



CPATT NEWS

Message from the Director

Greetings to all of you! We are pleased to send you our newsletter!

This feature highlights on-going research activities and the many accomplishments of our graduate students. Several of the students have received national scholarships, hosted outreach activities, won best paper awards and having completed their degrees have started their careers working in industry. Truly, we are all very proud of them and look forward to watching them succeed in the “real world”. Professor Ralph Haas will receive the Roy W. Crum Distinguished Service Award for lifetime achievement from TRB at the upcoming January meeting. Congratulations Ralph! Finally, we also, sadly, say goodbye to our friend and colleague Professor Khaled Soudki who passed away in September after a courageous battle with cancer. As noted, he was truly a research leader and will be sadly missed by all of his colleagues.

If you would like to learn more about anything we have presented in this newsletter, and are interested in applying to the pavement engineering professor position, please do not hesitate to contact either Laura Bland at lbland@uwaterloo.ca or Susan Tighe at stighe@uwaterloo.ca. We look forward to hearing from you!

Sincerely,

Susan L. Tighe, PhD., PEng.

Contents

Research Focus	
Poster Symposium Projects	4
Structures/Concrete	6
Individual Highlights	
In Memoriam – Dr. Soudki	2
Faculty Feature	3
Feature Student/Project	8
Upcoming Events	10
Announcements	11
Norman W. McLeod Chair	12
News and Awards	13

In Memoriam – Dr. Khaled Soudki



Members of the Department of Civil & Environmental Engineering mourn the loss of their friend and colleague, Professor Khal Soudki, who passed away early in the morning on Tuesday, September 17, 2013 after a long battle with cancer. A funeral prayer was held at the Waterloo Masjid the same day, with burial at Parkview Cemetery taking place afterwards. Khal leaves behind his wife, Rana Shami, and daughter Sara and son Adnan.

A graduate of the American University of Beirut (BEng, 1987), Cornell University (MSc, 1989) and the University of Manitoba (PhD, 1994), and held a postdoctoral position at Queens University in Kingston. Professor Soudki joined the Department of Civil & Environmental Engineering as Assistant

Professor in 1997. A prolific and well-respected researcher, he quickly progressed to Associate Professor in 2001 and full Professor in 2006. In 2003, he was appointed Canada Research Chair in Innovative Structural Rehabilitation; he was reappointed in 2006 for a further five-year term. He was also the founding Dean of Engineering at the American University in Dubai, UAE and a former visiting scholar at the Swiss Federal Laboratory for Material Testing (EMPA). He was also very active on many international scientific committees and was a Fellow of the American Concrete Institute.

Professor Soudki was an internationally renowned leader in the field of reinforced and prestressed concrete structures with emphasis on the use of advanced fibre reinforced polymers (FRP) for the repair of structures. His research and teaching contributions over the last twenty years resulted in over 250 research publications. Dr. Soudki has substantial experience with structural performance of concrete members and his research had high impact as it was directed at the repair of deteriorated structures with minimal cost, time and complexity. He worked with many public and private sector research partners to improve state-of-the-art practice. Khal leaves behind a legacy of scientific research in Canada and around the world.

On a personal note, I greatly miss Khal. He was hired shortly before me at UW and I took great joy in trying to convert him to becoming a pavement engineer. Obviously, bridges were his passion. His strength of character will always be admired and he will be fondly remembered by all of us here.

Feature Faculty Member

Giovanni Cascante, PhD., P.E.

Professor, Associate Chair Graduate Studies



Education

Dr. Cascante is a Professor at the University of Waterloo and the Associate Chair for Graduate Studies; he holds a B.Sc. degree in Structural Engineering (University of Costa Rica), a M.Sc. in Earthquake Engineering (Central University of Venezuela), and a Ph.D. in Geotechnical Engineering (University of Waterloo). Before joining the University, Dr. Cascante worked for more than 10 years as a Project Engineer (Trow Consulting Engineers Ltd.), Research Assistant, Post-doctoral Fellow (University of Waterloo), and Research and Consulting Engineer (Intevp S.A.).

Giovanni Cascante, PhD., Professor, Department of Civil and Environmental Engineering, University of Waterloo

Research Highlights

Around the world, cities are facing a major challenge: What to do about aging infrastructure such as bridges, water mains, roads, and electrical transmission lines. How can engineers know if they have years of life left in them or are on the verge of collapse? Dr. Cascante and his University of Waterloo research team are working towards innovating techniques to assess early deterioration in civil infrastructure – without taking the system apart.

His areas of expertise are in nondestructive testing of civil infrastructure, dynamic soil characterization (resonant column, BE, and ultrasonics), signal processing, numerical simulations of wave propagation, and vibration measurements. Dr. Cascante has authored more than 80 publications in refereed journals and technical conferences, including award-winning papers (ASTM 2005, SAGEEP 2005, TAC 2006). Dr. Cascante serves as an associate editor for the Geotechnical Testing Journal (ASTM) and the Journal of Environmental and Engineering Geophysics.

Professional Activity Highlights

- Recognized expert in the nondestructive evaluation of materials and civil infrastructure. Recent projects include: the development of new testing methodologies for the condition assessment of wood poles, asphalt pavements, concrete structures, earth structures, and pipelines.
- Invited speaker in USA, Europe, and South America to present the state-of-the-art on the dynamic characterization geomaterials using the resonant column device, piezoelectric transducers in the laboratory and the propagation of surface waves in the field.
- Associate Editor, Geotechnical Testing Journal (ASTM)
- Associate Editor, Journal of the Environmental and Engineering Geophysical Society (JEEG)
- Co-chair of the 64th Canadian Geotechnical Society and 14th PanAm Conferences, Toronto, 2011
- Member of the technical committee TC-9: Geophysical Testing, ISSMGE
- His research group has improved understanding of wave propagation in non-homogeneous media through numerical simulations.

Research Focus – Poster Symposium Projects

On Friday October 4, 2013 CPATT and the Norman W. McLeod Chair hosted our 3rd annual Graduate Student Poster Symposium in the E5 Student Design Centre. There were a total of 19 student participants, who prepared posters on their current research projects. Industry members, faculty, staff and students attended this event to learn more about what the students are researching. We appreciate Dr. John Emery for judging the posters and although all the students are winners, special congratulations to Marcelo Gonzalez, Amin Hamdi and Andrew Northmore. Thank you to the Norman W. McLeod Chair for donating the prizes. Below are a few pictures from the event and a list of the projects featured at the symposium. For the full abstracts, please see the abstract booklet attached to the email sent with the newsletter.



Doubra C. Ambaiowei, PhD Candidate (Supervisor: Susan Tighe) – Recycling and Testing of Recycled Asphalt Pavements

Tim Bandura, MSc Candidate (Supervisor: Carolyn Hansson) – Comparative Evaluation of the Chloride Threshold Values of Corrosion-Resistant Reinforcing Bars

James Cameron, MSc Candidate (Supervisors: Jeffrey West and Carolyn Hansson) – Engineered Fibre-Reinforced Concrete for use in Bridge Deck Link Slabs

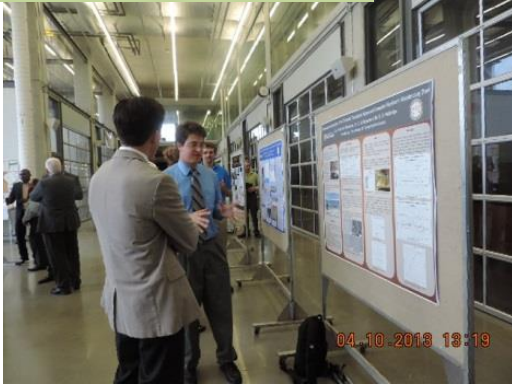
Norman Fong, MSc Candidate (Supervisors: Scott Walbridge and Robert Gracie) – Heat Straightening of Steel Girders

Marcelo Gonzalez, PhD Candidate (Supervisor: Susan Tighe) – Enhancing the Surface Characteristics of Canadian Concrete Pavements

Amin Hamdi, PhD Candidate (Supervisor: Susan Tighe) – Evaluation of Ontario's Pavement Design Methodology



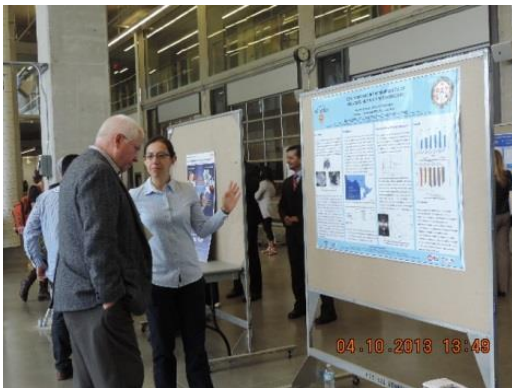
Research Focus – Poster Symposium Projects



Dan Pickel, MASc Candidate (Supervisors: Susan Tighe and Jeffrey West) – Assessing Internal Curing Benefits of Pre-soaked Recycled Concrete Aggregate on Variably Cured Concrete

Sonia Rahman, MASc Candidate (Supervisor: Susan Tighe) – Development of Acceptance Test Methods Related of Performance and Durability of Pervious Concrete

María-José Rodríguez, PhD Candidate (Supervisors: Giovanni Cascante and Mahesh Pandey) – NDT Condition Assessment of Distribution Lines



Ann Sychterz, MASc Candidate (Supervisors: Sriram Narasimhan and Scott Walbridge) – Vibration Characterization and Mitigation of Aluminium Pedestrian Bridges

Colin van Niejenhuis, MASc Candidate (Supervisor: Carolyn Hansson) – The Behaviour of Corrosion Resistant Reinforcing Alloys in Cracked Concrete Exposed to Deicing Agents

Cheng Zhang, MASc Candidate (Supervisor: Susan Tighe) – A Mechanistic-Empirical Aircraft Landing Distance Prediction Method

Yu (Tony) Hong, MASc Candidate (Supervisors: Jeffrey West and Carolyn Hansson) – Analysis and Design of Link Slabs in Jointless Bridges with Fibre-Reinforced Concrete

Gulfam Jannat, PhD Candidate (Supervisor: Susan Tighe) – Developing Optimized Pavement (Rigid and Flexible) Maintenance Schedule: Application of Pavement Deterioration Models over the Service Life of Pavements

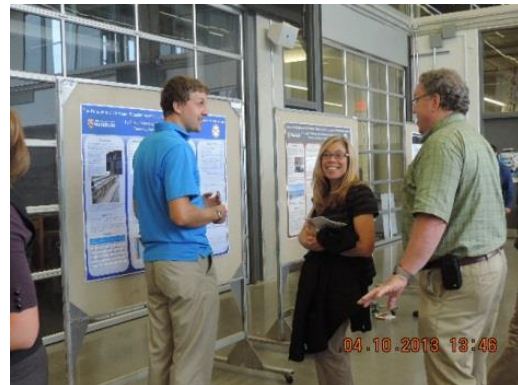
Andrew Northmore, MASc Candidate (Supervisor: Susan Tighe) – Sustainability of Solar Road Panels as Transportation Infrastructure



Dina Saad, PhD Candidate (Supervisor: Tarek Hegazy) – Microeconomic Rationale for Infrastructure Spending

Xiomara Sanchez, PhD Candidate (Supervisor: Susan Tighe) – Low Temperature Performance of Recycled Hot Mixtures in Ontario

Magdy Shaheen, PhD Candidate (Supervisor: Susan Tighe) – Predicting Hot Mix Asphalt Rutting using an Innovative Micromechanical Approach



Research Focus – Structures and Concrete Laboratory

The impact of anti-icing brines on the durability of reinforced concrete

In an effort to minimize traffic accidents on Ontario's highways, liquid anti-icing agents are being sprayed directly on the pavement or used to wet sand or rock salt to prevent the formation and adhesion of ice or packed snow. The rationale is that the liquids or wetted sand would remain on the pavement instead of being blown off by the traffic. The most common of the anti-icing agents are concentrated brines of NaCl, MgCl₂ or CaCl₂. The latter two salts will provide anti-icing to lower temperatures than does NaCl, but are known to have deleterious, albeit slow, reactions with the cement paste components of concrete. Little is known about their relative effects on the corrosion of embedded steel in concrete or of those components of highway structures directly exposed to the brines. The purpose of the project, funded by the Ministry of Transportation of Ontario, was to determine the impact of these salts on both the concrete and the steel and has been conducted by Mark Cremasco and Matthew Hunt, respectively.

The results, in Figure 1, of internal strain in concrete blocks exposed outdoors to the different brines, show that the cation (Na⁺, Mg⁺⁺ or Ca⁺⁺) has a major influence on the response to salt exposure. The greater strain was observed in the concrete exposed to MgCl₂ and the least by exposure to NaCl. Exposure to CaCl₂ or the multichloride (a mixture of CaCl₂ and NaCl) gives intermediate results. The rate of chloride ingress also differs with the type of salt: calcium chloride has the highest diffusion rate and can also cause an expansive reaction to form calcium hydroxychlorides which can result in cracking of the concrete, Figure 2. MgCl₂ diffuses slowly at first, because it reacts with Ca(OH)₂ in the concrete to form Mg(OH)₂ which precipitates and blocks the pores to further ingress. However, with longer exposure, it too can damage the concrete. NaCl enters the concrete more slowly than the other salts and does not have any detrimental effects on the concrete.

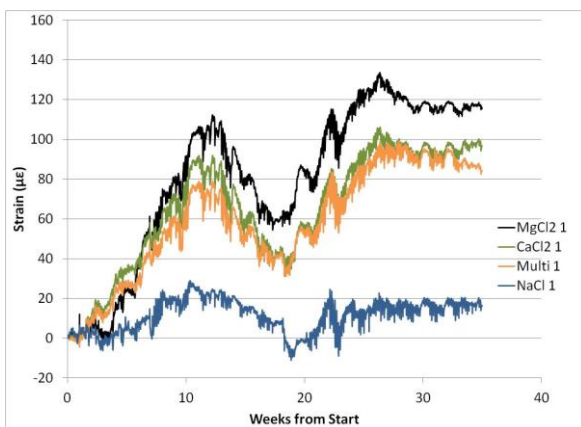


Figure 1. Water adjusted and corrected strain in concrete exposed to each of the four anti-icing solutions

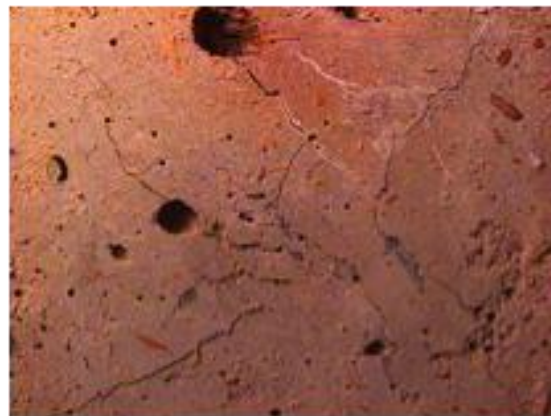


Figure 2. Cracks visible at the bottom of a concrete prism exposed at the top to a concentrated CaCl₂ solution, similar to that in anti-icing brine

Research Focus – Structures and Concrete Laboratory – Cont'd

Steel reinforcement (rebar) embedded in non-contaminated concrete forms a protective passive film on its surface (just as stainless steel does in the environment), because of the very highly alkaline concrete pore solution. A major negative factor associated with the use of $MgCl_2$ is that the reaction with $Ca(OH)_2$, described above, reduces the pH of the pore solution in concrete and causes dissolution of the passive film on the steel, resulting in rapid corrosion of the rebar, Figure 3. An example of this is shown in the data in Figure 4, of corrosion rates of rebar in simulated concrete pore solution with additions of the different brines.

Ongoing research at CPATT is investigating the longer term effects of anti-icing agents and alternative, more corrosion resistant, rebar materials. Please contact Professor Carolyn Hansson at chansson@uwaterloo.ca for further details.

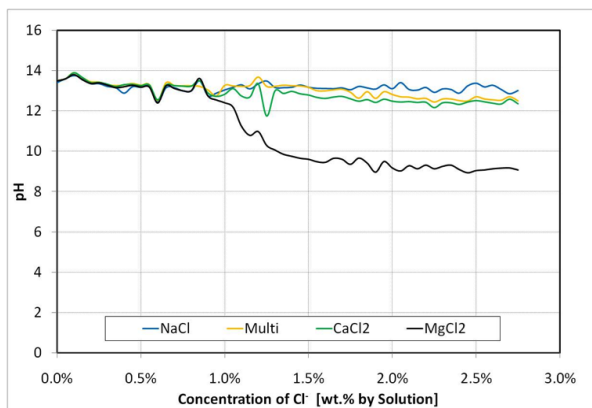


Figure 3. The effect of additions of the different anti-icing brines on the pH of simulated concrete pore solutions

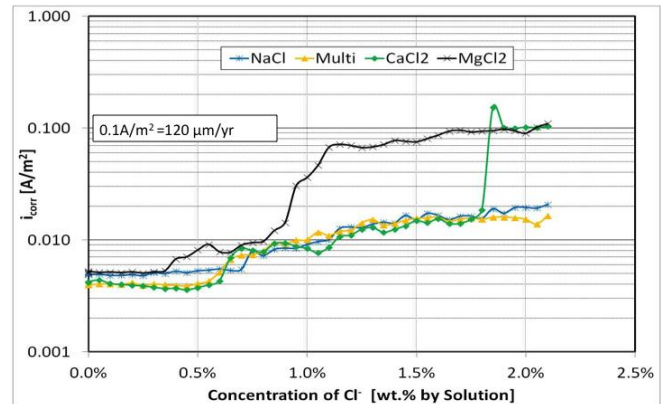


Figure 4. The corrosion rate of rebar in simulated pore solution containing increasing concentrations of the different anti-icing salts

October 2013 Highlights

Feature Student – Andrew Northmore



Andrew Northmore is a MASc candidate working in the Centre for Pavement and Transportation Technology. He has been a student at the University of Waterloo since 2006, when he began working towards his BAsC in Mechanical Engineering. He has been involved with CPATT since 2010 on a variety of projects as a co-op student, undergraduate research assistant, and, ultimately, graduate research assistant. His interest in innovative energy solutions led him to “see the light” and begin his Master’s Degree in Civil Engineering working on Dr. Susan Tighe’s solar road design project.

Feature Project – Structural Design of a Solar Road Panel for the Canadian Environment

Imagine a future in which not only are roads providing a means of transportation, but are also generating electricity for the buildings and utilities around them. Every day sees Canada’s paved roads and highways are exposed to 5.6-times more energy than we use daily as electricity. While tapping into this resource may seem far-fetched, Andrew’s research is focused on starting to make it into a reality.

The first problem to solve with this idea is how to design a solar panel that can support vehicle traffic; this is the core focus of Andrew’s thesis. Over the last two years he has designed and constructed prototypes from tempered glass and fiberglass reinforced polymers for structural testing on campus. He has also completed research on the effects of freeze/thaw cycling and salt brine application to transparent materials; determining the impact of Canadian winter maintenance activities on potential solar road panel materials.

While there are still many questions to be asked about solar road panel design, from friction availability to cost reduction, Andrew’s research brings this futuristic idea one step closer to reality with the hope that it will make both our pavement and energy infrastructure more sustainable in the long-term.

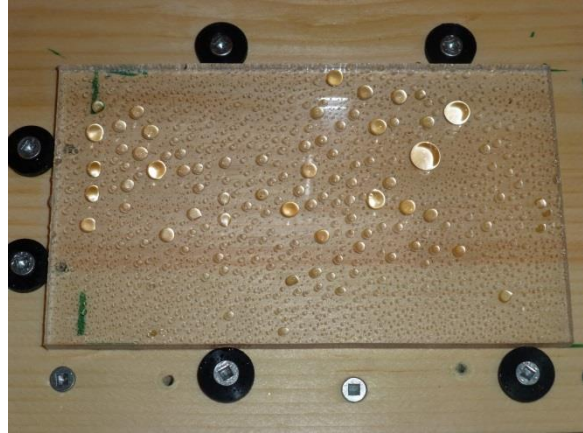
Andrew’s work has resulted in a few awards including:

- October 2013 - **Most Innovative Research Project** – University of Waterloo
- March 2013 - **1st Place Research Presentation** – University of Waterloo
- 2012-2013 – **Ontario Graduate Scholarship** – Government of Ontario - \$15,000
- 2012-2013 – **President’s Graduate Scholarship** – University of Waterloo - \$10,000
- June 2013 – **3rd Place in Graduate Student Paper Competition** – CSCE Conference
- 2011-2012 – **Canadian Provinces and Territories Scholarship** – TAC Foundation - \$3,000

Here are some pictures from the Solar Road project



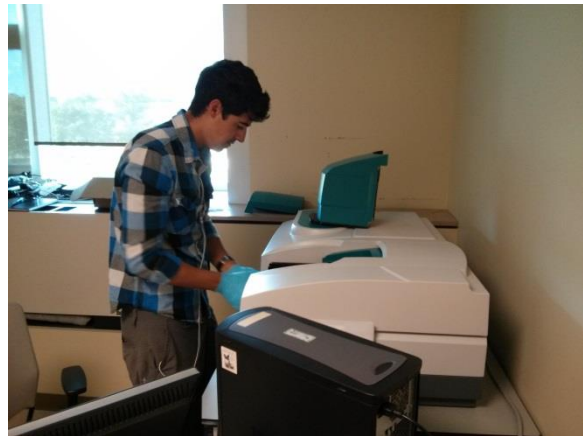
Solar road panel prototype for structural testing



Acrylic sample prepped for British Pendulum testing



Three-point bending of a polycarbonate sample



Transmissivity testing of a glass sample

Upcoming Events

Upcoming Events

November 2013 – 2014 – [Ontario Good Roads Association Academy for Municipal Asset Management 2013 Courses](#). The courses will be offered as notes below: Please contact Colette Caruso at colette@ogra.org or 289-291-6472 ext. 30 for more information and registration.

- Public Sector Finance Fundamentals – November 4-8, 2013 and November 3-7, 2014
- Asset Valuation and Capital Investment Planning – Classroom version available in 2015
- Managing Data for Municipal Assets – May 12-16, 2014
- Asset Data Collection and Condition Evaluation – October 28-November 1, 2013 and April 28-May 2, 2014
- Asset Management of Road Networks – October 27-31, 2014
- Asset Management of Public Buildings – October 6-10, 2014
- Asset Management of Municipal Fleets – Classroom version available in 2015
- Asset Management of Bridges – March 17-21, 2014
- Asset Management of Buried Infrastructure – March 31 – April 4, 2014
- Asset Management of Solid Waste Facilities – Classroom version available in 2015
- Asset Management of Parks and Recreation Facilities – Classroom version available in 2015
- Asset Management of Public Transit – Fall 2014

November 17-20, 2013 – [58th Annual Canadian Technical Asphalt Association \(CTAA\) Conference](#). This conference will be held at the Sheraton Hotel Newfoundland in St. John's, Newfoundland.

December 11, 2013 – [OHMPA 2013 Fall Asphalt Seminar](#). The Ontario Hot Mix Producers Association will be hosting their 22nd Annual Fall Asphalt Seminar. This event will be held at Le Jardin Conference Centre, 8440 Highway 27, Vaughan, ON.

January 12-16, 2014 – [Transportation Research Board 93rd Annual Meeting](#). This conference will be held at the Washington Marriott Wardman Park, Omni Shoreham, and Washington Hilton hotels in Washington, D.C. The UW Reception will be held during the TRB Meetings – date and time TBD

January and February, 2014 – [Engineering Outreach Girls Club Mentor](#) – a couple of the CPATT female graduate students will be volunteering their time to mentor students between Grades 4 and 6 the last Saturday of September, October and November.

Announcements

Awards/Recognition

Dan Pickel, MASc Candidate – Canadian Council for Independent Laboratories TAC Scholarship through the University of Waterloo - \$5,000

Gulfam Jannat, PhD Candidate – [Waterloo Alumni TAC Scholarship](#) - \$7,500

Aleks Kivi, MASc – Best Paper Award 2013 [Transportation Association of Canada Conference](#).

Vimy Henderson, PhD., Pavement and Materials Engineer, Golder Associates – [Top 20 Under 40 – Rock to Road Magazine](#)

Ralph Haas, PhD., PEng – [Roy W. Crum Distinguished Service Award](#) from the Transportation Research Board

CPATT was featured in the Canadian Weather & Society Advisor Newsletter in Summer 2013. The article highlighted some of the key design considerations for pervious concrete. The article can be found [here](#).

Job News

Congratulations to the following students on completing their degrees. We wish them success in their new roles at the respective companies.

Jonathan Boone, MASC., Project Engineer, Ministry of Transportation Ontario

Milos Posavljak, MASc., Project Engineer, Ministry of Transportation Ontario.

Md. Safiuddin, PhD. PEng., FIEB., Professor, School of Construction Management and Trades, Centre for Construction and Engineering Technologies, George Brown College of Applied Arts and Technology.

Many of you have likely worked with Dr. Md. Safiuddin during the last two years here with CPATT. Congratulations to him on his recent appointment as Professor at George Brown College in the Centre for Construction and Engineering Technologies. So, although he has left, he will continue to work with CPATT on various research projects.

Norman W. McLeod Chair in Sustainable Pavement Engineering

Objective of the Chair

The biggest news associated with the Chair is the recent advertisement of the faculty position. See below the advertisement and all highly qualified candidates are encouraged to apply.

Pavement Engineering and Management

The Department of Civil and Environmental Engineering at the University of Waterloo invites applications for a tenure-track position in the area of pavement engineering and management at the Assistant or Associate Professor rank. The preferred candidate will have a research record in design, construction, maintenance and rehabilitation of flexible and rigid pavements, and expertise in one or several research areas such as modern pavement materials, pavement performance modeling, pavement instrumentation and evaluation, and materials testing. Ability to teach courses such as pavement structural design, infrastructure management, transportation engineering, construction or materials is an asset. The successful candidate must complement the recently established Endowed Norman W. McLeod Chair in Sustainable Pavement Engineering.

Applicants must have potential or proven ability to develop an internationally recognized research program, must have excellent communication skills, and must have a strong commitment to teaching at the undergraduate and post-graduate levels. In particular, the successful applicant must have a strong interest in innovative teaching methods and curriculum development to support our undergraduate civil, environmental and geological engineering programs. The ideal applicant should expect to work with public and private sector research partners, and generate collaborative research funding to lead a successful research program.

The successful applicant is expected to have an engineering license for practice in Canada or to apply for an engineering license with the Professional Engineers of Ontario within 5 years. Salary will be commensurate with qualifications and experience. All qualified candidates are encouraged to apply; however, Canadians and permanent residents will be given priority. The University of Waterloo encourages applications from all qualified individuals, including women, members of visible minorities, native peoples, and person with disabilities.

Interested applicants are invited to submit their full curriculum vitae, along with a teaching vision statement. They are also requested to submit a research vision statement, specifically indicating how their innovative research directions will complement the ongoing research in the Department of Civil and Environmental Engineering. Each of the vision statements should be no more than two pages in length. The curriculum vitae, vision statements and the names and full contact information of at least three references should be sent to:

Professor Neil R. Thomson,
Chair, Department of Civil and Environmental Engineering,
University of Waterloo, Waterloo, Ontario, N2L 3G1
Email: neil.thomson@uwaterloo.ca

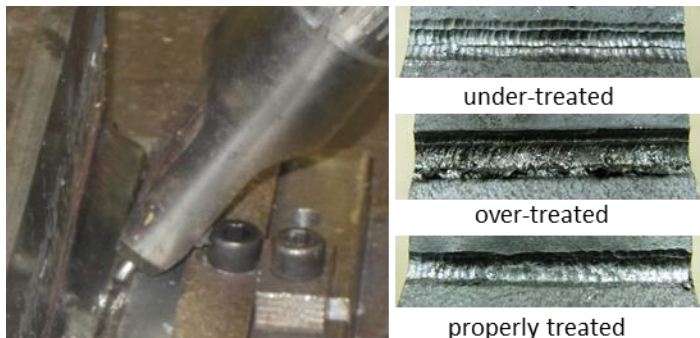
News

Shad Valley Program

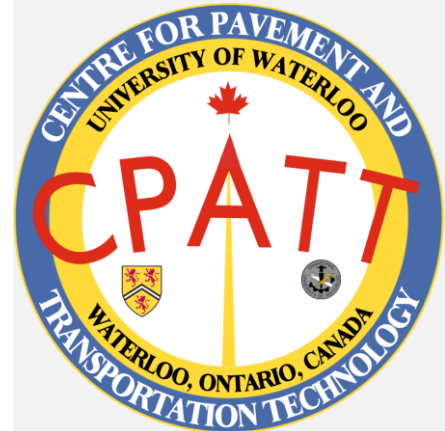
During the month of July, a large contingent of some of Canada's most promising high school students came to the University of Waterloo to participate in the Shad Valley enrichment program. The students took part in many workshops and lectures which focused on the sciences, engineering, technology and entrepreneurship. Daniel Pickel, who is a MAsc candidate under the supervision of Professors Jeff West and Susan Tighe, led the organization of a special workshop. As part of this program, UW's Centre for Pavement and Transportation Technology provided a workshop for a group interested in the field of Civil and Transportation Engineering. The students took part in various laboratory procedures including concrete compressive testing, asphalt batching, and performing several pavement tests. CPATT also hosted a presentation showcasing some of the interesting projects currently underway within the research group. The students took full advantage of the question and answer period portion of the presentation by asking many interesting questions of CPATT's director, Susan Tighe. This was a great event and CPATT was very happy to be part of it. We look forward to participating in the future.

Structures Standing Committee Meeting at TAC

In the Structures Standing Committee Meeting at TAC in Winnipeg on Sunday, September 22, Prof. Scott Walbridge gave a half hour talk on "Metal Bridge Design and Rehabilitation: Recent Research and Development Efforts", which discussed three ongoing research projects currently underway at the University of Waterloo (UW). The first project involves the retrofitting of steel bridge welds using "ultrasonic impact treatment" (UIT). Recent research at UW has allowed the effects of over- or under-treating on the fatigue performance of retrofitted bridge welds to be better understood. The second project, which is being carried out by Profs. Walbridge and West and their graduate students, is looking at new ways of providing a shear connection between precast concrete deck panels and steel bridge girders for accelerated bridge construction projects (i.e. rapid bridge replacement). The last topic of discussion was the use of aluminum in bridges. Prof. Walbridge has conducted several recent research projects in this area, including one in collaboration with Prof. Narasimhan on assessing and improving the vibration performance of aluminum pedestrian bridges. This project has included field instrumentation of the largest aluminum pedestrian bridge in Canada in Brossard, Quebec (44 m span).



Weld retrofitting by ultrasonic impact treatment



CPATT

University of Waterloo
200 University Ave, W
Waterloo, ON N2L 3G1
www.civil.uwaterloo.ca/CPATT/

Numbers and Email:

CPATT - Laboratory
519-888-4567 ext. 37731

Laura Bland - Office
519-888-4567 ext. 32289
lbland@uwaterloo.ca

Dr. Susan Tighe, Director
519-888-4567 ext. 33152
sltighe@uwaterloo.ca

Dr. Jeff West, Associate Director
519-888-4567 ext. 33323
jswest@uwaterloo.ca