Issue 5

CPATT NEWS

Message from the Director

This is a very special issue of our newsletter as the CPATT Test Track is 10 years old in June 2012. It is truly hard to believe the last decade has gone so quickly! It has been an excellent research and education tool. This issue provides some of our typical updates but the bulk of the issue focuses on the lessons learned from our Test Track. In addition, we have featured many of our former students and asked them what they have learned from their time at CPATT. Enjoy!

If you would like to learn more about anything we have presented in this newsletter, please do not hesitate to contact either Laura Bland at lbland@uwaterloo.ca or Susan Tighe at sltighe@uwaterloo.ca. We look forward to hearing from you!

Sincerely,

Susan L. Tighe, PhD., PEng.

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Feature CPATT Faculty Member
Sriram Narasimhan, PhD., P.Eng.
Assistant Professor

Education

Dr. Narasimhan is an Assistant Professor in the Department of Civil and Environmental Engineering at the University of Waterloo. He joined the Department in 2006 after completing his PhD at Rice University in Houston, Texas, USA. Sriram has worked for several years in the consulting industry with the American Bureau of Shipping in the Risk Consulting Division. His MEng degree was in Hydraulics from the Asian Institute of Technology and his undergraduate degree in Civil Engineering from Osmania University in Hyderabad, India.

Sriram Narasimhan, PhD., PEng, Assistant Professor, Department of Civil and Environmental Engineering, University of Waterloo

Research Highlights

Sriram's research focus is on infrastructure condition assessment and infrastructure protection using novel system identification and structural control methods.

- He has several peer-reviewed publications in the area of protection of structures using seismic dampers and tuned mass dampers to withstand natural hazards such as earthquakes and windstorms.
- His work in the area of system identification has resulted in several novel algorithms to estimate the properties of buildings and bridges.
- His algorithms in the area of signal processing have shown significant potential for use with wireless sensor networks for cost-effective and rapid infrastructure condition assessment.
- He is currently working with researchers within UW as well as around the world to develop vibration mitigation methods aimed at enhancing the performance and comfort of pedestrians in light-weight aluminum and stress ribbon bridges.

Professional Activity Highlights

- Sriram is an active champion and has led efforts to enhance the visibility of issues surrounding aging infrastructure and to develop cost-effective mitigation solutions using control devices.
- He currently serves on three international journal editorial boards, and is an active reviewer for over a dozen journals.
- Recipient of the Distinguished Performance Award (2011) from the UW Faculty of Engineering, and has been nominated three times in a row for the Research Excellence Award in the Assistant Professor category in the department of Civil and Environmental Engineering.
- Sriram has been prominently featured as an expert in the media in the aftermath of recent earthquakes such as the ones in Japan and Haiti.

Research Focus – John J. Carrick Pavement Laboratory

Joshua Stipancic (co-op) with the aggregate prior to sieving

Sieving approximately 5 tonnes of material

Xiomara Sanchez (PhD Candidate) adding asphalt cement during mixing process

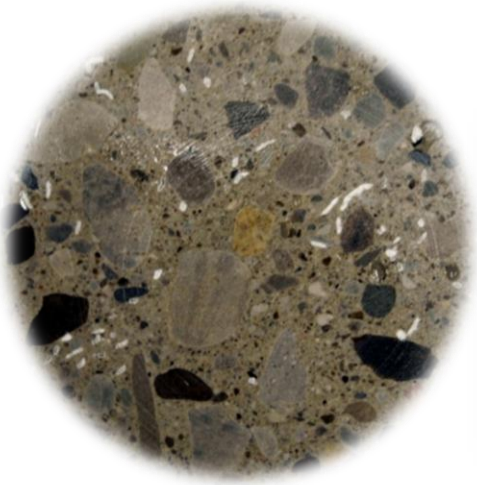
Md. Safiuddin (Post-doc) running the Asphalt mixer

Laboratory Updates

Great progress has been made on the recycled asphalt pavement (RAP) project over the past few months, which is being funded in partnership with the Ministry of Transportation Ontario and the Ontario Hot Mix Producers Association. The CPATT team is also working in partnership with DBA Engineering. Approximately 5 tonnes of material was sieved in preparation for the batching and mixing process.

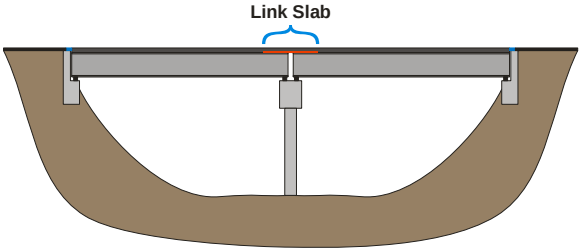
In addition to sieving, mixing has begun in the CPATT laboratory. To date, four of the proposed RAP mix designs have been completed, with 290kg of material prepared for each mix type. The separated aggregate was batched together in precise proportions according to the mix designs. The aggregate batches were then combined with asphalt cement to create the raw asphalt material. Two remaining mix designs are scheduled to be completed by the middle of May. Following batching, tests were performed to determine the maximum relative density of the mixes. Thus far, all results have fallen within an acceptable range, and the lab created mixes are matching the specifications of the mix designs.

Following the completion of the remaining mix designs, samples will be created and laboratory testing of the materials will begin. Results of the study are being incorporated into an upcoming Canadian Technical Asphalt Association (CTAA) paper.



Research Focus – Structures & Concrete Lab

Structures/Concrete Update



Schematic of a two-span bridge with link slab
(only the deck link slab is continuous at interior support)

Fresh concrete mix with synthetic macro fibres

Outdoor exposure specimens with embedded strain and temperature sensors

A UW research project sponsored by the Ontario Ministry of Transportation is studying the use of a fibre-reinforced concrete (FRC) link slab as an alternative to bridge deck expansion joints. The link slab concept may be used in new bridge construction or as a retrofit, and gives the bridge a continuous deck surface while accommodating strains due to loading, thermal cycles and shrinkage.

The FRC for link slabs uses a high dosage of fibres to provide post-cracking tensile strength. The UW research is focusing on FRC mixture proportioning to provide the increased flexural and tensile strength and toughness requirements while maintaining desired compressive strength, workability and durability characteristics. The basic mechanical and fresh properties of FRC mixes with a range of compositional variables are currently being examined in a parametric study. In addition, the long-term internal strains in three mixtures are being monitored in outdoor exposure conditions with and without salt ponding.

The next stages of the research will study the FRC flexural properties and toughness (ASTM C1609 flexural test), FRC shrinkage characteristics, and effects of repeated loading. The overall goal is the develop FRC mixtures with optimal mechanical and long-term properties for use in bridge deck link slabs.

Contact Dr. Carolyn Hansson and Dr. Jeff West for further details.

Research Focus
CPATT Field Work: April 2012

CUPOLEX ® Pavement Trial – Milton, Ontario

In collaboration with Holcim (Canada) Inc., Pontarolo Engineering Ltd., Applied Research Associates Inc., and the Ministry of Transportation Ontario (MTO), CPATT participated in the construction of a trial CUPOLEX ® concrete pavement in April 2012. CUPOLEX ® are interlocking dome-shaped plastic units that serve as framework for concrete. This technology has been widely used in the construction of floor slabs worldwide and is now being evaluated for use in construction of pavements. This product can reduce the amount of concrete material required, as well as the required granular base thickness, since the dome shape provides an increased load carrying capacity.

The 100 metre trial section was constructed on April 13, 2012 on the access road to Dufferin Aggregates' Milton Quarry using a slipform paver. This site sees high volumes of heavy aggregate trucks making it an ideal location for testing this new method of pavement construction. Prior to the paving, CPATT installed instrumentation to monitor the pavement responses. Strain gauges were placed on the concrete, along with pressure cells and moisture probes in the granular layers below. CPATT researchers designed and placed the instrumentation and will regularly collect and analyze the pavement response data in an effort to evaluate performance to date and predict future performance.

Pressure cell sensor installation on April 5, 2012 at the Milton Dufferin Quarry

Josh Stipancic (undergraduate student, co-op term), Aleks Kivi (MASc Candidate), Dan Pickel (MASc Candidate)

Concrete embedment strain gauge sensor installation

Strain gauges mounted on Cupolex prior to paving

Research Focus
CPATT Field Work – Cont'd

Cupolex all set up prior to paving

Paving operation

Texture/curing machine

CPATT Crew: Aleks Kivi, Doubra Ambiaowei and Dan Pickel (all MASc Candidates)

Finished Product

Moisture probes

May 2012 Highlights
Feature Student – Zaid Alyami

Zaid Alyami is a MASc Candidate under the supervision of Dr. Susan Tighe. In May 2010, Zaid received his BASc in Civil and Environmental Engineering along with the Management Science option and Structural Certificate. In the fall of 2010 he began his MASc degree. Zaid values continuing education and self-improvement. Currently, he is a Certified Associate in Project Management (CAPM) from the Project Management Institute (PMI). In addition, he completed the Leadership Certificate from the Organizational and Human Development Student Leadership Program at the University of Waterloo.

During his co-op terms at the University of Waterloo, Zaid worked as an Asset Management Project Coordinator for Public-Private-Partnerships (PPP) projects including Golden Ears Bridge, Anthony Henday Drive, South East Stoney Trail, and Kicking Horse Canyon project. In addition, Zaid worked as an Estimator, Field Technician and a Research Assistant.

Zaid's research interests lies in the area of asset management, public private partnerships, and performance modeling. He has presented a few papers on these subjects at conferences.

Feature Project – Automated Performance Measures for Contract Administration

This project is a joint effort between the Centre for Pavement and Transportation Technology (CPATT) and the Ministry of Transportation Ontario (MTO) as part of the Highway Infrastructure Innovation Funding Program (HIIFP).

The final report presented to MTO provides a review of Performance Based Contracts (PBC) focusing on performance measures. A review of the current state-of-the-practice is conducted to identify key performance measures employed by other agencies. In addition, several road agencies in North America are reviewed to evaluate the important physical attributes agencies are using as performance inputs to evaluate the overall condition of road assets. Moreover, the study provides a review of performance specifications implemented by the MTO including pavement with warranty and minimum oversight contracts. A review of warranty types and periods is presented along with monitoring framework of performance measures. Moreover, recommended performance measures for flexible and rigid pavements and granular shoulders are presented. Finally, a comprehensive list of available data collection technologies was presented along with a selection method using multi-criteria decision criteria approach.

May 2012 Highlights

CPATT Test Track Turns 10!

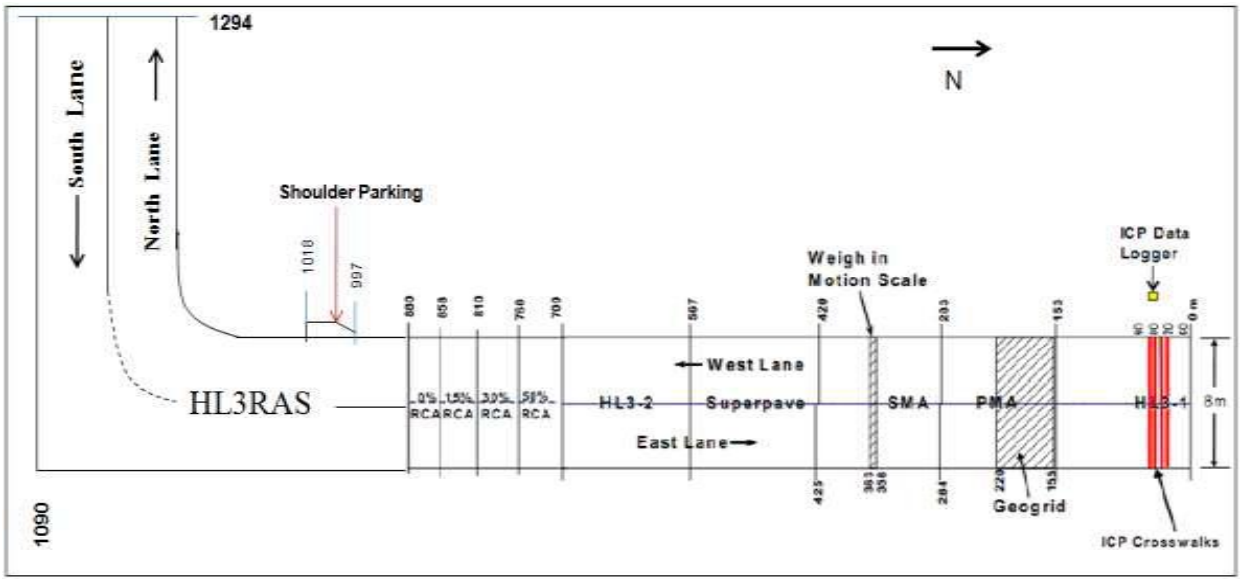
The CPATT Test Track was constructed in June 2002. It was the result of a partnership between federal, provincial and municipal governments, private sector, and the University. The Test Track in located in the southeast corner of the Regional Municipality of Waterloo's Waste Management Facility. The Test Track is located along Erb Street West in Waterloo; it is close to the University of Waterloo campus, making it an ideal location. Over the last ten years, visitors from all over the world have come to see the Test Track and learn how it is being used to advance pavement engineering, not only in Ontario but across Canada.

In 2002, the Test Track consisted of a 700m long test strip, with various asphalt mix designs, embedded sensors, various weigh in motion devices, wireless data transmission, trenchless and trenched installations of high density polyethylene pipe and geogrid reinforcement. Now, the Test Track is 1294m long and 8m wide. It includes fifteen different types of pavement including the five original asphalt surface mixes: Hot-Laid 3 (HL3), Polymer-Modified Asphalt HL3 (PMA), Stone Mastic Asphalt (SMA), SuperPave, Conventional Jointed Plain Concrete Pavement (JPCP) with 15% Recycled Concrete Aggregate (RCA), JPCP with 30% RCA, JPCP with 50% RCA, and a Recycled Asphalt Shingles (RAS) section. The first portions of the Test Track were constructed in June 2002, which contain two control sections (HL3-1, HL3-2) and three flexible sections (PMA, SMA, SuperPave). The PMA section is further divided into two sections, half of which is reinforced with a BX 1200 biaxial geogrid. The JPCP sections were constructed in June 2007 with a control section and varying percentages of RCA including: 50%, 30%, 15% and 0%. The last section of the Test Track is a HL3 RAS mix design and it was constructed in 2009.

There are also four interlocking concrete pavement crosswalks with different bedding materials located at the first section, within the first control HL3-1 section. The centreline of the first crosswalk is located at 0+060, and the following ones are located at 0+070, 0+080 and 0+090 of the Test Track. The Test Track enjoys two loading frequencies. The Southbound lanes have heavy loaded trucks moving garbage, and the northbound lane has unloaded trucks. This has provided excellent information on the impact of loaded trucks on pavement. The complete Test Track layout is shown on the next page.

May 2012 Highlights

CPATT Test Track Turns 10! – Cont'd



The primary objective of the CPATT Test Track is to investigate the impact of axle loads and environment on flexible and rigid pavement structures. Also, to compare the performance of various innovative paving materials through various measurements. Some pictures below and on the next page, show the Test Track when it was first constructed and also more recent pictures of the Test Track now.

It has also been an excellent educational tool for educating both undergraduate and graduate students. Since construction, over 1,000 undergraduate and graduates have not only visited the Test Track, but have used the data from the Test Track for course assignments and other research. It has been a valuable and strategic asset for research and education of students.

Inspection Team at JPCP construction

Asphalt Strain Gauge Installation

May 2012 Highlights

CPATT Test Track Turns 10! – Cont'd

Paving RAS section in 2009

Richard Wei, Susan Tighe, Mohammed Karim, Angela Jeffrey (2002)

Regular FWD measurements: Thank you Partners

Friction testing using the British Pendulum

Crosswalk section construction being observed by undergraduate and graduate students

Portable FWD measurement

Transportation Research Board
January 2012
University of Waterloo Hospitality Suite

The Faculty of Engineering and the Transportation Group in the Department of Civil and Environmental Engineering at the University of Waterloo were pleased to host a complimentary alumni and friends networking reception, during the 2012 TRB Annual Meetings. This event was held at the Washington Marriott Wardman Park Hotel on January 24th, 2012. Some pictures from the event are below.

Prof. Bruce Hellinga speaking at the event

Richard Korczak, Liam Butler, Dom Hu, Mohamad Hegazi

Guest mingling at the event with Aleli Osorio

Prof. Susan Tighe and Prof. Jeff Casello calling out prize winners

Zaid Alyami, Leanne Whiteley-Lagace, Qisen Zhang, Dom Hu, Amin Hamdi

Andrew Northmore, Richard Korczak, Mehran Kafi Farashah, Zaid Alyami, Mohamed Hegazi

Visit by Delegation from Chang'an University

On November 9, 2011 the University of Waterloo's Civil and Environmental Engineering Department hosted a seminar for the visiting Delegation from Chang'an University in China. Some pictures of the seminar are below.

Susan Tighe presenting on CPATT activities

Group Photo of the Delegates with the presenting professors: Jeff West, Susan Tighe and Carl Haas

Susan Tighe with a few of the Delegates presenting her with a thank you gift

The visitors were able to take some time to vist Niagara on the Lake

Girl Guide Engineering Badge Day!

On March 31, 2012 the University of Waterloo's Engineering Science Quest (ESQ) hosted a Girl Guide tour of the engineering labs. We had approximately 120 Girl Guides and 20 Guide Leaders. The girls and their leaders were split into 4 colour-coded groups, which rotated through activities and tours. After the lab tours, the girls took part in an activity called Draw an Engineer. The idea behind this activity was to see how children perceive engineers. This was a great day for the Girl Guides and also for the volunteers who worked in the lab. Thank you to our students Mehran Kafi Farashah, Xiomara Sanchez, Dan Pickel and Josh Stipancic for volunteering your time to help with this Faculty of Engineering Event.

Girl Guides in the walk-in freezer in the CPATT laboratory

Girl Guides learning how to mix asphalt in the CPATT laboratory

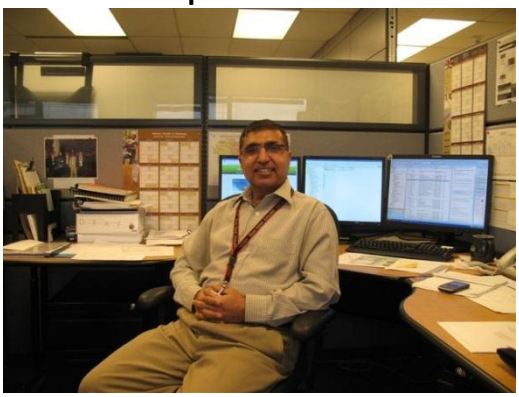
Mehran Kafi Farashah teaching the girl guides about pervious concrete

Mehran Kafi Farashah and Josh Stipancic giving the girl guides a lab tour

Speakers Corner – Former Student Perspective

Since graduating from the graduate program at the University of Waterloo, where are you now?

Mohammad Karim, MASc., P.Eng – Pavement Engineer – City of Calgary
Master's Completion – 2003



"Looking back at the June of 2002 when I was a Master's student under the supervision of Dr. Tighe, and she asked me to work as inspector on the construction of the original portion of the CPATT Test Track (back then we used to call it Waterloo Test Track). I remember we installed 5 different mix types, a few conventional (HL8, HL3, etc.), one Superpave and one of them being SMA. I knew very little about SMA at the time and the way it bled during installation, I thought this would be the worst mix type we ever had. However, 10 years later, now I know a lot more about SMA and Superpave, we use them most of the time on our major roads here in Calgary. I learned that we need to adjust the blend for the right mix to be produced. We also need to find the right location for the right mix at the right time.

I remember when Dr. Tighe asked me to write my observations from the duration of the construction, I wrote a few pages. While working as inspector on the original construction of the Test Track, I learned how important it is to note and keep record of all the observations in order to evaluate the long term performance. Having a good construction record can help us trace back a problem, if we have any, to the condition at the time of construction. I also remember when I was asked to take as many photos as we can. I follow that advice still today. A picture is worth a thousand words. It helps us show the things that the words can not explain."

Susanne Chan, MASc, P.Eng – Pavement Design Engineer – Ministry of Transportation Ontario
Undergraduate – Spring 2000 (U of Waterloo), Post-Grad – Fall 2001 (U of Waterloo)

"Since I graduated, I have been working at the Minstry of Transportation Ontario. My work is closely related to pavement and our office has done numerous research studies with the University of Waterloo, in particular related to CPATT. The various technology and mix design types at the CPATT Test Track has made tremendous contribution to the industry. I was involved with the Single Wide Base tire study to use the CPATT Test Track for simulation tests. Also, I have managed the MTO funded HIIFP study project on pavement sustainability supported by CPATT. I am looking forward to working with CPATT again in the future."

Shown in the picture above is Susanne with ther husband, Anson and their little boy Bosco, who turns 2 this month.

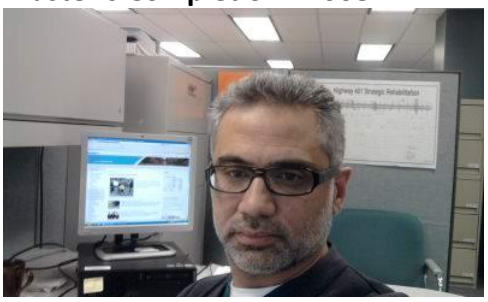
Speakers Corner – Cont'd

Since graduating from the graduate program at the University of Waterloo, where are you now?

Lori Schaus, MASc., PEng - Project Engineer – Applied Research Associates Inc. (ARA)
Undergraduate Completed – 2005, Master's Completed – 2007

"My time at CPATT was an amazing learning experience. At the time of my Master's research in porous asphalt, the CPATT laboratory was fairly new. We were constantly setting up new equipment and trying out new testing procedures. With the assistance of the staff and other students, I learned a lot about laboratory procedures, testing protocols, and the fundamental elements of asphalt and concrete. In my career with ARA, I have moved away from laboratory testing and now work as a project engineer designing pavements and supervising field investigations. Although I no longer work in a laboratory setting, the opportunity to study at the CPATT laboratory gave me a solid base to start my career on."

Fazal Mabood, MASc, P.Eng. – Pavement & Design Evaluation Officer – Ministry of Transportation Ontario
Master's Completion - 2008



"I did PFWD and FWD testing on the CPATT Test Track for correlation purposes to determine pavement deflection and Subgrade Resilient Modulus values. Based on data from the Test Track and other test sites (Hwy 630, 650, 651) I developed correlation equations between the conventional FWD and the lightweight PFWD. These correlations were very practical and statistically significant. Moreover, I also had to demonstrate whether the PFWD could be used to monitor variation in pavement strength due to different weather conditions. My main focus was to determine the true spring thaw strength of pavements which to introducing the PFWD as a tool to impose Load Restrictions at the right time. This exercise was also validated through PFWD defection data at the Test Track."

"In my current position, I am continuously involved in reviewing FWD testing and data analysis; assisting the geotechnical engineer in providing appropriate directions to consultants on rehabilitation/resurfacing projects based on the results from FWD testing for major highways such as Highway 401, 400, 12, 11, and 7. I am applying the knowledge I have gained while pursuing my masters and working at CPATT. This helped give me the foundation for my current job and career.

Speakers Corner – Cont'd

Since graduating from the graduate program at the University of Waterloo, where are you now?

Sudip Adhikari, MASc. PEng. – Systems Management Engineer – Saskatchewan Ministry of Highways and Infrastructure
Master's Completion - 2008

Sudip has been working as a Systems Management Enigneer for the Saskatchewan Ministry of Highways and Infrastructure for three years. His research topic was "Performance Evaluation of Interlocking Concrete Pavements" to assess the performance he was involved in construction of three different interlocking concrete crosswalk designs at the CPATT Test Track and four at the UW Ring Road. For the evaluation of structural performance, he was also involved in installation of strain gauges and pressure cells at different locations in the pavement layers. Thermistors and moisture probes were also installed to monitor temperature and moisture variation. He also performed pavement functional and safety evaluation periodically on the test sites. "I learned to perform different performance evaluation techniques on the pavements while working at the CPATT Test Track. I also learned to incorporate pavement performance data into pavement management systems and analyze them for better decision making. I also had great exposure to the construction of unique interlocking concrete pavements and laboratory testing of different pavement constructiion materials. I am utilizing this very knowledge and skills I obtained at CPATT in my job on a daily basis."

Ken Huen, MASc. – Project Engineer – Ministry of Transportation Ontario
Master's Completion – August 2005

"My experience in CPATT was focused on participating in projects where leading edge technologies were installed in the pavement, analyze the dynamics of the pavement under loading, and develop a model to predict performance. Working with the CPATT group has provided me with a great sense of team work, the value of networking in the industry, and the importance of implementing and evaluating new technologies on Ontario Highways."

Speakers Corner – Cont'd

Since graduating from the graduate program at the University of Waterloo, where are you now?

Leanne Whiteley-Lagace, MASc. PEng. – Pavement Engineer – Stantec Consulting Ltd.
Undergraduate Completed – 2004, Master's Completed - 2006

"I work as a pavement engineer with the Infrastructure Management & Pavement Engineering group at Stantec Consulting. My primary focus is pavement management systems. I am involved with the implementation and on-going support of both municipal and provincial/state level pavement mangement systems across North America. Looking back at my experience in the graduate program at Waterloo, I am grateful for the professional development opportunities that were made available to me, including writing papers, delivering presentations, attending conferences, and organizing seminars/conferences."

M. Alauddin Ahammed, Ph.D., P.Eng – Pavement Design Engineer – Manitoba Infrastructure and Transportation (MIT)
Doctoral Completed – 2008

"The dream to pursue graduate studies at the University of Waterloo came to reality when Prof. Tighe agreed to be my PhD. supervisor. My PhD. research was related to pavement surface characteristics. In my current role, I am mainly involved in pavement structural design and assessment, research/investigation and project management, and relevant new technologies. Although I have minimal exposure now in the area of my PhD research, working with the CPATT team was an honour for me. In fact, it was a milestone for my career. I am grateful for the opportunity to work with the great team of CPATT and to attend/participate in various activities including workshops, meetings, and conferences, which I still miss. There is no monetary value of the training, comfort and encouragement that I received from the whole team, especially from Dr. Tighe."

Upcoming Events

June 6-9, 2012 – 2012 Canadian Society of Civil Engineers (CSCE) Annual Conference. This event is being held in Edmonton, AB.
June 8-9, 2012 – 8th Annual Inter-University Symposium on Infrastructure Management (AISIM). This event is being held at the Georgia Institute of Technology in Altanta, GA.
July 8-12, 2012 – 10th International Conference on Concrete Pavements. This conference is being held in Québec City, QC.
September 17-21, 2012 – Summer Winter Integrated Field Technologies (SWIFT) 2012 Conference and Trade Show. This conference is being held at the Fairmont Banff Springs Hotel, Banff, AB.
October 14-17, 2012 – 2012 Transportation Association of Canada (TAC) Conference and Exhibition. This conference is being held in Fredericton, NB.
November 17-21, 2012 – 57th Annual Canadian Technical Asphalt Association (CTAA) Conference. This conference will be held in Vancouver, BC.

Welcome New Students and Congratulations

Marcelo Gonzalez, MASc Candidate
Md. Safiuddin, Post-Doctoral Fellow

Congratulations to **Jodi Norris**, CET, Former CPATT Research Technolgoist, who has accepted a position at Golder Associates Ltd, we wish her the best of luck!

Congratulations to **Rana Tehrani Yekta**, who received the 2012 Vale Master's of Engineering Scholarship Award

Congratulations to **Professor Jeff West**, who has been named a Fellow with the American Concrete Institute.

Past CPATT Seminars

Wednesday March 7, 2012
Seminar entitled "Emergency Response Following the 2010 Chilean Earthquake"
Speaker: Dr. Hernan de Solminihac Tampier, Minister of Mining, Chile
Thursday April 5, 2012
Seminar entitled "Long Life Asphalt and Concrete Pavement Considering Fast Track Construction"
Speaker: Dr. John Harvey, Professor, Civil and Environmental Engineering, University of California at Davis

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