ISIS INNOVATOR
NEWSLETTER OF ISIS CANADA RESEARCH NETWORK February 2007
The Canadian Network of Centres of Excellence on Intelligent Sensing for Innovative Structures

ISIS EDUCATION MODULES

are being used by

200 Persons in 50 Countries

To facilitate the transfer of its technology and to prepare engineering students and technologists for the workplace, ISIS Canada has developed several Education Modules for the engineering design community. These modules are primarily being used around the world as teaching aids for undergraduate engineering and technical college curricula. However, numerous practicing engineers are also utilizing the education modules to familiarize themselves with the use of new materials and design concepts.

Dr. Kenneth Neale, Eng.,
Université de Sherbrooke
Vice-President, ISIS Canada
Chair, Education Committee

Dr. Luke Bisby, P.Eng.,
Queen's University
Principal Author,
Education Modules

Education Committee
Dr. Kenneth Neale, Chair
Dr. Nemkumar Banthia
Dr. Luke Bisby
Dr. Roger Cheng
Dr. Raafat El-Hacha
Mr. Garth Fallis
Dr. Robin Hutchinson
Dr. Aftab Mufti
Dr. John Newhook, Chair Elect
Dr. Khaled Soudki
Dr. Gamil Tadros
Dr. Leon Wegner

Nine modules are currently planned, and the first five of these are available for download:

1. Mechanics Examples Incorporating FRP Materials
2. An Introduction to FRP Composites for Construction
3. An Introduction to FRP Reinforcement for Concrete
4. An Introduction to FRP Strengthening of Concrete Structures
5. An Introduction to Structural Health Monitoring
6. Application & Handling of FRPs
7. Life Cycle Engineering & Costing
8. An Introduction to Prestressing with FRPs
9. Durability of FRPs for Construction

Go to www.isiscanada.com/education/education.html for more information

International Workshop on Reforming Civil and

Due to initiatives in the US, especially by Dr. Emin Aktan, Drexel University, to stimulate a discussion of the status of civil engineering education, a workshop was held in Istanbul on October 3 and 4, 2006, through a grant from the National Science Foundation (NSF) of USA. The objective of the workshop was to establish an international consortium to ensure that future civil engineers are equipped to address changed societal concerns. The proposal for establishing the consortium called for a 'renaissance' in civil engineering.

Dr. Aftab Mufti, President and Scientific Director of ISIS Canada, was invited to become a member of the consortium and to contribute a Canadian point of view on the need for reformation in civil engineering education at the conference in Istanbul. The Canadian delegation was composed of B. Bakht, L. Bisby, J.J.R. Cheng, L.G. Jaeger, K. C. Johns, A.A. Mufti, (Head of delegation), S. Nesbit, P. Rasmussen, and G. Razaqpur.

A planning meeting of the Canadian delegates was held in Toronto on August 8, 2006, to discuss the US proposal and to plan the Canadian presentations. The group concluded that the Canadian civil engineering education does not face exactly the same problems as in the US. For example, it was found that many of the 'societal concerns' mentioned in the US proposal were already to a large extent addressed in our undergraduate and graduate curricula. There is of course always room for program improvements and it was agreed that Canadian civil engineering educators should be actively involved in the various initiatives in the US.

In his summary report, Dr. Emin Aktan noted some of the major issues and challenges for civil engineering education in the USA. Point-form summaries of presentations by non-Canadian delegates are provided in an ISIS report, soon to be published. While some of the points made by the non-Canadian delegates have universal character and apply equally to Canada, there are some elements that distinguish the Canadian context from that of the USA. The following is a brief overview of some of the issues raised by the Canadian delegates at the workshop.

Canadian university context

Engineering degree programs in Canadian universities have not been under the same pressure from state authorities and granting agencies as those in the USA. For example, there has been no external pressure to reduce credit hours. Canadian engineering programs are usually a year longer (four years) than bachelor degrees in other fields and are also significantly more demanding. While the average number of credit hours required for a civil engineering bachelor degree in the US is of the order of 125, the CEAB minimum requirement for engineering programs is of the order of 140 to 145 credit hours. Canadian engineering programs typically require around 160 to 170 credit hours. Canadian graduates generally fare very well in the US examinations for licensure. The general opinion among many civil engineering educators in Canada is that a Master's degree is not needed for the practice of the profession except in highly specialized areas such as advanced structural engineering. Good students are typically encouraged to pursue graduate studies in their field of interest.

Accreditation of engineering programs in Canada

Canada has a very stringent accreditation process for engineering programs. For example, all the engineering science and engineering design courses must be taught by licensed engineers. Students graduating from an accredited program have direct access to the profession with virtually no subsequent requirements for examination (professional practice in Canada is regulated by a relatively simple system of provincial bodies which include all engineers.) The accreditation process has contributed to the fact that Canada has a relatively small number (26) of engineering schools. The quality of undergraduate engineering education is felt to be uniformly good. The USA in contrast has a very diverse academic network producing graduates from a large number of universities and schools. The US also has a well-developed system of private, for-profit companies and other bodies, which administer a complex post-university examination system. US studies on academic content must inevitably take into account this complex and diverse system. To Canadian eyes, this seems to be the main motivation for the body of knowledge (BOK) concept that is currently being promoted in the United States.

ISIS CANADA JOINING FORCES

As part of the Network's ongoing focus on technology transfer, ISIS Canada continues to joint venture with others on demonstration projects. The following are brief synopses of two of these projects.

Highway 40 East in Montreal is subjected to the same environmental conditions as most roadways across the country, necessitating premature replacement of the concrete travel surface. Endeavoring to minimize deterioration caused by corroding steel reinforcements, and thereby reducing maintenance costs, ISIS Canada teamed up with government and industry leaders to evaluate the benefits of alternative design options.

Using the expertise of Dr. Brahim Benmokrane, ISIS Canada Project Leader at the Université de Sherbrooke and Dr. Xiaoyi Bao, ISIS Canada Project leader at the University of Ottawa, the rehabilitation programs began on September 21, 2006. Construction included the use of continuous reinforced concrete pavements using GFRP (glass fibre reinforced polymers) and FOSs (fibre optic sensors).

A total length of 16 km of electrical gauge cables were installed. These gauges (more than 250) are used to monitor the strain in concrete and GFRP bars. BPR Inc. from Montreal helped with the installation of the sensors. The cables were installed in PVC tubes initially embedded in the foundation (sub-base) of the highway until the data acquisition system is installed. The project includes the use of several types of FOSs including Fabry-Perrot (from RocTest Ltd.), Bragg-Grating (from Avensys) and Brillouin sensors (from Dr. Bao at the University of Ottawa). The distributed Brillouin FOS's were installed over the length of the North and South lanes.

Environmental Engineering Education in Istanbul, Turkey

Public perception of the profession of civil engineering
While presenters from the US expressed a general concern about the public perception of the profession of civil engineering, the Canadian delegation was less pessimistic. Highly publicized failures of civil engineering structures (e.g. the dikes of New Orleans) were referred to by US presenters as the source of the bad perception. However, these failures appear in most cases to be the result of poor public administration rather than civil engineering education. Recruiting the best students into civil engineering has not been hindered in Canada due to these perception issues. In Canada, the civil engineering profession is being promoted as the one with the highest relevance to society's major problems. Canadian civil engineering programs attract a good number of very bright students, interested in the environment, international development, urban issues, etc.

Intercultural, international dimensions
Canadian civil engineering participates strongly in Canada's export economy. Many of our larger engineering and construction firms could not have grown without strong, sustained, international activities. Canada is a bilingual country, present in the engineering of infrastructure in the English-speaking and French-speaking world, but also increasingly in Latin America and the Far East. There is a long-standing tradition of political involvement of civil engineers in public decision-making in Canada. This base of political skills is a strong card in international activities. There is a trend in Canada to recognize inter-cultural and language skills as a top priority for improving civil engineering education.

Curriculum reform
Canadian schools of engineering are aware of, and profit from, the wealth of experience of their US counterparts, through participation in ASEE, ASCE, and other bodies. However, Canadian schools are also watching and assimilating experience from curriculum reform in the UK, the European Union, and Australasia. These experiences rely much less, or not at all, on a licensure examination protocol. They do however involve competency-based approaches, the use of portfolios to assess professional readiness, and a wider acceptance of new strategies for learner-centred education. There are good examples of innovative curriculum reform in many Canadian schools. Integration of diverse knowledge and skill sets, competency development, soft skill integration, and other objectives are pursued in several schools. The integration of new FRP and monitoring technologies into Canadian curricula using ISIS Canada-developed modules was a success story that was presented by the Canadian delegation.

Canadian delegates from left: Dr. Leslie Jaeger, Dr. Kenneth Johns, Dr. Peter Rasmussen, Dr. Aftab Mufti, Dr. Luke Bisby, Dr. Susan Nesbit, Dr. Baidar Bakht, Dr. Ghani Razaqpur and Dr. Roger Cheng

Photos of Highway 40 in Montreal during construction.

ISIS AND GEOIDE WORK TOGETHER

ISIS Canada and another Network of Centres of Excellence, GEOIDE (Geomatics for Informed Decisions), a research and development organization that aims to consolidate Canadian expertise in the field of geomatics on the development of software for management of floods caused by river ice and assessment of other geological risks, are joining forces. Three specified projects targeted for collaboration are:

1) CN/CP railway bridges
2) Brillouin sensing for monitoring Manitoba Hydro dams
3) Wireless sensing technology for GEOIDE's sensing van

ISIS CANADA CREATES DURABILITY MONOGRAPH

Dr. Nemkumar Banthia, P.Eng., University of British Columbia
Editor, Durability of Fibre Reinforced Polymers in Civil Infrastructure

As FRPs (fibre reinforced polymers) are becoming more common in replacing steel as a material of choice in both rehabilitation and construction, it became evident that it was necessary to develop a set of guidelines for the design and construction industry regarding material and bonding selection for various applications to ensure durability of the construction facility. With this in mind, ISIS Canada spearheaded an initiative to create a monograph entitled Durability of Fibre Reinforced Polymers in Civil Infrastructure, to fill this need.

In spite of the increasing acceptance of the use of FRPs in civil structures, a number of questions remain unanswered. One pressing issue on the user's mind is the durability of the FRPs themselves. Because FRPs may be produced by numerous techniques including filament winding, pultrusion, resin transfer molding, contact molding, compression molding, etc., the influence of the manufacturing process on durability remains obscured. The influence of various inert or active additives added to the polymeric phase such as fillers, plasticizers, stabilizers, and sizing and other coatings placed on fibres, also requires more study.

The Durability of Fibre Reinforced Polymers in Civil Infrastructure monograph addresses all the key issues surrounding the use of FRPs for civil applications. If you are interested in ordering a copy of the manual, please contact: Charleen Choboter at choboter@cc.umanitoba.ca

UPCOMING EVENTS

2007 ISIS Canada 12th Annual Conference
St. John's, Newfoundland May 2-4, 2007
For more information visit: www.isiscanada.com/conference/conference07.htm

2007 International Symposium on Integrated Life-Cycle Design & Management of Infrastructures
Shanghai, China May 16-18, 2007
For more information visit: www.bridgetongji.edu.cn/ilcmi2/

The Third International Conference on Durability & Field Applications of Fibre Reinforced Polymer Composites for Construction (CDCC 2007)
Quebec City, Quebec May 22-24, 2007
For more information visit: www.civil.usherbrooke.ca/cdcc2007

PROTECT2007: First International Workshop on Performance, Protection & Strengthening of Structures under Extreme Loading
Whistler, British Columbia August 20-22, 2007
For more information visit: www.civil.ubc.ca/protect2007

The 3rd International Conference on Structural Health Monitoring of Intelligent Infrastructure (SHMII-3)
Vancouver, British Columbia November 14-16, 2007
For more information visit: www.isiscanada.com/shmii-3

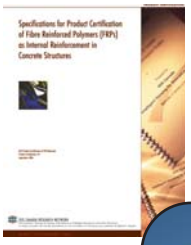
5th International Conference on Advanced Composite Materials in Bridges and Structures (ACMBS-V)
Winnipeg, Manitoba September 22-24, 2008
For more information visit: www.isiscanada.com/acmbs

* Check the ISIS Canada website **www.isiscanada.com** for information on the 2007 workshops on ISIS case studies and Life Cycle Engineering and Cost Analysis for bridge decks being conducted across Canada as part of a technology transfer program.

TECHNOLOGY TRANSFER ACTIVITIES

ISIS CANADA PUBLISHES SPECIFICATIONS FOR FRP PRODUCT CERTIFICATION

As the use of FRPs (fibre reinforced polymers) in civil structures becomes more widespread, a growing need for quality assurance of the FRP materials becomes imperative. In order to meet this need, ISIS Canada led an initiative to create and publish a product certification on Specifications for Product Certification of Fibre Reinforced Polymers.



ISIS Product Certification of FRP Materials

The scope of the specifications deals with FRPs as internal reinforcement in concrete components of structures such as bridges, buildings and marine structures. The product certification encompasses information on FRPs in the form of bars and grids. The fibres include glass, carbon and aramid fibres, and matrices include isophthalic polyester, vinylester and epoxy resins.

This document provides much needed information for owners of infrastructure, consulting engineers, FRP manufacturers, and the construction industry, all of whom need confidence and assurance that the materials being purchased and used have the quality envisioned during the design process.

To order a copy of the ISIS document "Specifications for Product Certification of Fibre Reinforced Polymers (FRPs) as Internal Reinforcement in Concrete Structures", please contact Charleen Choboter at choboter@cc.umanitoba.ca

Dr. Brahim Benmokrane, Eng., Université de Sherbrooke
Chair, ISIS Canada Technical Committee on Product Certification of FRP Materials

Technical Committee on Product Certification of FRP Materials:
Dr. Brahim Benmokrane, Chair, Dr. Baidar Bakht, Dr. Lawrence Bank; Dr. Nemkumar Banthia, Mr. Marc Demers, Mr. Bernard Drouin, Ms. Ruth Eden, Mr. Garth Fallis, Mr. Sylvain Goulet, Mr. Doug Gremel, Mr. David Lai, Mr. Gene Latour, Mr. Ralston MacDonnell, Dr. Aftab Mufti, Dr. Kenneth Neale, Mr. Jean-François Poulin, Mr. Guy Richard, Mr. Walter Saltzberg, Dr. Shamim Sheikh , Dr. Gamil Tadros, Mr. Allan Wiseman

APPOINTMENTS AND RECOGNITION

Kenneth Neale, Ph.D., Eng., FCAE, FCSCE

Dr. Kenneth Neale, Vice-President of ISIS Canada, and Canada Senior Research Chair in Advanced Engineered Material Systems at the Université de Sherbrooke, has been appointed by the Standards Council of Canada to Chair the ISO TC71 SC6 committee. ISIS Canada would like to congratulate Dr. Neale on this achievement.

Daniele Inaudi, Ph.D., P.Eng.

Dr. Daniele Inaudi, Chief Technology Office for RocTest Ltd., has accepted an invitation to join the Technology Transfer and Commercialization Committee (TTCC) of the ISIS Canada Research Network. Dr. Inaudi resides in Switzerland and his European experience and expertise are a welcome addition to the ISIS team.

John P. Newhook, Ph.D., P.Eng.

Dr. John Newhook, Project Leader for ISIS Canada and an Associate Professor and Head of the Department of Civil Engineering at Dalhousie University has been re-elected as the Scientific representative on the ISIS Board of Directors. Dr. Newhook will serve for the final three years of the ISIS mandate, until March 31, 2009. Dr. Newhook will also become chair of the ISIS Education Committee in the spring of 2007.

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Aftab Mufti, Ph.D., FCSCE, FEIC, FASCE, FCAE, P.Eng.

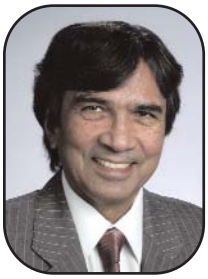
Dr. Aftab Mufti, President and Scientific Director of ISIS Canada, and Professor of Civil Engineering at the University of Manitoba, is the recipient of the Lifetime Achievement Award from the International Institute of FRP in Construction (IIFC) for his outstanding contributions to the field of fibre-reinforced polymer composites for construction. The IIFC, based in Hong Kong, was established in 2003 to advance the understanding and application of FRP composites in civil infrastructure, and its membership includes top civil engineers from around the world.

Amir Fam, Ph.D., P.Eng.

ISIS Canada would like to congratulate Dr. Amir Fam, ISIS Canada Project Leader and an Associate Professor and Canada Research Chair in Innovative and Retrofitted Structures at the Department of Civil Engineering of Queen's University, for receiving the Early Researcher Award of Ontario from the Ministry of Research and Innovation.

Suong Van Hoa, Ph.D., Eng.

Dr. Suong Van Hoa, ISIS Canada Project Leader and Chair of the Department of Mechanical and Industrial Engineering at Concordia University, was awarded the NSERC Synergy Award 2006 for "Development of composite technology for aircraft applications". Dr. Hoa is also Editor-in-chief for North America of the Journal of Science and Engineering of Composite Materials. ISIS Canada would like to congratulate Dr. Hoa on his outstanding accomplishments.



Baidar Bakht, M.Sc., D.I.C., D.Sc.

Dr. Baidar Bakht, President of JMBT Structures Research Inc., consultant to ISIS Canada Research Network and Adjunct Professor of Civil Engineering at the universities of Toronto and Manitoba, continues to be honoured by his peers. At the recent Composites in Intelligent and Sustainable Civil Infrastructure Symposium in New Delhi, India, Dr. Bakht was honoured for his lifetime contribution to the profession. ISIS Canada would like to congratulate Dr. Bakht on receiving this honour.