

Norman W. McLeod Chair in Sustainable Pavement Engineering



3/14/2013

2012/2013 Annual Report

This report provides an update of the activities of the Norman W. McLeod Chair from January 2012 – January 2013 inclusive.

Prepared by:

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Norman W. McLeod Chair in Sustainable Pavement Engineering

2012/2013 ANNUAL REPORT

This report is intended to summarize the activity of the Chair from January 2012 to January 2013.

1.0 Scope and Objective of the Chair

The scope of the Chair focuses on emerging and innovative pavement technology, state-of-the-art research infrastructure in areas of design, materials, construction, preservation, safety, and management for tackling specific problems, developing new technologies and training skilled people.

The objective of the Chair is to:

- Provide cutting-edge sustainable pavement engineering research.
- Develop sustainable and cost-effective materials, designs, construction and management tools.
- Collaborate with government, industry, and academia.
- Teach and supervise students.
- Disseminate findings through seminars, newsletters, papers and reports.

One main objective of the Chair is to provide specialized training needed to meet the challenges of transportation engineering in the 21st century. The research and teaching program is designed to develop future leaders and to advance critical partnerships between universities, government, and the private sector.

The Norman W. McLeod Chair in Sustainable Pavement Engineering is in support of the Centre for Pavement and Transportation Technology (CPATT). CPATT has been at the forefront of exceptional research, training and professional activities. This success is rooted in both the experienced and skilled faculty members, as well as the state-of-the-art facilities such as the John J. Carrick Pavement Laboratory at the University of Waterloo, the CPATT Test Track at Waterloo Region's Waste Management Facility and several satellite test sites located across Canada. All of these facilities support the state-of-the-art research program. The current and future research will continue to advance key research needs but will also provide strategic training for the industrial partners and the broader community at large. Development of national and international partnerships will also facilitate technology transfer.

1.1 Personnel Associated with the Chair Management

- Susan Tighe – Chair

- Laura Bland – Administrative Assistant
- Md. Safiuddin – Research Associate
- Anca Constantinescu – Faculty Financial Officer
- Heidi Mussar – Senior Manager, Graduate Financial Aid and Awards

2.0 Partners

We greatly appreciate the support of our partners in the Norman W. McLeod Chair in Sustainable Pavement Engineering. Our industry partners are key industry stakeholders and are knowledgeable in the areas of research in which the Chair will pursue. The resources and expertise they can provide is extremely beneficial as we move forward on various research initiatives. Below is a list of our partners:

- Capital Paving Limited
- DBA Engineering Ltd.
- Golder Associates Ltd.
- Holcim Canada Inc.
- LVM-Jegel
- McLeod Endowment
- McAsphalt Industries Limited
- Miller Paving Limited
- Ministry of Transportation Ontario
- Ontario Good Roads Association
- Ontario Hot Mix Producers Association
- Ready Mixed Concrete Association of Ontario
- Roto-Mill Inc.
- Shiloh CanConstruct
- Stantec Consulting Limited
- Steed and Evans Limited



3.0 Outreach

Over the past year we have hosted a Graduate Student Poster Symposium and also 3 seminars.

3.1 Graduate Student Poster Symposium

On Friday September 21st 2012 we held a Graduate Student Poster Symposium in the E5 Student Design Centre. The event started at 12:30pm – 3:00pm and lunch was provided for the guest. In total, 21 graduate students, who participate in CPATT, prepared posters on their current research projects. Approximately 100 industry members, faculty, staff and students attended this event to learn more about what the students were researching.

This event was a great way for industry partners to come to the University and ask the students questions and get a better understanding of some of the current research projects. It was also a great opportunity for the students to network with the industry members and receive feedback on their work.

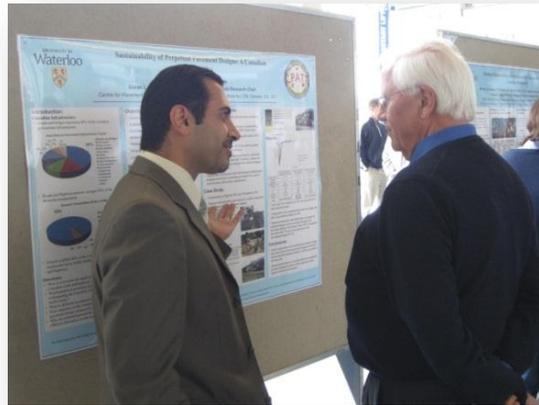
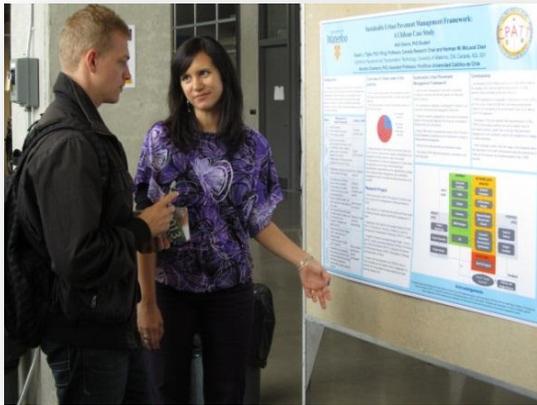
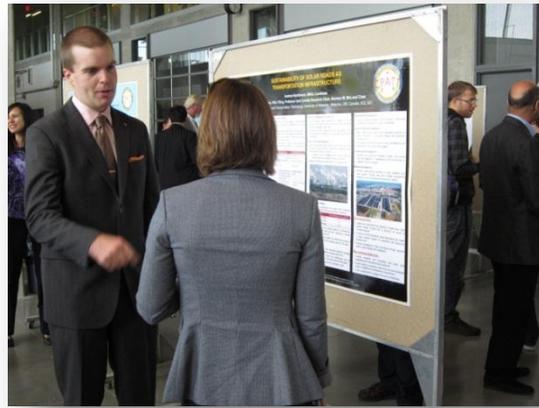
Booklets were provided to the guests, which presented an abstract of each of the student's projects. We received great feedback from the guests for this event. Some of which include:

“I was very pleased with the CPATT Student Poster Symposium. The number of students participating, their level of knowledge and the variety of topics were impressive. It provided me with a sense of comfort – that these students would be our future leaders in their various study areas sharing their knowledge as an academic with others or working in their field of interest. Their knowledge and enthusiasm were contagious, making the room buzz with discussions, questions, debates and excitement. I look forward to the next session to meet another group of eager students who are driven to make a difference in their study area.” – **Gerry Chaput, P.Eng, Assistant Deputy Minister – Ministry of Transportation Ontario (MTO)**

“The CPATT Poster Symposium was well worth attending and very interesting. The quality of the research along with the variety of research topics was very nice to see. It is great to see that the University, CPATT and Susan support the growth and professional development of their students. There was a good mix of industry people, academics and students and I look forward to attending next year's event.” – **Amir Abd El Halim, PhD., PEng, Principal, Practice Leader, Infrastructure and Pavement Engineering – Stantec Consulting**

“It was an honour to be a Poster Reviewer for the September 2012 Graduate Student Poster Symposium hosted by CPATT and the Norman W. McLeod Chair in Sustainable Pavement Engineering. Attending the Chair Advisory Board Meeting with its comprehensive review of activities and projects with focus on strategic planning, followed by reviewing and discussing 21 well prepared and informative posters covering a wide range of topics from recycling to ultrasonic testing, made for an informative and enjoyable networking day at Waterloo. There were posters on recycling asphalt and concrete aggregates, rubber modified asphalt, hot-on-hot paving, sustainable pavements, surface characteristics, pavement performance, pavement maintenance and rehabilitation materials, methods, and management, mechanistic-empirical pavement designs, concrete reinforcement, and bridge structure repair systems. Discussion of each poster with the graduate students clearly indicated a lot of hard work was in progress and the applied research will certainly result in a broad spectrum of enhanced applied infrastructure technology. During a poster and research wrap-up with the graduate students, the increasing focus on sustainability and the importance of reviewing and incorporating previous research was emphasized. Stantec kindly provided some poster prizes and these were awarded to posters on: maintenance and rehabilitation programs for pavements under performance based contracts; performance evaluation of urban pavements rehabilitation with concrete; and advanced concrete element testing. The Graduate Student Poster Symposium is certainly an important technology transfer and networking component of CPATT and the Chair.” - **John Emery, PhD., MASCE, P.Eng, Adjunct Professor of Civil Engineering at McMaster and Waterloo, President and Principal Engineer – Shiloh CanConstruct Limited**

Some pictures of this event are shown below:



3.2 Hernan de Solminihac Seminar

On March 7, 2012, the Norman W. McLeod Chair co-hosted a seminar on “Emergency Response Following the 2010 Chilean Earthquake”. The invited speaker, Dr. Hernán de Solminihac Tampier, Minister of Mining, Chile, presented on his experience with Emergency Response system. Hernán Eduardo de Solminihac Tampier is the Minister of Mining in Chile. Previously he was the Minister of Public Works of Chile. In February 2010, Sebastian Piñera, the elected President of Chile, invited him to join his cabinet. The new government took office in March 2010 with Hernán de Solminihac sworn in as the Minister of Public Works. From March 2010 until July 2011 he was in charge of the Ministry of Public Works. At the end of July, he took over as Minister of Mining.

His presentation included a general description of Chile, international outlook of earthquakes and catastrophes, a case study which included the damage assessment, emergency and reconstruction and lessons learned. The complete presentation can be found at: https://uwaterloo.ca/centre-pavement-transportation-technology/sites/ca.centre-pavement-transportation-technology/files/uploads/files/Hernan_Presentation.pdf.

This seminar was very beneficial to all those that attended. There was also a very good question and answer section where various issues were discussed.

We greatly appreciate Dr. Hernán de Solminihac, taking the time to travel to the University of Waterloo and present a very insightful and interesting presentation. His knowledge and expertise in this area was evident in his presentation and also the question and answer session after the presentation.

3.3 John Harvey Seminar

On April 5, 2012, the Norman W. McLeod Chair co-hosted a seminar on “Long Life Asphalt and Concrete Pavement Considering Fast Track Construction”. The invited speaker, Dr. John Harvey, Professor, Civil and Environmental Engineering, University of California at Davis, presented on his experience with Fast Track Construction. Dr. John Harvey is the Principal Investigator of the California Department of Transportation sponsored Partnered Pavement Research Center for research, development and implementation for a wide range of pavement technology, management, cost and environmental topics. Professor Harvey works in the areas of pavement materials, design, management, and environmental life cycle assessment. He has worked on projects for the US Federal Highway Administration, the Strategic Highway Research Program, the Federal Government of Nigeria and the World Bank, several states, industry and a number of local agencies. Professor Harvey teaches pavement engineering, pavement materials and construction management classes at UC Davis.

The presentation can be found at: https://uwaterloo.ca/centre-pavement-transportation-technology/sites/ca.centre-pavement-transportation-technology/files/uploads/files/John_Harvey_Seminar.pdf

This seminar was very beneficial to all those that attended. There was also a very good question and answer section where various issues were discussed.

We greatly appreciate Dr. John Harvey, taking the time to travel to the University of Waterloo and present a very insightful and interesting presentation. His knowledge and expertise in this area was evident in his presentation and also the question and answer session after the presentation.

3.4 David Timm Seminar

On January 9, 2013, the Norman W. McLeod Chair co-hosted a seminar for students on “Perpetual Pavement Research at the NCAT Test Track”. The invited speaker, Dr. David Timm, Brasfield & Gorrie Professor, Civil Engineering, Auburn University, presented on his experience with the National Center for Asphalt Technology Test Track at Auburn University. Dr. David Timm has been at Auburn University since 2011 after completing his doctoral degree at the University of Minnesota where he also received bachelor (1996) and master (1997) degrees. His main research interests are in flexible pavement modeling and structural pavement design. He works extensively with the National Center for Asphalt Technology Pavement Test Track. He teaches senior and graduate level courses in Civil Engineering Materials and Pavement Design. He also teaches various industry short-courses and he is a registered professional engineer in Alabama.

He discussed the fundamental concepts of perpetual pavement design and presented two case studies from the National Center for Asphalt Technology Test Track at Auburn University. Both cases included sections built at the Test Track with embedded instrumentation that provided valuable information regarding pavement response (i.e. stress and strain) and were subjected to extensive falling weight deflectometer testing to characterize the in-situ material properties. The first set of sections were designed and built in 2003 according to the 1993 AASHTO Pavement Design Guide and were not intended to be perpetual. The second set of sections was built in 2006 as part of a perpetual pavement experiment and included a rehabilitation component. Valuable insight into how perpetual pavements function and can be designed and rehabilitated in the future were gained from these section. The complete presentation can be found at: <https://uwaterloo.ca/centre-pavement-transportation-technology/sites/ca.centre-pavement-transportation-technology/files/uploads/files/TimmWaterloo.pdf>

We greatly appreciated Dr. David Timm taking to time to visit the University of Waterloo and present his finding in the area of perpetual pavements. This was especially beneficial to CPATT as we do extensive work at our CPATT Test Track in Waterloo.

3.5 Vincenzo Gallelli Seminar

On January 28, 2013, the Norman W. McLeod Chair co-hosted a seminar for the students on “Pavement Surface Performance Evolution and WMS\A for Eco-friendly Pavement Solutions: Two Experimental Research Approaches”. The Invited speaker, Dr. Vincenzo Gallelli, Associate Professor, Territorial Planning, University of Calabria (Italy), presented on pavement surface performance. Some information about the research presented is below.

Pavement surface texture and skid resistance have a great influence on road functionality and can affect user’s safety, vehicle operational costs, and environmental sustainability. The assessment of the evolution of pavement surface performance plays a fundamental role in road pavement management and is useful in order to achieve adequate allocation of maintenance resources. Furthermore, in recent years, several warm mix asphalt (WMA) technologies have been developed in order to enable significant energy savings and harmful emissions restraint by reducing mixing and compaction temperatures in hot mix asphalt (HMA) production processes.

In light of the above, two experimental researches were carried out in the Laboratory of Road Materials at the University of Calabria. One of the studies focused on the evaluation of pavement surface performance evaluation by means of a two-year monitoring of an experimental road section. Four different dense graded friction courses were designed with aggregates of different petrographic nature: limestone, basalt and expanded clay. Several surface performances were measured by means of different devices. This work is part of a wider research project designed and in partnership with the Road Network Division of Provincial Administration of Cosenze (Italy), with the final aim of conducting a technical and economic study of the definition of the allowance thresholds in the road management and maintenance contracts.

The second study is a laboratory investigation of compaction characteristics of WMA produced by water-containing methodology with the addition of synthetic zeolites. The influence of the time elapsed between mixing and compaction operations on mixes compactibility was also evaluated in order to define the optimum “Micro-Foaming Time” (FT), in which the additive can completely release the water contained. A systematic comparison between traditional HMA and warm mixes produced at lower mixing/compaction temperatures was carried out: two compaction methods (impact/gyratory) were used. Data obtained from the experimental tests showed that the foaming process due to the addition of the zeolite has a peak value of intensity when the mix is compacted after 1 hour of FT; the effect seems to vanish for a longer period of time when the behaviour of the warm mix is close to that of the mix compacted at the same lower temperature without the additive. The complete presentation can be found at: https://uwaterloo.ca/centre-pavement-transportation-technology/sites/ca.centre-pavement-transportation-technology/files/uploads/files/Seminar_Gallelli_28Jan.pdf

We greatly appreciated Dr. Vincenzo Gallelli taking to time to visit the University of Waterloo and present his finding in the area of perpetual pavements.

5.0 Recent Projects

Below is a list of some of the recent research projects which relate to the Chair, which Susan Tighe is the principal investigator:

Title	Agency	Year	Status
Engineering Criteria and Standards for Key Performance Indicators Used in Pavement Management	Ministry of Transportation Ontario	2013-2014	Applied

Development of Acceptance Test Methods Related to Performance and Durability of Pervious Concrete	Ministry of Transportation Ontario	2013-2015	Applied
Determination of Low Temperature Properties of Asphalt Mixes Based on AASHTO T322 and Bending Beam Rheometer (BBR)	Ministry of Transportation Ontario	2013-2014	Applied
Sustainable long life concrete pavements	Natural Sciences and Engineering Research Council of Canada	2012-2014	In-progress
	Cement Association of Canada	2012-2014	In-progress
Improving the fatigue performance of hot mix asphalt	Ministry of Transportation Ontario	2012-2014	In-progress
Determination of dynamic modulus for hot mix asphalt required for mechanistic-empirical pavement design guide implementation	Ministry of Transportation Ontario	2012-2014	In-progress
Evaluation of rubber modified asphalt: past, present, future	Ontario Tire Stewardship	2012-2014	In-progress
	Natural Sciences and Engineering Research Council of Canada	2013-2014	Applied
Determining quantity of recycled asphalt pavement in hot mix asphalt research	Ministry of Transportation Ontario	2011-2014	In-progress
	Ontario Hot Mix Producers Association	2011-2014	In-progress
	Natural Sciences and Engineering Research Council of Canada	2012-2014	In-progress
Development and Evaluation of a Braking Availability Testing Device	Team Eagle Ltd.	2010-2013	In-progress
	Ontario Centres of Excellence	2010-2013	In-progress
C-LTPP Database Review	Transportation Association of Canada	2011-2012	Completed
Evaluation of Pavement Distress Measurement	City of Markham	2010-2012	Completed
Quantifying Pavement Sustainability	City of Markham	2010-2012	Completed
Assessment of Long-Term Performance and Cost-	Ministry of Transportation Ontario	2010-2012	Completed

Effectiveness of Standard Pavement Treatments Used in PMS2			
Automated Performance Measures for Contract Administration	Ministry of Transportation Ontario	2010-2012	Completed
2012 TAC Pavement Asset Design and Management Guide	Transportation Association of Canada	2009-2012	Completed
Usage of Recycled Asphalt Shingles	Miller Paving Ltd.	2008-2012	Completed
	Ontario Centres of Excellence	2010-2013	Completed

6.0 Board of Advisors Meetings

The second Board of Advisor’s (BOA) meeting was held on September 21, 2012. The main focus of this meeting was to discuss the roles and responsibilities of the board, briefing on current commitments and projects, the annual report and planning for the future. Some of the Chair’s current commitments include a focus on practical research and working on advancing sustainability related to pavement, training of students, working with industry members, communicating with partners, attending and hosting events and seminars, recruiting students both international and Canadian. The group also reviewed the roles and responsibilities of the Board some of which are overseeing the strategic direction of the Chair, in conjunction with the University’s Strategic Plan and direction. Provides insight and advice on research directions, dissemination of results, partnerships and sources of funding. The board discussed key areas of interest and a working group was formed to develop a Roadmap/White Paper for a five year time frame to assist in providing strategic direction to the Chair. This should be focused on sustainability research for Ontario.

The annual report (2011) was also discussed which was distributed in January 2012. This annual report included many of the same heading as in this report. Overall the board was very positive on the achievements of 2011.

7.0 Funding

7.1 Return on Investment

The initial investment in the Chair has been heavily leveraged by the ability to attract high quality students. Since the inception, four full government scholarship students have joined the group. In addition, all industrial funds on research projects have been matched 2:1.

7.2 Total Effective Financial Resources

Initial investment of \$1,500,000 has resulted in approximately \$950,000 research funds and \$300,000 funding towards students. Some of this funding for students comes from research projects but also funding comes from scholarships and assistance as described below. In addition, it has enabled for two open houses where more than 500 people have participated. Also five seminars have been hosted where in total of approximately 150 people have attended. The Chair program is also fully utilizing the original \$10 Million CPATT laboratory. This was originally funded by the federal and provincial governments (Canadian Foundation for Innovation (CFI), the Ontario Innovation Trust (OIT) and Ontario Research and Development Challenge Fund (ORDCF)).

Faculty and Personnel Salary

The salaries for faculty and personnel are approximately \$300,000/per year. These salaries include: Susan Tighe, Laura Bland (Administrative Assistant), Md. Safiuddin (Research Associate), part salary to support Chair for Anca Constantinescu (Faculty Financial Officer), and part salary to support the Chair for Heidi Mussar (Assistant Director, Graduate Financial Aid & Awards). These salaries are provided by the Canada Research Chair program and the University Operating Budget with the exception of Laura Bland and Md. Safiuddin, whose salaries are from Research Funds.

Student Salary Assistance

Total funding since January 2011 from student assistance programs is approximately \$111,000. The following is a list of the student assistant programs that are included in this amount.

- NSERC USRA
- Ontario Graduate Scholarships
- President's Graduate Scholarships
- Dean's Incentive Program
- Saudi Arabian Scholarship Funds
- Transportation Association of Canada Scholarships
- Canadian Technical Asphalt Association
- Part-time students – part-time students salaries are covered by industry

Awards

- 2012 – Mohab El-Hakim (PhD Student) – Annual Inter-University Symposium on Infrastructure Management
- 2012 – Andrew Northmore (MAsc Student) – Canadian Society of Civil Engineering
- 2011 – Mohab El-Hakim (PhD Student) – Annual Inter-University Symposium
- 2011 – Bijan Ahmadi with Brenda McCabe – Canadian Society of Civil Engineering

Industry Hosted Events

- Participation in Ontario Good Roads Association Winter 2011 and 2012 Seminars
- Participation in the Milestones newsletter – Ontario Good Roads Association
- Ontario Hot Mix Producers Association – Fall 2011 and 2012 Seminar
- Cement Association of Canada – Fall 2012 Seminar

Keynote Addresses

- 2012. “Aircraft Anti-Skid Braking Availability Tester”, International Air Safety Summit, Buffalo, April
- 2012. “Concrete Pavement Leading Initiatives”, Cement Association of Canada Annual Conference, June, Toronto
- 2012. “Transportation and Adaptation to Climate Change Workshop”, Prince George, May
- 2012. “Performance Evaluation of Heavy Duty Canadian Highways – Ontario Experience, International Symposium on Heavy Duty Asphalt Pavements and Bridge Pavement, China, May
- 2012. “Evaluating Sustainability”, Australian Asphalt Paving Association, Queensland Main Roads Annual Meeting, Brisbane, Australia, April
- 2012. “Can Sustainability be Incorporated into Pavement Engineering Best Practices: What Practitioners and Researchers Should Consider“, 7th International Conference on Maintenance and Rehabilitation of Pavements, New Zealand, August
- 2012. “Design of Perpetual Pavements” International Society for Asphalt Pavements (ISAP), Nanjing, China, May
- 2011. Developing Sustainability Criteria for Pavement Engineering, International Conference in Managing Pavement Assets, Santiago, Chile, November.
- 2011. Climate Change Impacts on Sustainable Construction, Cement Association of Canada, June.
- 2011. Innovations in Canadian Concrete Pavement Research and Education, Ready Mixed Concrete Association of Ontario, September
- 2011. Improving Runway Safety: Braking Availability Tester, International Conference on Winter Operations, Montreal, October.
- 2011. Diversity in Engineering: A Professor Perspective, Women and Engineering Forum.

8.0 Future Plans

8.1 New Faculty Position

One of the primary motivations of the Chair is to expand the current pavement research program by hiring a new faculty member. Due to the current payouts on the endowment the advertisement will instead be issued in 2013 once the full \$1.5 million amount of the endowment has been received. This is unfortunate but related directly to the current market returns. The Board discussed the new faculty position and the upcoming plans for this.

The new faculty member must have a strong background in pavement engineering and management. 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. We will keep you updated on that progress.

8.2 Upcoming Seminars

We again plan to host two to three seminars per year. These have yet to be scheduled but we will be sure to keep the Board posted on all seminars so that they can fully participate in the activities.

8.3 Collaboration

Over the next few years the plan is to continue to develop and expand on external collaboration through outreach. We will also start to initiate research based on the Road Map ideas. We will have active participation in various external meetings, seminars and conference. This also includes active student participation in these activities.