictions." *Journal of Construction Engineering and Management*.
3. Siu, M., Lu, M., AbouRizk, S., and Tidder, V. (2016). "Quantitative Assessment of Budget Sufficiency and Resource Utilization for Resource-Constrained Project Schedules." *Journal of Construction Engineering and Management*, 10.1061/(ASCE)CO.1943-7862.0001106, 04016003.
4. RazaviAlavi, S., and AbouRizk, S. (2015). "A hybrid simulation approach for quantitatively analyzing the impact of facility size on construction projects." *Automation in Construction*, 60, 39-48. doi:10.1016/j.autcon.2015.09.006
5. Siu, M. F., Lu, M., and AbouRizk, S. M. (2015). "Resource supply and demand matching scheduling approach for construction workforce planning." *Journal of Construction Engineering and Management*. [http://dx.doi.org/10.1061/\(ASCE\)CO.1943-7862.0001027](http://dx.doi.org/10.1061/(ASCE)CO.1943-7862.0001027)
6. Alanjari, P., RazaviAlavi, S., and AbouRizk, S. (2015). "Hybrid Genetic Algorithm-simulation Optimization Method for Planning Dynamic Layout of Material Yard Laydown." *Journal of Construction Engineering and Management*. [http://dx.doi.org/10.1061/\(ASCE\)CO.1943-7862.0001017](http://dx.doi.org/10.1061/(ASCE)CO.1943-7862.0001017)
7. Siu, M. F., Lu, M., and AbouRizk, S. M. (2015). "Zero-one programming approach to determine optimum resource supply under time dependent resource constraint." *Journal of Computing in Civil Engineering*. [http://dx.doi.org/10.1061/\(ASCE\)CP.1943-5487.0000498](http://dx.doi.org/10.1061/(ASCE)CP.1943-5487.0000498)
8. AbouRizk, S., Hague, S., Ekyalimpa, R. Newstead, S. (2014). "Symphony: A Next Generation Simulation Modeling Environment for the Construction Domain." *Journal of Simulation*. doi: 10.1057/jos.2014.33.
9. Morley, D., Lu, M., AbouRizk, S. (2014). "Identification of Invariant Average Weighted Haul Distance to Simplify Earthmoving Simulation Modeling in Planning Site Grading Operations." *Journal of Construction Engineering and Management*, 140(12). [http://dx.doi.org/10.1061/\(ASCE\)CO.1943-7862.0000907](http://dx.doi.org/10.1061/(ASCE)CO.1943-7862.0000907)
10. Corona-Suarez, G. A., AbouRizk, S., Karapetrovic, S. (2014). "Simulation-based Fuzzy Logic Approach to Assessing the Effect of Project Quality Management on Construction Performance." *Journal of Quality and Reliability Engineering*. <http://dx.doi.org/10.1155/2014/203427>.
11. Nassar, N. and AbouRizk, S. (2014). "A Practical Application for Integrated Performance Measurement of Construction Projects." *Journal of Management in Engineering*, 30(6). [http://dx.doi.org/10.1061/\(ASCE\)ME.1943-5479.0000287](http://dx.doi.org/10.1061/(ASCE)ME.1943-5479.0000287)
12. Hadiuzzaman, M., Zhang, Y., Qiu, T., Lu, M., AbouRizk, S. (2013). "Modeling the impact of work-zone traffic flows upon concrete construction: a high level architecture based simulation framework." *Canadian Journal of Civil Engineering*, 41(2): 144-153, doi: 10.1139/cjce-2013-0103.
13. Hammad, A., AbouRizk, S., Mohamed, Y. (2013). "Application of KDD Techniques to Extract Useful Knowledge from Labor Resources Data in Industrial Construction Projects." *Journal of Management in Engineering*, 30(6), doi: 10.1061/(ASCE)ME.1943-5479.0000280.
14. Alanjari, P., RazaviAlavi, S., AbouRizk, S. (2014). "A simulation-based approach for material yard laydown planning." *Automation in Construction*, 40, 1-8, <http://dx.doi.org/10.1016/j.autcon.2013.12.010>.
15. Hammad, A. and AbouRizk, S. (2014). "Knowledge Discovery in Data: A Case Study." *Journal of Computer and Communications*, 2, 1-28, doi:10.4236/jcc.2014.25001.
16. Al-Battaineh, H., and AbouRizk, S. (2013). "Optimization of Intermediate-Level Budget Allocation Using a Genetic Algorithm." *International Journal of Architecture, Engineering and Construction*, 2(3), 144-157.
17. Ekyalimpa, R., AbouRizk, S., Mohamed, Y., SABA, F. (2013). "A Prototype for Project Management Game Development Using High Level Architecture." *International Journal of Simulation and Process Modeling*, 9(3):131-145. doi: 10.1504/IJSPM.2014.064384
18. Shahin A., AbouRizk S., Mohamed Y., Fernando S. (2013). "Simulation Modeling of Weather-Sensitive Tunnelling Construction Activities Subject to Cold Weather." *Canadian Journal of Civil Engineering*, 41(1): 48-55. doi: 10.1139/cjce-2013-0087.
19. Shahin, A., AbouRizk, S. M., and Mohamed, Y. (2013). "A weather generator for use in construction simulation models." *International Journal of Architecture, Engineering and Construction*, 2(2): 73-87.
20. Siu, M. F., Lu, M., AbouRizk, S. M. (2013). "Combining Photogrammetry and Robotic Total Stations to Obtain Dimensional Measurements of Temporary Facilities in Construction Field." *Visualization in Engineering*, 1(4), 1-15.
21. Taghaddos, H., Hermann, U., AbouRizk, S., and Mohamed, Y. (2012). "A Simulation-Based Multi-Agent Approach for Scheduling Modular Construction." *J. Comput. Civ. Eng.*, 28(2), 263-174. doi: 10.1061/(ASCE)CP.1943-5487.0000262
22. AbouRizk, S. (2013). "Closure to "Role of Simulation in Construction Engineering and Management" by Simaan AbouRizk." *J. Constr. Eng. Manage.*, 139(2), 252-253.

23. Al-Bataineh, M., AbouRizk, S., and Parkis, H. (2013). "Using Simulation to Plan Tunnel Construction." *J. Constr. Eng. Manage.*, 139(5), 564–571.
24. Alvanchi, A., Lee, S., AbouRizk, S. (2012). "Dynamics of Workforce Skill Evolution in Construction Projects." *Canadian Journal of Civil Engineering*, 39(9): 1005-1017.
25. Azimi, R., Lee, S., and AbouRizk, S. (2012). "Applying Basic Control Theory Principles to Project Control: A Case Study of Off-Site Construction Shops." *J. Comput. Civ. Eng.*, 26(6), 681–690.
26. Alvanchi, A., Azimi, R., Lee, S., AbouRizk, S., Zubick, P. (2012). "Off-site Construction Planning Using Discrete Event Simulation." *Journal of Architectural Engineering*, 18(2), 114-122.
27. PAN, W., Lee, S., AbouRizk, S. (2011). "Estimating gas emissions from construction equipment: Using special purpose simulation." *The International Journal of the Constructed Environment*, 1(2): 155-174.
28. Zhang, Y., AbouRizk, S., Xie, H., Moghani, E. (2012). "Design and Implementation of Loose-Coupling Visualization Components in a Distributed Construction Simulation Environment with HLA." *Computing in Civil Engineering*, 26(2) 151-269.
29. Alvanchi, A., Lee, S., AbouRizk, S. (2012). "Dynamics of Working Hours in Construction." *Journal of Construction Engineering and Management*, 137(1), 66-77.
30. Azimi, R., Lee, S., AbouRizk, S. (2011). "Intelligent Look-Ahead Scheduling for Structural Steel Fabrication Projects." *International Journal on Advances in Software*. 4(1 & 2), 207-217, ISSN: 1942-2628
31. Xie, Hua, AbouRizk, S.M., Zou, J. (2011). "A Quantitative Method of Updating Cost Contingency throughout Project Execution." *Journal of Construction Engineering and Management*, 138(6), 759-766.
32. Taghaddos, H., AbouRizk, S., Mohamed, Y., Hermann, U. (2011). "Simulation Based Auction Protocol for Resource Scheduling Problems." *Journal of Construction Engineering and Management*, 138(1), 31-42.
33. AbouRizk, S., Halpin, D., Mohamed, Y., Hermann, U. (2011). "Research in modelling and simulation for improving construction engineering operations." *Journal of Construction Engineering and Management*, 137(10), 348-352.
34. Ebrahimi, Y., AbouRizk, S., Fernando, S., and Mohamed, Y. (2011). "Simulation Modeling and Sensitivity Analysis of a Tunneling Construction Project's Supply Chain." *Engineering, Construction and Architectural Management*, 18(5): 462-480.
35. Ebrahimi, Y., AbouRizk, S., Fernando, S., and Mohamed, Y. (2011). "SSCS: A Simulation Toolkit to Model the Supply Chain of Construction Projects." *Simulation - Transactions of the Society for Modeling and Simulation International*, 87(8): 657-667
36. Shahin, A., AbouRizk, S.M., Mohamed, Y. (2011). "Modeling Weather-Sensitive Construction Activity Using Simulation." *Journal of Construction Engineering and Management*, 137(3): 238-246.
37. Alvanchi, A., Lee, S., AbouRizk, S. (2011). "Modeling Framework and Architecture of Hybrid System Dynamics and Discrete Event Simulation for Construction." *Computer-Aided Civil and Infrastructure Engineering*, 26(2):77-91.
38. Azimi, R., AbouRizk, S., Lee, S., Alvanchi, A. (2011). "A Framework for Automated and Integrated Project Monitoring and Control System in the Fabrication Phase of Steel Construction Projects." *Automation in Construction*, 20(1): 88-97.
39. AbouRizk, S. (2010). "Role of Simulation in Construction Engineering and Management." *ASCE Journal of Construction Engineering and Management*, 136(10),1140-1153
40. Tian, X., Mohamed, Y., and AbouRizk, S. (2010). "Simulation-Based Aggregate Planning of Batch Plant Operations." *Canadian Journal of Civil Engineering*. 37(10), 1277-1288.
41. Ahn C., Lee S., Peña-Mora F., AbouRizk S. (2010). "Toward Environmentally Sustainable Construction Processes, The U.S. and Canada's Perspective on Energy Consumption and GHG/CAP Emissions." *Sustainability*, 2(1), 354-370.
42. Boskers, N., and AbouRizk, S. (2010). "SPS Tools for Capital Project Planning Analysis." *International Journal of Simulation and Process Modeling*, 6(1), 58-66.
43. Shaheen, A., Robinson Fayek, A. and AbouRizk, S. (2009). "Methodology for Integrating Fuzzy Expert Systems and Discrete Event Simulation in Construction Engineering." *Canadian Journal of Civil Engineering*, 36(9),1478-1490
44. Wang, P., AbouRizk, S. (2009). "Large-scale simulation modeling system for industrial construction." *Canadian Journal of Civil Engineering*, 36(9), 1517-1529.
45. Wang, P., Mohamed, Y., AbouRizk, S., and Rawa, A.R.T. (2009). "Flow Production of Pipe Spool Fabrication: Simulation to Support Implementation of Lean Technique." *Journal of Construction Engineering Management, ASCE*, 135(10), 1027-1038.
46. Zhang, X., Mao, X., AbouRizk, S.M. (2009). "Developing a Knowledge Management System for Improved Value Engineering Practices in the Construction Industry." *Journal of Automation in Construction, Elsevier*, 18(6),777-789
47. Lu, Y. and AbouRizk, S. (2009). "Automated Box-Jenkins Forecasting Modeling." *Journal of Automation in Construction, Elsevier*, 18(5), 547-558.
48. Song, L., Mohamed, Y. and AbouRizk, S. (2009). "Early Contractor Involvement in Design and its Impact on Construction Schedule Performance." *Journal of Management in Engineering, ASCE*, 25(1), 12-20.
49. Zhou, F., AbouRizk, S., and AL-Battaineh, H. (2009). "Optimisation of Construction Site Layout Using a Hybrid Simulation-Based System." *Simulation Practice and Theory, Elsevier*, 17(2), 348-363.
50. Mao, X., Zhang, X., and AbouRizk, S. (2009). "Enhancing Value Engineering Process by Incorporating Inventive Problem-Solving Techniques." *Journal of Construction Engineering and Management, ASCE*, 135(5), 416-434.
51. Song, L. and AbouRizk, S. (2008). "Measuring and Modeling Labor Productivity Using Historical Data." *Journal of Construction Engineering and Management, ASCE*, 134(10), 786-794.

52. Ourdev, I., Xie, H., and AbouRizk, S. (2008). "An Intelligent Agent Approach to Adaptive Project Management." *Tsinghua Science and Technology*, 13(S1), 121-125.
53. Fan, H., AbouRizk, S., Kim, H. and Zaiane, O (2008). "Assessing Residual Value of Heavy Construction Equipment Using Predictive Data Mining Model." *Journal of Computing in Civil Engineering*, ASCE, 22(3), 181-191.
54. Fan, H., Kim, H., AbouRizk, S., Han, S.H. (2008). "Decision Support in Construction Equipment Management Using a Nonparametric Outlier Mining Algorithm." *Expert Systems with Applications*, 34(3), 1974-1982.
55. Mohamed, Y., Borrego, D., Francisco, L., Al-Hussein, M., AbouRizk, S. (2007) "Simulation-based scheduling of module assembly yards: Case study." *Engineering, Construction, and Architectural Management* 14(3), 293-311.
56. Shaheen, A., Fayek, A., and AbouRizk, S. (2007) "Fuzzy Numbers in Cost Range Estimating." *Journal of Construction Engineering and Management*, ASCE, 133(4), 325-334.
57. Mao, X., Zhang, X., and AbouRizk, S. (2007) "Generalized Solutions for Su-Field Analysis." *The TRIZ Journal*. August 2007. Available online <http://www.triz-journal.com/archives/2007/08/03/>
58. Appleton, B., Niaz, M. AbouRizk, S.M. and Al-Hussein, M., (2006) "Priority Rating Logic Simulation Model for Tower Crane Operations Management." *Journal of Construction Research*. 7(2), 133-147.
59. AbouRizk, S., Allouche, M and Siu, K (2006) "Standardized Risk Analysis for Infrastructure Assessment." *Infrastructure Reporting and Asset Management*, ASCE, 131-140.
60. Sharma, V., Al-Hussein, M., and AbouRizk, S. (2006). "Residential Construction Lot Grading Approval Process Optimization: Case Study of City of Edmonton." *Journal of Construction Engineering and Management*. 132(12), 1225-1233.
61. Van Tol, A., and AbouRizk, S. (2006). "Simulation Modeling Decision Support Through Belief Networks." *Simulation Modeling Practice and Theory*, 14(5), 614-640.
62. Song, L., and AbouRizk, S. (2006). "Virtual Shop Model for Experimental Planning of Steel Fabrication Projects." *Journal of Computing in Civil Engineering*, ASCE, 20(5), 308-316.
63. Zhang, X. Q., and AbouRizk, S. M. (2006). "Determining a reasonable concession period for private sector provision of public works and services." *Canadian Journal of Civil Engineering*, 33(5), 622-631
64. Mohamed, Y., and AbouRizk, S. (2006). "A Hybrid Approach for Developing Special Purpose Simulation Tools." *Canadian Journal of Civil Engineering*. 33(12), 1505-1515.
65. Chung, T., Mohamed, Y. and AbouRizk, S. (2006) "Bayesian Updating Application into Simulation in the NEST Tunnel Project." *Journal of Construction Engineering and Management*, ASCE, 132(8), 882-894.
66. Song, L., Wang, P., and AbouRizk, S.M. (2006) "A Virtual Shop Modeling system for Industrial Fabrication Shops." *Simulation Modelling Practice and Theory*. 14(5), 649-662.
67. Agbulos A., Mohamed Y., Al-Hussein M., AbouRizk S., and Roesch J. (2006) "Application of Lean Concepts and Simulation Analysis to Improve Efficiency of Drainage Operations." *Journal of Construction Engineering and Management*, ASCE, 132(3), 291-299.
68. Ruwanpura, J., AbouRizk, S., and Allouche, M. (2005). "An analytical method to predict soil types for underground construction operations." *Journal of Civil Engineering and Environmental Systems*, 22(1), 49-69.
69. Mohamed, Y., and AbouRizk, S. (2005). "Framework for Building Intelligent Simulation Models of Construction Operations." *Journal of Computing in Civil Engineering* ASCE, 19(3), 277-291.
70. Song, L., Al-Battaineh, H., and AbouRizk, S. (2005). "Modeling uncertainty with an integrated simulation system." *Canadian Journal of Civil Engineering*, 32(3), 533-542.
71. Mohamed, Y., and AbouRizk, S. (2005). "Application of the Theory of Inventive Problem Solving (TRIZ) in Tunnel Construction." *Journal of Construction Engineering and Management*, ASCE, 131(10), 1099-1108.
72. Mohamed, Y., AbouRizk, S. (2005). "Technical Knowledge Consolidation Using TRIZ." *Journal of Construction Engineering and Management*, 131(9), 993-1001.
73. Song, L., AbouRizk, S. (2005). "Quantifying Engineering Project Scope for Productivity Management." *Journal of Construction Engineering and Management*, 131(3), 1-8.
74. AbouRizk, S., Ruwanpura, J., Allouche, M. (2004). "Analytical Methods to Reduce Uncertainty in Tunnel Construction Projects." *Canadian Journal of Civil Engineering*, 31(2), 345-360.
75. Farrar, J., AbouRizk, S., Mao, X. (2004). "Generic Implementation of Lean Concepts." *Journal of Lean Construction*, 1(1), 1-23.
76. Fernando, S., Van Tol, A., AbouRizk, S. (2003) "Boring Deeper into Tunnelling Simulation." *Technical Note, Journal of Canadian Tunnelling*, 2003: 181-187.
77. Salem, O., El-Assaly, E., and AbouRizk, S. (2003). "Performance Prediction Models of Pavement Highway Network in Alberta." *Transportation Research Board*, TRB 2003.
78. Salem, O., AbouRizk, S., and Ariaratnam, S. (2003). "Risk-Based Life-Cycle Costing of Infrastructure Rehabilitation and Construction Alternatives." *Journal of Infrastructure Systems*, ASCE, 9(1), 6-15.
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APPENDIX II

PAPERS PUBLISHED IN CONFERENCE PROCEEDINGS

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2. Zhang, L., and AbouRizk, S. "Predictive and Diagnostic Analysis of Shield Cutter Head Failures in Tunnel Construction." Accepted, CRC2016.
3. Zhang, L., Wu, X., and AbouRizk, S. "How to protect adjacent bridges due to tunnel excavation: A case study." Winter Simulation Conference 2015.
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5. Werner, M., Abourizk, S. "Simulation case study: Modelling distinct breakdown events for a tunnel boring machine excavation." Winter Simulation Conference 2015.
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8. Zhang, L., AbouRizk, S. M., and Wu, X. "Simulative route planning for pedestrian evacuation in metro stations." CONVR2015.
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APPENDIX III

BOOKS/BOOK CHAPTERS, THESES, REPORTS, GUIDES AND MANUALS

▪ Books/Book Chapters

1. AbouRizk, S. M., Hague, S. A., Ekyalimpa. R. (2015). Construction simulation: An introduction using Symphony. Edmonton, AB: University of Alberta.
2. Bernold, L. E. and AbouRizk, S. M. (2010) Managing Performance in Construction. John Wiley and Sons, N.Y., 528 pp, ISBN 978-0-470-17164-6.
3. Ahuja, H., Dozzi, S., and AbouRizk, S. (1994). "Project Management: Techniques in Planning and Controlling Construction Projects." Second Edition, John Wiley and Sons, New York, N.Y. ISBN 0-471-59168-8. 24 Chapters in 505 pages.
4. AbouRizk, S., Halpin, D, and Sawhney, A. (1994). "Modeling Uncertainty in Construction Simulation." Chapter 17 in Uncertainty Modeling and Analysis: Theory and Applications, Editors Ayyub, B, And Gupta M. Published by North Holland under series Machine Intelligence and Pattern Recognition Vol. 17, 287-304 ISBN 0 444 81954 1.

▪ Reports, Guides, Manuals and Theses

1. AbouRizk, S., Robinson Fayek, A. (April, 2015). "A Practical Guide to Productivity: A Review of Key Factors and Techniques." Draft. 67 pages. Produced and distributed by Hole School of Construciton Engineering, University of Alberta.
2. AbouRizk, S.M. (2009) Risk Analysis for Construction Projects: A Practical Guide for Engineers and Project Managers. Produced and published through the CRC/NSERC IRC, 110 pp. ISBN 978-1-55195-252-9
3. AbouRizk, S.M., and AbouRizk, H. (2009) Human Factors and Productivity Improvement: Assessing the Impact of Individual and Environmental Factors on Construction. Produced and published through the CRC/NSERC IRC, 54 pp. ISBN 978-1-55195-251-2
4. AbouRizk, S.M., ed. (2009) Innovation in Construction: Tools, Techniques, and Approaches for the Next Generation of Construction Projects. Proceedings of the 16th Annual Canadian Construction Research Forum. Produced and published through the CRC/NSERC IRC, 409 pp. ISBN 978-1-55195-253-6
5. AbouRizk, S.M., Siu, K.L., and Allouche, M. (2005) "Edmonton Bridges the Gap: A Risk Analysis Approach to the Municipal Infrastructure Gap." Summit: Canada's Magazine on Public Sector Purchasing. January/February 2005, 10-11.
6. AbouRizk, S. M. (2003) "NSERC reallocation submission 2002 -Grant selection committee 06 (Civil Engineering)" co-authored by fourteen individuals, chaired by Ralph Haas
7. AbouRizk, S. M. (2003) "Calgary Trail –Anthony Henday Structures Evaluation of Risk and Uncertainty", technical report submitted to Alberta Transportation and Associated Engineering, 11 pages.
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11. Allouche, M., El-Assaly, A., and AbouRizk, S. (2000). Defining the Independent Average Service Lives of Parameters and their Effect on Road Deterioration in Alberta, March 2000.
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14. Rashwan, S., and AbouRizk, S. (1997). "Concrete Mix Design Optimization." Submitted to Lafarge Canada, September 1997.
15. AbouRizk, S. (1997). "Construction Site Dewatering." Submitted to PCL Construction Services, September 1997.
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28. AbouRizk, S. M. (1985). "Sensitivity Analysis of Construction Operations." MSc Thesis, Georgia Institute of Technology, Atlanta, GA.

APPENDIX IV

TRAINING OF HIGHLY QUALIFIED PERSONNEL

Doctoral Students

36	Ramzi Labban	2015	Manager	Consolidated Contractors Intl. Co.	Lebanon
35	Ronald Ekyalimpa	2015	Post-doctoral Fellow	University of Alberta	Canada
34	Elmira Moghani	2012	Project Control Coordinator	Delcan Corporation	Canada
33	Hua Xie	2011	Project Controls	URS Corporation	Canada
32	Reza Azimi*	2011	Project Cost Controls Advisor	Cenovus Energy	Canada
31	Amin Alvanchi*	2011	Assistant Professor	Sharif University of Technology	Iran
30	Hosein Taghaddos*	2010	Assistant Professor	University of Tehran	Canada
29	Ahmed Hammad	2009	Project Controls Manager	Worley Parsons	Canada
28	Xiaoming Mao	2008	Project Controls Specialist	Syncrude Canada	Canada
27	Mohammed Al-Battaineh	2008	Manager	SMA Consulting	Canada
26	Hongqin Fan	2007	Associate Professor	Hong Kong Polytechnic University	China
25	Hussien Al-Battaineh	2007	President	EHan Engineering Ltd.	Canada
24	Gilberto Corona-Suarez*	2007	Associate Professor	Autonomous University of Yucatan	Mexico
23	Tae Chung	2007	Consultant	Vancouver, B.C.	Canada
22	Wael El-Ghandour	2006	Consultant – Project Control	Imperial Oil/ExxonMobil	Canada
21	Adham Shahin	2006	Project Controls Engineer	CoSyn Technology	Canada
20	Ping Wang	2006	Project Controls Manager	WorleyParsons	Canada
19	Zhang Xueqing	2006	Assistant Professor	Hong Kong University of Science and Technology	China
18	Jason Lueke*	2005	National Practice Leader Trenchless Services	Associated Engineering	Canada
17	Robert Langevine	2005	Life Cycle Maintenance Engineer	City of Edmonton	Canada
16	Nadim Nassar	2005	Vice President - Operations	SNC Lavalin Arabia	Saudi Arabia
15	Anthony Van Tol	2004	Construction Manager Planning Fort Hills	Suncor Energy	Canada
14	Lingguang Song	2004	Associate Professor	University of Houston	USA
13	Yasser Mohamed	2002	Associate Professor	University of Alberta	Canada
12	Janaka Ruwanpura*	2001	Vice-Provost, International	University of Calgary	Canada
11	Jianfei Xu	2001	Chief Technology Officer	DXI Solutions, DRAXWare Inc.	Canada
10	Ming Lu	2000	Associate Professor	University of Alberta	Canada
9	Erez Allouche*	2000	Associate Professor	Louisiana Tech University	USA
8	Dany Hajjar	1999	Application Performance Management Consultant	WextWise	USA
7	Ossama Salem*	1999	Yabroudi Chair Professor	Syracuse University	USA
6	KN Gopalakrishnan*	1998	Project manager	EDS Systemhouse Inc.	Canada
5	Mohan Manvazhi	1998	Senior Lecturer	University of Wolverhampton	UK
4	Brenda McCabe	1997	Chair, Professor	University of Toronto	Canada
3	Nader Chehayeb	1996	Construction Manager	Dar-Al Handassa	Lebanon
2	Jingsheng Shi	1995	Professor, Art E. Favre Endowed Chair	Louisiana State University	USA
1	Anil Sawhney	1994	Associate Dean and Director	Amity University	India

*** Co-supervisor****Masters Students**

67	Chen Sun *	2015			Canada
66	Lance Cooper	2015	Project Coordinator	PCL Industrial Constructors Inc.	Canada
65	Sean Newstead *	2015	Project Manager	SMA Consulting	Canada
64	Xiaolin Hu*	2014			
63	Riphay Al-Hussein	2014	Business Development Analyst	Waiward Steel Fabricators	Canada
62	Eric (Xiangyu) Zhou	2014			China
61	Eilnaz Alyari Tabrizi	2013	Project Control Specialist	Fluor Canada	Canada
60	Pejman Alanjari	2013	Project Controls Specialist	FT Services	Canada
59	Hala AbouRizk-Newstead *	2013	Manager, Business Services	SMA Consulting Ltd.	Canada
58	Chandan Kumar *	2013	Project Manager Trainee	Gaursons Promoters (Pvt.) Ltd.	India
57	Mahsa Ghaznavi	2013	Construction Engineer		Canada
56	Veronica Barton (Haring)	2013	Project Coordinator	Graham Construction	Canada
55	Kim Tucker	2012	Junior Project Controller	Flint Energy Services	Canada
54	Jangmi Hong	2012	Bridge EIT	AECOM	Canada
53	Jesse Kostelyk	2012	Manager – Value, Risk, and Project Controls	SMA Consulting Ltd.	Canada
52	Fayyad Sabha*	2012	Project Engineer	Bird Industrial Group	Canada
51	Meimanat Soleimanifar *	2011	PhD Student	University of Alberta	Canada
50	Wenjia Pan *	2010			
49	Oscar Gomez	2010	Sr. Project Coordinator	Graham Earthworks	Canada
48	Eduardo Sosa Silverio	2009	Project Engineer	SMS Consulting Inc.	Canada
47	Shahzad Nadeem	2008	Project Engineer	Pacer Management Services	Canada
46	Mahsoo Naderi	2008	Project Engineer	Stantec	Canada
45	Xue Ying Tian *	2008	Project Engineer	North American Construction Group	Canada
44	Jose Rodriguez Flores	2008	Project Coordinator	Alberta Infrastructure	Canada
43	Ali Hendi	2007	Senior Engineer	Enbridge	Canada
42	Yasser Ebrahmy Khorramabad *	2006	Project Engineer	Co-Syn	Canada
41	Jose Teres *	2006	Project coordinator	PCL Constructor	Canada
40	Fangyi Zhou	2006	Project Manager	Ehan Engineering Ltd.	Canada
39	Dongcheng Huang	2005	Project Engineer	PCL Industrial	Canada
38	Rashid Iqbal	2005	Project Engineer	North American Construction Group	Canada
37	Yinan Wang	2005	Project Planner	Flour Daniel Canada	Canada
36	Yong Lu	2004	Project Estimator	Flour Canada	Canada
35	William Koehn	2004	Vice President – Earthworks	Graham Group Ltd.	Canada
34	Susan Keating	2004	Project Engineer	Stantec –Edmonton	Canada
33	Slaven Tustonic*	2003	Engineering Evaluations	ATB Financial	Canada
32	Brad Appleton	2003	Project Manager	PCL Constructors Inc.	Canada
31	Nathan Boskers	2002	Vice President – Development	Springwood Land Corporation	Canada
30	Jack Farrar	2002	Project Manager	Standard General Construction	Canada
29	Anthony Van Tol	2000	Construction Manager Planning	Suncor Energy	Canada

			Fort Hills		
28	Omar Molina Bas	1999	Associate Professor	University of Puerto Rico	US/Puerto Rico
27	Ahmed Hammad	1999	Project Controls Manager	WorleyParsons	Canada
26	Siri Fernando	1998	Engineering Manager	City of Edmonton	Canada
25	Emad Al-Sharief	1998	Partner	Blois, Nickerson & Bryson LLP	Canada
24	Mohib Faig	1998	Vice-President	Double M Engineering	Sudan
23	Brent Larison	1998	UDP	Omnus Investments Ltd.	Canada
22	Kevin Mather	1998	Vice President, Supply Chain	North American Construction Group	Canada
21	William Boyd	1997	Vice President, Operations	Sully-Miller Contracting Co.	Canada
20	Tony Li	1997	Project Engineer	GKO Design Consultants	Canada
19	Jamie Feuffel	1997	Operations Manager	PCL Industrial Management	Canada
18	Paul Knowles	1997	Operations Manager	PCL Construction	Canada
17	Terry Hesse	1996	Developer	PCL Constructors Ltd.	Canada
16	Wissam Saadi	1996	Regional Director Middle East	Satellier Inc.	UAE
15	Talal Kaiss	1996	Construction Engineer	North American Construction Group	Canada
14	Aaron Yackiwitckuck	1996	Estimating Engineer	Waiward Steel	Canada
13	Jillian Osborne Dressel	1996	Finance Executive	Meade Construction Group, Inc.	USA
12	Yuan Zhang	1996	Project Coordinator	Northern AB Institute of Technology	Canada
11	Hector Gutierrez	1996	Construction Engineer	Protecnica	Columbia
10	Nils Hahn	1995	Construction Engineer	PCL Construction Services Division	Canada
9	Walter Foo	1995	Project Manager	Canadian Natural Resources Limited	Canada
8	Thampi Thomas	1995	Senior Associate – Mechanical Engineering	Syncrude Canada Ltd.	Canada
7	Peter Schneider	1995	Project Manager	Strathcona Project MGMT	Canada
6	Jason Portas	1995	Operations Manager	PCL Construction Management	Canada
5	Richard Kania	1994	Principal Engineer, Pipeline Integrity	TransCanada	Canada
4	Rod Wales	1994	Vice President, Venture Development	Ledcor	Canada
3	Frederic J. Johnson	1993	Operations Manager	Canadian Helicopters Ltd	Canada
2	Sheldon Schroeder	1993	Vice President - Horizon Upstream Project	Canadian Natural Resources Limited.	Canada
1	Hanna Obeid	1993	Construction Engineer	Pinnacle International	Canada

* Co-supervisor