

CPATT NEWS

SUMMER 2017 ISSUE

NORMAN W. MCLEOD

CHAIR IN SUSTAINABLE PAVEMENT ENGINEERING

CPATT

CENTRE FOR PAVEMENT AND
TRANSPORTATION TECHNOLOGY



UNIVERSITY OF WATERLOO
FACULTY OF ENGINEERING
Department of Civil &
Environmental Engineering

CPATT NEWS

SUMMER 2017 ISSUE

A MESSAGE FROM THE DIRECTOR

Welcome to our Summer 2017 addition of CPATT News!

It is with great pleasure that I can formally announce, Professor Hassan Baaj has been elected the new CPATT Director, effective immediately. The decision was concluded at our yearly Board of Advisors meeting on September 7, 2017. Due to my new position as the Deputy Provost and Associate Vice-President, Integrated Planning and Budgeting, at the University of Waterloo, I will be stepping down as Director of CPATT. Myself, and the CPATT Board members are confident that Professor Baaj will be a great leader, and will continue to do novel and innovative research with CPATT. Congratulations, Professor Baaj.

In this newsletter, we highlight some of the various projects underway at the Centre for Pavement and Transportation Technology (CPATT). This includes: high performance asphalt mixture applied in airport pavement, moisture susceptibility of Warm Mix Asphalt, quantifying the environmental impacts of pavement maintenance activities, the Imperial Oil Research Program, research collaborations between the University of Waterloo and China, and a spotlight on the Fulbright program with Dr. John Daly

We also highlight some events from the past few months, which includes a seminar by Dr. Felipe A. Halles, Dr. Chris Bachmann's award winning paper on "Modelling the Impacts of Free Trade Agreements on Domestic Transportation Gateways, Corridors, and Ports", and a spotlight on graduate student achievements.

There are many special features on some of our current graduate students. We have also included a feature on one of our newest faculty members, Dr. Rebecca K. Saari, in our Civil and Environmental Engineering Department, at the University of Waterloo.

Should you have any questions related to our activities please do not hesitate to contact us.

Sincerely,
Susan L. Tighe, PhD, PEng

CPATT NEWS

SUMMER 2017 ISSUE

1. Faculty Feature - Dr. Rebecca K. Saari
2. Student Feature - Frank Liu (PhD Candidate)
3. Student Feature - Saied Salehiashani (PhD Candidate) and Tracy Zhou (MAsc Candidate)
4. Student Feature - Sarbjot Singh (MAsc Candidate)
5. Student Feature - Filzah Nasir (MAsc Candidate)
6. Highlights & Events - Fred Burggraf Award Winner, Dr. Chris Bachmann
7. Highlights & Events - University of Waterloo Engineering Day
8. Student Spotlight
9. Seminar Feature - Dr. Felipe A. Halles
10. Research Feature - Fulbright Specialist Program
11. Research Feature - Imperial Oil
12. Research Feature - Imperial Oil (cont'd)
13. Research Feature - CPATT Lab WorkFocus
14. Research Feature - Capital Paving Field Trip
15. Research Feature - China Research Partnership
16. Research Feature - China Research Partnership (cont'd)
17. Research Feature - Ongoing and Recently Completed CPATT Research Projects
18. Research Feature - Ongoing and Recently Completed CPATT Research Projects (cont'd)
19. Contact Information

You can follow us on Facebook or visit our official University of Waterloo CPATT webpage, for up-to-date news and events, by clicking on the links below:



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FACULTY FEATURE

REBECCA K. SAARI, PhD



Dr. Saari is an Assistant Professor in the Department of Civil and Environmental Engineering at the University of Waterloo in Waterloo, Canada. She graduated from the University of Toronto with a BAsC in Engineering Science (2005) and an MASc in Mechanical and Environmental Engineering (2007). She completed her Ph.D. in Engineering Systems from Massachusetts Institute of Technology in 2015, where she was a Total MIT Energy Initiative Fellow, a Martin Sustainability Fellow, and recipient of the Roos Dissertation Prize.

In her research, she develops tools to improve decisions about sustainable infrastructure, including transportation and energy infrastructure. Her work is published in *Environmental Science & Technology* and *Nature Climate Change*, included in “Climate Change in the United States: Benefits of Global Action”, and covered in news outlets including CBC, NBC, and New York Times. She is an experienced professional engineer, and a former government scientist with Environment and Climate Change Canada.

How do climate change and climate policy affect human health? Combating climate change is a long-term global challenge with near-term local health “co-benefits” from pollution reduction. Policies that reduce greenhouse gas emissions can also reduce outdoor levels of air pollutants that harm human health by targeting the same emissions sources. Climate policies are linked to health co-benefits through a complex policy-to-impacts pathway. Their design and scope can affect who gains from pollution reductions and by how much. Dr. Saari examines this relationship using integrated modeling techniques.

This research serves to inform decisions about sustainable infrastructure, including transportation and energy, as well as the design of environmental policy that affects this infrastructure.

When she’s not working, Dr. Saari enjoys skiing, hiking, and reading with her son.

More information about Dr. Saari, can be found on her personal website, **here: <http://saarir.scripts.mit.edu/index/>**

STUDENT FEATURE

FRANK LIU, PhD CANDIDATE

Frank (Yang) Liu was born in Xi'an, China. He received his B.Eng. (in Highway Engineering) and MAS. (Pavement Engineering) in Chang'an University (China), Frank joined CPATT in September 2016 as a PhD student under the supervision of Professor Susan L. Tighe. During his Master degree, he worked on asphalt pavement Hot in-place Recycling Technology (HIR), focusing on pre-heating of old pavement, he did some modeling and laboratory work about the effect of pre-heating condition on the performance of regenerated pavement.

Frank's PhD research topic is focused on high performance asphalt mixture applied in airport pavement. Shear distress is frequently observed in many airports in Canada, as well as in other countries. High performance asphalt mixture aims at addressing the shear force caused by aircraft tire when a full brake or turning maneuvers happens. Frank's focus is preventing shear distress by optimization of asphalt mixture and structural design of airfield flexible pavement.



STUDENT FEATURE

SAEID SALEHIASHANI, PhD CANDIDATE



In 2004 Saeid graduated from K.N. Toosi University of Technology, Iran with a Bachelors degree in Civil Engineering. Saeid received his Master's degree in Civil Engineering from Louisiana Tech University, in the United States, in 2013. During his research, Saeid worked on a project titled "Evaluation of Dynamic Shear Rheometer Tests for Asphalt Emulsions" which was funded by the Louisiana Transportation Research Center (LTRC). Saeid did an internship in the Bureau of Materials & Research at New Hampshire Department of Transportation as Engineering Aide with assigned tasks mostly involved AASHTO M320 testing of asphalt binder. This included sample preparation and operation of the following tests: Rolling Thin Film Oven (RTFO), Pressure Aging Vessel (PAV), Dynamic Shear Rheometer (DSR) and Bending Beam Rheometer (BBR).

Saeid Joined the CPATT team as a Ph.D. student, under the supervision of Professor Susan L. Tighe, in January, 2017. His current research topic focuses on moisture susceptibility of Warm Mix Asphalt.

TRACY ZHOU, MASc CANDIDATE



Tracy (Bingqian) Zhou is currently a Masters Candidate in the Department of Civil and Environmental Engineering, at the University of Waterloo, under the supervision of Professor Susan L. Tighe. She is also working as a graduate research assistant in the CPATT lab. Tracy obtained her bachelor's degree in Civil Engineering at the University of Waterloo in 2013. Following this, she worked in the field of marketing for several years. Tracy is also an MBA Candidate at the Maastricht School of Management, Netherlands.

Her current research focuses on utilizing waste materials of Lean Oil Sands (LOS) and Asphaltenes on the gravel roads in Imperial Oil's Kearl Lake Site, in Northern Alberta. The purpose of the project is to achieve high performance pavement by using available waste materials, and to minimize the financial cost and construction effort as well. Laboratory tests are performed to identify the optimal proportion of LOS/Asphaltenes and gravel in the mixture. In addition, raw material properties supplied by Imperial Oil Inc. will be further investigated and analyzed as part of her study.

STUDENT FEATURE

SARBJOT SINGH, MASc CANDIDATE



Sarbjot Singh (Sunny) moved to Canada last year and commenced his MEng. in the Civil and Environmental Engineering department at the University of Waterloo in September 2016. The courses he took in his first term sparked an interest in the field of Transportation Engineering and the CPATT lab, which lead to him to pursue a MASc. degree instead, working on the field ageing of Asphalt Cement under the supervision of Professor Hassan Baaj.

Sunny obtained his bachelor's degree, B.Eng (HONS) in Civil Engineering from the University of East London, London, United Kingdom. He finished his degree in 2011 and began working for a structural engineering consultancy in London. He has more than four years of design experience working on a diverse range of architecturally driven new build and refurbishment projects in residential, retail, commercial, community and education sector. He has gained experience in the use of a variety of materials including steel, timber, concrete, masonry and glass, and has also developed his knowledge in the use of more recently developed products used in addressing cold bridging and insulation issues.

In his spare time, Sunny enjoys attending seminars and talks on interesting engineering topics, reading books, watching movies and socializing with his colleagues in the pub after work.

STUDENT FEATURE

FILZAH NASIR, MASc CANDIDATE



Filzah Nasir is a Masters candidate under the supervision of Dr. Rebecca Saari and Dr. Susan Tighe. Her graduate research is focused on quantifying the environmental impacts of pavement maintenance activities. In particular, she is quantifying the impacts of emissions and pollutants from maintenance activities and the effects of these emissions on human health and the environment.

The transportation sector is Ontario's largest contributor to greenhouse gas emissions. Given increased regulations such as Ontario's Cap and Trade program, infrastructure agencies are incentivized to reduce emissions. The Ontario Ministry of Transportation, a partner on this project has repeatedly highlighted their commitment to sustainability in infrastructure management. Filzah research aims to aid with the incorporation of sustainability in pavement management systems and decision-making.

Filzah completed her undergraduate degree from the University of Waterloo in April 2016. During her undergraduate career, Filzah's capstone design team developed a simple air quality monitoring device and along with a user interface and visualization software. The team won first place in GE Canada Innovation Award in March 2016.

HIGHLIGHTS & EVENTS

FRED BURGGRAF AWARD WINNER



Dr. Chris Bachmann, an Assistant Professor in the department of Civil and Environmental Engineering at the University of Waterloo, has won the Transportation Research Board (TRB) Fred Burggraf Award for his paper, “Modelling the Impacts of Free Trade Agreements on Domestic Transportation Gateways, Corridors, and Ports”.

The Fred Burggraf Award was established in 1966 to stimulate and encourage young researchers to contribute to the advancement of knowledge in the field of transportation. It provides recognition of excellence in transportation research by researchers 35 years of age or younger. The award is accompanied by a cash prize and was named in honor of the late Fred Burggraf, who served as the Board’s director from 1951 until his retirement in 1964. This award will be presented to Dr. Bachmann at the upcoming TRB conference in Washington, DC on January 8, 2018.

Congratulations, Dr. Bachmann! You can find more information about Dr. Bachmann and his research on his personal website: <http://www.civil.uwaterloo.ca/bachmann/>

Abstract Canada has recently made progress with several free trade agreements (FTAs), and although the government has carried out considerable analysis of their potential impact on the Canadian economy, little to no work has been done to assess the potential impact on Canada’s transportation system. The objective of the research was to estimate the impacts of recent and forthcoming FTAs on Canada’s domestic trade infrastructure. This study extended a typical computable general equilibrium simulation of an FTA by estimating high-level domestic supply chain characteristics (i.e., subnational region of origin or destination, subnational region of exit or entry, international transportation mode, port of clearance) and by converting the resulting trade flows to freight flows measured in tonnage. The results indicate that the Comprehensive Economic and Trade Agreement (CETA) between Canada and the European Union (EU) may have had large impacts on Canada’s Continental and Atlantic Gateways, especially at the Port of Montreal, Quebec, as a result of trade creation with the EU. CETA also has had impacts on various crossings at the U.S. border as a result of trade diversion with the United States. Simulations, however, suggested that the Canada–Korea Free Trade Agreement has had relatively small impacts, mostly concentrated in the Asia-Pacific Gateway, particularly at the Port of Vancouver, British Columbia. Although the impacts were FTA-specific, this research demonstrated the need to consider FTAs in commodity forecasting and freight transportation planning, because they could make sizable changes to future freight flows on domestic transportation infrastructure.

Journal link: <http://trrjournalonline.trb.org/doi/abs/10.3141/2611-01>

HIGHLIGHTS & EVENTS

UNIVERSITY OF WATERLOO ENGINEERING DAY

On July 14, 2017, the tradition continued. The Faculty of Engineering celebrated Engineering Day with our incredible community of students, alumni, professors and staff. This year's activities included a colour throw, BBQ featuring the famous 'Boggan Burgers, free treats and refreshments, a photo booth, purpling, The Tool and The Tool Bearers!

The Tool made a special appearance on Engineering Day, as it's The Tool's 50th Birthday this year! Special treats were served and engineering alumnus Jim Pike (BASc 1969, Mechanical), who brought our engineering mascot to campus when he was the EngSoc president, made a guest appearance. View a video about The Tool's history featuring Jim Pike and The Tool, here: <https://drive.google.com/file/d/oB68YomQtGEvgLWpqMnZXWEltSDA/view>

Click on the picture link below to see a short video on the day's festivities.



STUDENT SPOTLIGHT

- **Amma Wakefield** has successfully completed her PhD Comprehensive Exam entitled “Evaluation of Asphalt Cement Properties in Hot Mix Asphalt With and Without Recycled Asphalt Pavement (RAP)” on August 1, 2017. Congratulations, Amma!
- **Milos Posavljak** has successfully completed his PhD Comprehensive Exam entitled “Development of Tools for Infrastructure Asset Management and Cross-Asset Trade-Off Analysis for Public Agencies” on August 15, 2017. Congratulations, Milos!
- **Taha Younes** has successfully completed his PhD Comprehensive Exam entitled “The Impact of Additives on the Performance of Cold In-Place Recycled Pavement” on June 21, 2017. Congratulations, Taha!
- **Andy Jian** has successfully completed his MASc Seminar entitled “Local Calibration of the MEPDG Prediction Models Using More Accurate Field Measurements: Rigid Pavement Analysis” on August 4, 2017. Congratulations, Andy!
- **Dan Pickel** has received the University of Waterloo Graduate Scholarship. This award is given in recognition of his combined academic excellence and scholarly contributions as outlined in his Activity Report for the Spring 2017 academic term. Congratulations, Dan!
- **Taha Younes and Frank Mi-Way Ni** have both received the Irene Marguerite McLeod Postgraduate Scholarship. This award is given in recognition of academic excellence and outstanding graduate research productivity in the Transportation group. in the Spring 2017 term. Congratulations, Taha and Frank!
- **Jorge Baron Carol** has successfully completed his bachelors thesis presentation entitled “Moisture Evaluation of Warm Mix Asphalt containing Dolomitic Sandstone Aggregate” on May 11, 2017. Jorge is now continuing his studies in Spain.



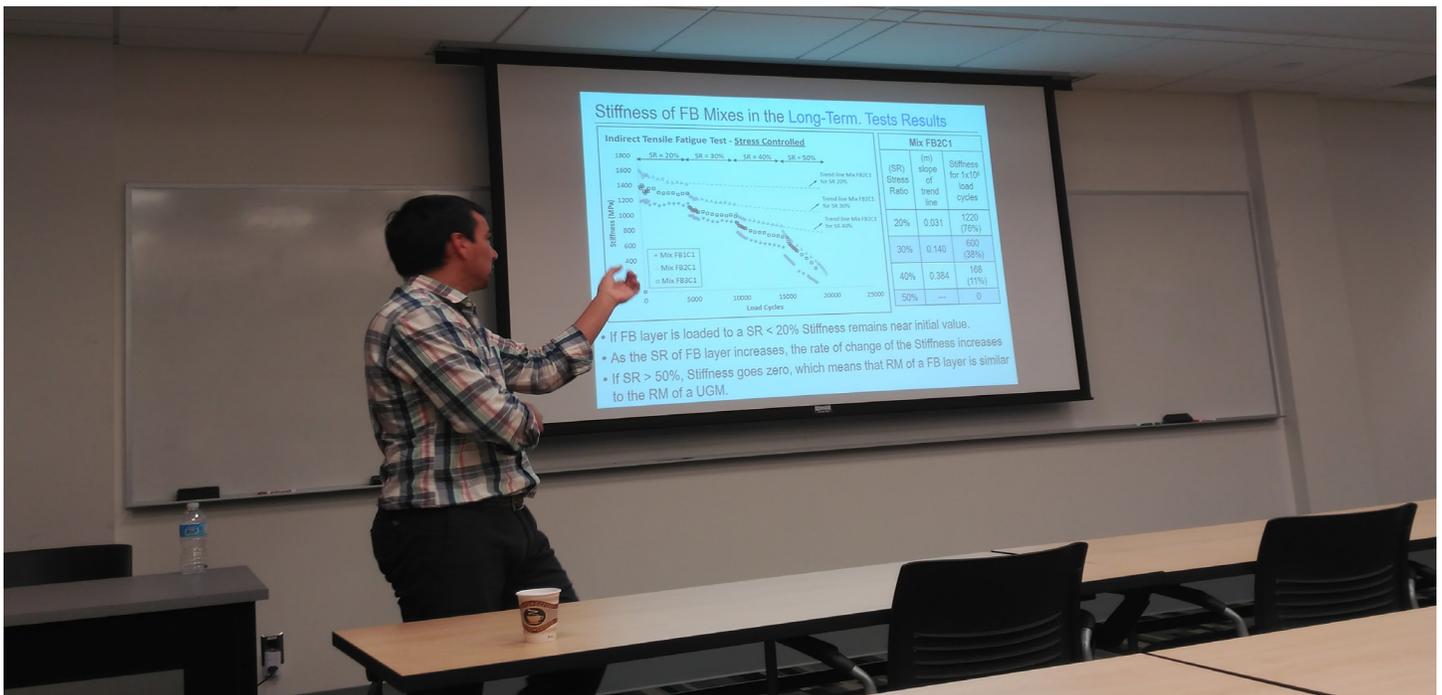
SEMINAR FEATURE

FELIPE A. HALLES, PhD



CPATT and the Norman W. McLeod Chair in Sustainable Pavement Engineering hosted a seminar on Wednesday, June 28, 2017, entitled “Analysis of Critical Points for Ensuring Mechanical Performance of Recycled/Stabilized Mixes, with Foamed Bitumen and Cement”, presented by Dr. Felipe Halles. Dr. Halles is a Civil Engineer in Chile. He obtained his MSc degree in 2001 in the field of Pavement Management Engineering, from Pontificia Universidad Católica de Chile. In 2013 he completed his PhD degree, also from Pontificia Universidad Católica de Chile. His main research focus was on Foamed Bitumen Recycling/Stabilization. Dr. Halles is now the General Manager of ALTAVIA Road Engineering, a Chilean company founded in 2011. Their research is mainly focused on the provision of non-traditional solutions for road infrastructure.

ABSTRACT Foamed bitumen mixes take time for curing and acquiring strength. This period of time depends on many variables which are not always predictable, considering the constructive constraints occurring on the field. This presentation discusses certain elements that are crucial to consider in the definition of the characteristics of recycled mixtures, and the optimization of mechanical performances in construction planning.



RESEARCH FEATURE

FULBRIGHT SPECIALIST PROGRAM



The Bureau of Educational and Cultural Affairs of the U.S. Department of State announced on April 24, 2017 that Dr. John H. Daly III has been awarded a Fulbright Specialist Program grant to study and to conduct further research in the area of public infrastructure asset management within the academic area of engineering education at the University of Waterloo in Canada, specifically in collaboration with Professor Susan Tighe. In the execution of this study effort, Dr. Daly will also be working in conjunction with the Ontario Good Roads Association (OGRA).

Dr. Daly is currently the Manager Director of the Genesee County Road Commission located in Flint, Michigan. He is an elected member of the Board of Directors of the Michigan County Road Association (CRA) and is also a past President of CRA.

The Fulbright Specialist Program sends highly qualified U.S. faculty and professionals to serve as expert consultants on curriculum, faculty development, institutional planning and related subjects at academic institutions abroad for a period of two to six weeks. The Fulbright Specialist

Program allows overseas universities, cultural centers, non-governmental organizations and other institutions abroad to develop collaborative projects which host a leading academic or professional at their institution to work on diverse, short-term collaborative projects focused on education and training. These projects support critical priorities identified by the host institutions and are supported by U.S. embassies and the binational Fulbright Commission abroad.

The Fulbright Specialist grant funds two visits to the University of Waterloo. The product of the first visit is a Preliminary Strategic Assessment of the OGRA Accredited Asset Manager program; this product has been completed and sent to the University of Waterloo and OGRA earlier this month. The product from the second visit is “A Student’s Guide to the AAM Capstone Project” and should be completed and delivered by the end of December.

More information about Fulbright can be found on their website, here: <http://www.fulbright.ca/>

RESEARCH FEATURE

IMPERIAL OIL RESEARCH PROGRAM

Northern Alberta is home to many large reserves of oil within oil sands. These oil sands represent a significant natural resource that play a large role in Alberta's economy. In order to extract these oil sands and, more specifically, the bitumen within them, several oil companies have developed mining operations in northern Alberta.

Oil sands mining operations require significant man-power and many different operations. As such, the mining projects cover large areas which are interconnected with many roads serving varying types and volumes of traffic. This traffic mainly includes pick-up trucks, personnel transport buses, dump trucks, and various pieces of large equipment. While the roads see significant levels of heavy traffic, their remote location places restrictions and cost premiums on all the typical road building materials, making typical road construction impractical. Furthermore, the environment in the location is aggressive, with very cold winters combined with muskeg ground surfaces.

Imperial Oil is interested in improving the safety and performance of the roadways within its oil sands mine facility. Issues have been identified in the past relating to dust, potholes, washboarding, drainage, and other concerns. For this reason, a research program has been developed between Imperial Oil and the Centre for Pavement and Transportation Technology (CPATT). The focus of the research program is to determine best practices for maintaining the road network considering cost, material availability, man-power requirements, and, above all, safety.

As a first step in the research program, a site visit was conducted in order to assess the existing road network and practices. Over the course of three days, members of CPATT worked closely with on-site personnel to investigate areas of concern as well as areas which have historically performed well. During this visit, the assessment included:

- Visual assessment
- Roughness and profile measurements using SurPro equipment
- Surface deflection modulus measurement using Lightweight deflectometer
- Roughness using rRuf software from Rival Solutions
- Vehicle-mounted image capture from Rival Solutions

Further investigation has taken place into the suitability of some readily-available materials on site to improve roads, with a focus on dust-suppression.

RESEARCH FEATURE

IMPERIAL OIL RESEARCH PROGRAM (CONT'D)

The results of the research program will include recommendations for an effective road maintenance program, including dust suppression plans, road construction recommendations, and mixture designs for surfacing materials using available products.



Pictured above are PhD candidates Eskedil Melese and Daniel Pickel in Northern Alberta, Canada, at the Imperial Oil site, working with a Surpro and planning an LWD.

RESEARCH FEATURE

CPATT LAB WORK FOCUS

The CPATT lab at the University of Waterloo has acquired some new equipment this past term to aid with some exciting projects coming up. Notably, the new equipment has consisted of a Rotary Evaporator (Rotovap) system for recovering asphalt binder and a new oven.

Rotovap

Through our partners the Ministry of Transportation Ontario (MTO), CPATT has taken a Rotovap system on long term. The setup had served MTO's Bituminous Materials Section for a number of years, but has since become redundant when they acquired a new system. The Rotovap is one of the two most commonly used methods for asphalt binder recovery, and the most modern and better performing one compared with the Abson method (1933).



Asphalt binder needs to be recovered from mixtures for quality testing and research purposes. The rotary evaporator method is described in MTO LS 284. The setup includes a rotary evaporator, thermometric device, manometer or vacuum gage, gas flowmeter, sample container, vacuum system, and oven. The solution of solvent and asphalt binder mixture from the extraction apparatus is placed in a rotating flask and distilled by partially immersing the flask in a hot oil bath. The solution is subjected to partial vacuum and flow of nitrogen gas. The recovered binder can then be tested and evaluated in the lab.

Rotary Evaporator Recovery Setup

The Rotovap was installed under one of the fume hoods in the CPATT lab by Dandi Zhao and Sona Khalifeh (two undergraduate co-op students). It will go well with the Centrifuge asphalt extraction equipment already present beside it. The device will be used with upcoming projects dealing with RAP binders and developing the extraction solvents themselves. CPATT would like to extend thanks to our partners in the MTO Bituminous Materials Section for allowing us to loan the device.

RESEARCH FEATURE

CAPITAL PAVING FIELD TRIP

The UW Cive 740 (Innovative and Sustainable Materials in Civil Engineering) graduate class field trip took place on August 21, 2016. The students had the opportunity to visit the asphalt plant situated in Puslinch and have a guided tour by Larry Wilson (Vice President, Capital Paving). The plant is a State of the art CMI STD 400 combination asphalt plant equipped with nine cold feed bins allowing the company to produce a wide range of asphalt mixes with different fractions of fine and coarse virgin aggregates and Reclaimed Asphalt Pavement (RAP) materials. The students learned about the operation of the asphalt plant explaining how the aggregates are dried and heated and how asphalt cement and the RAP fractions are added to the hot aggregates in the mixer. The plant allows using the heat in the mixer to warm-up the RAP for a better asphalt cement blending. Mr Wilson gave a general presentation of the plant and its



components followed by a visit to the control room where the students had an explanation of the fully automatic operation of the plant. Next, was a tour of QC laboratory of Capital Paving where asphalt mix designs are conducted and production samples are tested to ensure that they comply with standards and specifications. Lastly, the students were taken to the aggregate pit in Guelph and had an explanation of the operation of pit for the production of both virgin and recycled aggregates.

The field trip was very informative and interesting and fulfilled its anticipated objectives. This field trip completed the theoretical knowledge that the students acquired in the classroom and helped them to better understand the manufacturing and operational side of some of the civil engineering materials. The students and the course instructor, Prof. Hassan Baaj, would like to thank Capital paving, and in particular Mr. Jim Kelly (Vice President, Capital Paving) and Mr. Larry Wilson (Vice President, Capital Paving) for this great opportunity!

RESEARCH FEATURE

CHINA RESEARCH PARTNERSHIP

Sponsored by the University of Waterloo's International Research Partnership Grants - China (IRPG-China), Professor Susan L. Tighe has been working together with her research team in CPATT and Chinese partners on the proposed project Implementing Sustainable Transport Infrastructure Maintenance Programs for Special Regions in China. Over the past six months, the project has progressed significantly in terms of research activities, partnership developments, research projects, budget allocations, and research activity plans for the second half a year.

Research Activities: Starting from March 2017 when rewarded with IRPG-China, Prof. Tighe met with research team to discuss how to strengthen and improve the Centre for Pavement and Transportation Technology (CPATT) by adding an international partnership research program with Chang'an University and Chinese Alliance of Pavement Recycling Industrials. Under this program, a number of workshops and technical seminars have been conducted in Canada for 14 Chinese visitors from Guangxi provincial department of highway transportation investment group during June 26 – July 12, 2017, ranging from road safety improvement strategies to Ontario pavement maintenance management experience. In addition, a series of Canadian experience with pavement recycling technologies and their potential applications to China's highway infrastructural management have been systematically designed, which will help to promote Canadian technical expertise and international reputation in the field of highway industrial development.

Partnership Developments: One of the main purposes of the rewarded IRPG-China program is to expand and/or develop into a large scale of sustainable partnership research projects on the basis of the existing partnership (i.e., Chang'an University and Chinese Alliance of Pavement Recycling Industrials). The progress made in this area is a potential expansion of the IRPG-China program, including: 1) Zoyon Science and Technology that is associated with Wuhan University and Shenzhen University, specializing particularly in 2D and 3D data collection and automated evaluation of hardware and software technologies, 2) Zhengping Road and Bridge Construction that is a member of the Chinese Alliance of Pavement Recycling Industrials, specializing in road construction and maintenance in cold and desert plateau regions. Both companies have recently sent their senior management delegations (Chairman or general manager level) to visit the CPATT at University of Waterloo, and both delegations met with Prof. Tighe to express their interests in the IRPG-China program through developing new opportunities or extending the ongoing program.

Research Projects: There are three major components contributing the research projects relating to the IPRG – China program: 1) the original project as documented in the IPRG-China program, which aims to promote Canadian research products in the area of Roads Recycling and Green Pavement Technologies;

RESEARCH FEATURE

CHINA RESEARCH PARTNERSHIP (CONT'D)

2) the research project associated with Shaanxi Provincial 100 Talents Plan, which has been awarded to Prof. Tighe through Chang'an University's research and education sponsorship program; 3) a proposed research project that was submitted to Shaanxi Science and Technology Commission in July for applying research funding, which is currently under review and evaluation process. The proposed research aims to identify and develop new research applications in the area of implementing Sustainable Transport Infrastructure Maintenance Programs in the world. In addition, Prof. Tighe has been invited as an International Academic Advisor to an ongoing large research project titled "The Base of Special Regional Highway Engineering Sustainable Development Subject Innovation Introduction", which is sponsored by China's Ministry of Education and State Foreign Expert Bureau and the project is awarded to Highway Engineering College of Chang'an University.

Activity Plans: For the second half of the year, the following activities have been scheduled: 1) a team of 4 people will travel to China for about 10 days visiting Changan University, Shenzhen University and may extend to Changsha University of Science and Technology for expanded partnership developments. Two people will be stay at Chang'an University for about 4 weeks as visiting scholars (postdoctoral fellowship) to conduct a series of lab tests related research work, while two others will review through workshops and meetings the ongoing partnership research projects as well as potential projects. 2) The Chinese Alliance of Pavement Recycling Industrials will send a 10-person study group to Ontario for attending a week combined in-house training and field construction projects on pavement recycling. 3) Chang'an University is expected to send visiting graduates and professors to University of Waterloo for a short term of visiting exchange programs.



RESEARCH FEATURE

KEY CPATT RESEARCH THEMES

- Incorporating Sustainability into Pavement Design, Construction, Maintenance and Management
- Climate Change Impacts on Long Life Infrastructure
- Life Cycle Economic Analysis in Public and Private Sector Infrastructure
- Smart Pavement Materials And Structures for the Road of the Future (Nanomaterials, Self-Healing Materials, Phase-Change Materials, Anti-oxidants, Solar Pavements, Lightweight Aggregates, ..)
- Optimization of the Use of Recycled and Alternative Materials in Sustainable Infrastructure Systems
- Advanced Testing Methods and Characterization Techniques of Infrastructure Construction Materials

ONGOING AND RECENTLY COMPLETED CPATT RESEARCH PROJECTS

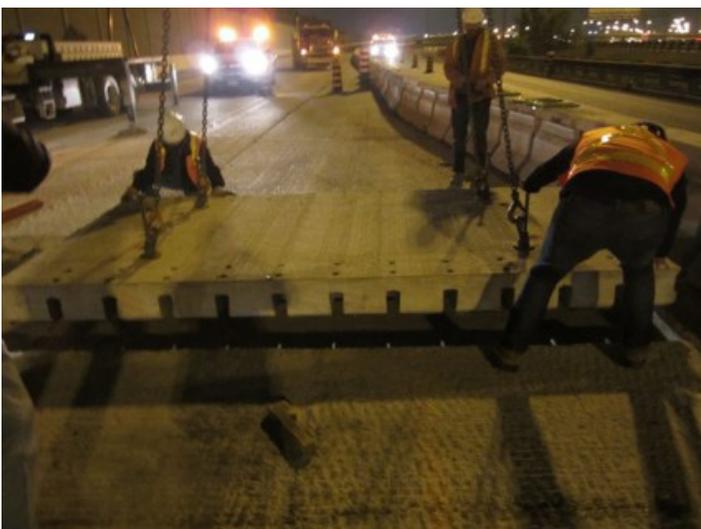
- WMA and Coloured HMA
- Evaluation of Reclaimed Materials as Sustainable Alternative Construction Aggregates for OPSS Granular B Type II
- Physical Characterization of Foamed Glass Lightweight Aggregate (LWA) for use in Unbound Granular Pavement Layers
- Cost-Effective Pavement Maintenance and Rehabilitation (M&R) Schedules: Application of MEPDG Distress Models and Key Performance Index (KPI)
- Local Calibration of the MEPDG Prediction Models Using more Accurate Field Measurements
- Asset Valuation: A Performance Measure for Comprehensive Infrastructure Asset Management
- Rehabilitation of municipal composite pavements using concrete overlays
- Self-Healing Technology for Asphalt Pavements
- Investigation of Various Treatment Methods for Enhancing the Physical Properties of Recycled Concrete Aggregate for Hot Mix Asphalt
- Investigation of Different Factors Affecting Asphalt Cement Aging and Durability
- Development of an accelerated asphalt mixture aging/conditioning procedure for performance testing of asphalt mixtures
- Pavement Flood Risk Assessment and Management
- Full-depth Reclamation (FDR) with Hydraulic Road Binders (HRB) for Improved Performance of Low-volume Roads
- Use of Hydraulic Road Binders (HRBs) in Subgrade Stabilization
- Precast Concrete Inlay Panels for Rut Repair on High-Volume Flexible Pavements

RESEARCH FEATURE

ONGOING AND RECENTLY COMPLETED CPATT RESEARCH PROJECTS (CONT'D)

- Development of High Modulus Asphalt (or EME) mix design technology for use on Ontario's Highways
- Improving Durability of HMA Produced With (RAP) By Enhancing Binder Blending
- Safety and Throughput Evaluation of High-volume Highways in Ontario, Canada
- Extraction and Recovery of Asphalt Binder
- DENT and MSCR as Fatigue Predictors in HMA
- High Performance Asphalt Mixture Applied in Airfield Pavement
- Field Full Scale Instrumentation and Finite Element Simulation of Pavement Structural Layer Coefficients with the Use of CEMATRIX Lightweight Cellular Concrete
- Development of a Framework to Evaluate AC Properties in Plant Produced HMA With and Without RAP
- Deterioration Mechanism and Diagnostic Approaches for Cement Stabilized Base (CSB) Underneath Asphalt Concrete (AC) Layers
- Evaluation of Using Lean Oil Sands (LOS) and Asphaltenes as Materials on Gravel Roads
- Assessment and Improvement of MTO's Imaging Processing Systems for Usage in Pavement Management
- Pavement Crack Survey Visualization System Based on 3D Image Technology

For more information about any of our current or past projects, sponsors or partners, graduate students or research assistants, please contact Professor Hassan Baaj (see contact page for details).



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