

# CPATT NEWS WINTER 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

# WINTER 2017 ISSUE

## A MESSAGE FROM THE DIRECTOR

Welcome to our Winter 2017 addition of CPATT News!

We hope all your projects have been successful throughout 2016 and wish everyone a prosperous and rewarding 2017.

In this newsletter we highlight some of the various projects underway at CPATT. This includes pavement sustainability, the development of a decision-making tool aimed to incorporate sustainable aspects in the management of pavement networks, and the utilization of data from the Long-term Pavement Performance (LTPP) database, to identify effectiveness of highway maintenance procedures in dry-freeze climates.

We also highlight some events from the past few months which include seminars by Dr. Christiane Raab and Dr. James Tsai, the Graduate Student Poster Symposium, a Lunch and Learn session with the Miller and McAsphalt groups, and the participation of our graduate students in the Transportation Association of Canada student committee meetings.

There are also many special features on some of our current graduate students and the newest Transportation Faculty member, Dr. Chris Bachmann, 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., P.Eng

Norman W. McLeod Professor in Sustainable Pavement Engineering

Director of CPATT

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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

## CHRIS BACHMANN, PhD



Dr. Chris Bachmann is an Assistant Professor in the Department of Civil and Environmental Engineering at the University of Waterloo in Waterloo, Canada. He holds a BAsC, MASc, and PhD, from the University of Toronto, in Toronto, Canada. Dr. Bachmann is primarily interested in studying the interaction between transportation systems and economies, including international trade and freight transportation. He has expertise in transportation modelling, including microscopic traffic flow simulation, discrete choice models, and travel demand modelling, as well as economic modelling, including Life Cycle-Cost Analysis (LCCA), Input-Output (IO) analysis, and Computable General Equilibrium (CGE) modelling.

His Research Group has been supported by various agencies including: Transport Canada; Industry Canada; the Ministry of Transportation of Ontario (MTO); Innovation, Science and Economic Development (ISED) Canada; and the National Science and Engineering Research Council

of Canada (NSERC). Dr. Bachmann teaches “Economics and Life Cycle Analysis” to Civil and Environmental engineers, and in 2018 will teach the first offering of “Transportation Engineering Applications”, at the University of Waterloo. Additional information including recent journal publications can be found on his website:

**<https://www.civil.uwaterloo.ca/bachmann/>**

In his spare time (for which demand greatly exceeds supply), Dr. Bachmann enjoys being active, including strength training and powerlifting, cross-country and road running (5K, 10K, half-marathon), mountain biking (at Waterloo’s Hydrocut), and Kayaking. He also enjoys time spent outdoors at a more leisure pace, including camping and hiking.

# FACULTY FEATURE (cont.)

## DR. BACHMANN'S CURRENT PROJECTS INCLUDE:

- According to the Government of Canada, the Comprehensive Economic and Trade Agreement (CETA) between Canada and the European Union (EU) is “broader in scope and deeper in ambition than the historic North American Free Trade Agreement”. Previous Free Trade Agreements (FTAs) suggest sizeable changes to trade flows may be imminent. For example, the cross-border trade between the United States (US) and Canada increased rapidly following the implementation of the North America Free Trade Agreement (NAFTA). This research extends a typical CGE simulation of a FTA by estimating high-level domestic supply chain characteristics (including the subnational region of origin/destination, subnational region of exit/entry, international transportation mode, and port of clearance) and converting the resulting trade flows to freight flows measured in tonnage. Results indicate that CETA may have large impacts on Canada’s Continental and Atlantic gateways, especially at the Port of Montreal, due to trade creation with the EU. CETA also has impacts on various border crossings with the US, due to trade diversion with the US.
- Limited pipeline capacities along major routes and major environmental concerns about unintended releases have led to increased restrictions on pipeline expansion in Canada and increased dependence on rail as the preferred alternative mode of shipping petroleum. Rail shipments of petroleum bulk crude are expected to increase significantly over the next 10-20 years, especially if crude oil prices experience a turnaround and bring new sources into production (e.g., heavier Alberta oil sands). Rail shipments are often characterized by long-hauls, frequently through built-up areas where the consequences of unintended incidents, fires and releases can be especially severe (e.g. Lac Megantic). While the risk of accidental releases from pipelines is lower than for rail, if a spill or leak were to occur and remain undetected for a period of time, the environmental consequences of such an incident could be substantial. This research is quantifying the relative risks between shipping crude oil by pipeline as compared to rail to establish cost-effective and safe multi-modal regulatory strategies at the national level.
- The new United States administration has discussed renegotiating or withdrawing from the North American Free Trade Agreement (NAFTA) as a cornerstone of a larger plan to create more jobs in the US. Many believe this type of US protectionism could have devastating impacts since NAFTA partners essentially make things together in an integrated supply chain. This research is providing a current and objective view of the Canada-US trade relationship, and an examination of the degree to which the Canadian and US economies could be impacted by a US protectionist approach to trade with Canada. The research is: quantifying the economic connectedness of the US and Canada; determining the contributions of Canadian and US trade to the Canadian and US economies; and estimating potential trade and transportation impacts in Canada and US, which could arise due to a US protectionist approach to trade with Canada.

# STUDENT FEATURE

## **SERGEY AVERYANOV, MAsc CANDIDATE**



In 2012 Sergey graduated from Ural State Federal University, Russia, with a degree in Industrial and Civil Engineering. During his last year of study Sergey conducted research and defended a Thesis on the “Evaluation of the Engineering Safety of Buildings, using a Mobile Diagnostic System”. The objective of the research was to evaluate the condition of a 16-story aging reinforced concrete building, where cracking had developed in the foundation (allegedly due to installation of piles for an adjacent building).

The research included: evaluation of foundation crack propagation using strain gauges, instrumenting each story of the building with sensors to measure wave propagation caused by the impact to the top story of the building, assess the conditions of load bearing elements, FEM of the building including soil properties.

In the last three years of his studies in Russia, Sergey completed an additional program and received a second major in Economics and Business Management. After graduation, Sergey worked for a Design and Construction Company called Zhilstroy - Stroyteck, which specialized in design and construction of high-rise condominiums.

Sergey’s research interests include: the durability of structures, advances in materials (fiber reinforced polymers (FRPs), admixtures and fillers), advances of construction techniques, effective methods for concrete construction in cold climates, the use of modular systems, and intelligent sensor technologies to monitor the response of structures. These interests led him to pursue a MAsc degree in the Fall of 2016, with Professor Susan Tighe, at the University of Waterloo.

Sergey has attended a number of conferences and events since starting his degree, such as: the Transportation Association of Canada (TAC) Conference and Exhibition, the Graduate Student Poster Symposium held at the University of Waterloo, and the Ontario Hot Mix Producers Association (OHMPA) Conference. Sergey is looking forward to attending and presenting at more events in the future.

# STUDENT FEATURE

## SEYEDATA (ATA) NAHIDI, PhD CANDIDATE

Syeddata (Ata) Nahidi started his PhD in the Civil Engineering Department, at the University of Waterloo, in 2016, under the supervision of Professor Susan Tighe.

Ata worked as a Field Engineer in Iran for more than a year prior the moving to Buffalo, NY to obtain his M.Sc. degree in Civil Engineering from SUNY-University at Buffalo. During his master's, he worked on various topics related to Transportation Engineering such as: Traffic Safety, Geometric Design of Highways, Public-Private Partnership (P3 or PPP), and Pavement Quality and Control. He proposed a comprehensive methodological framework which was providing an appropriate context for transportation Agencies to decide whether to adopt PPP for a given project, and if to adopt one, which type of PPP should be adopted.

Ata would like to gain more experience related to Pavement Engineering during his PhD, by conducting research in the Centre for Pavement and Transportation Technology (CPATT).

In his spare time Ata also studies Cosmology, Mathematics, and Physics, as well as, Literature and Psychology. He also enjoys listening to music, going to the gym, watching various TV series and documentaries, and spending time with friends and family.



# STUDENT FEATURE

## ABIMBOLA GRACE OYEYI, PhD CANDIDATE

Abimbola Grace Oyeyi commenced her PhD in September 2016 in the Civil and Environmental department, under the supervision of Professor Susan Tighe. She obtained her Bachelor's degree in Quantity Surveying from Obafemi Awolowo University,, Nigeria in 2010, and Master's degree in Transport Planning and Engineering from the University of Leeds, United Kingdom in 2013.

She started her career as a Project Quantity Surveyor prior to her Master's degree, working in mainly building construction in Nigeria. There, she obtained experience in Building construction management and a little of transportation construction which sparked an interest in transportation and the desire to pursue a Masters and Ph.D in the field. Before coming to Waterloo, she worked as an Assistant Lecturer in the Department of Transport Management Technology at the Federal University of Technology, Akure, Nigeria.

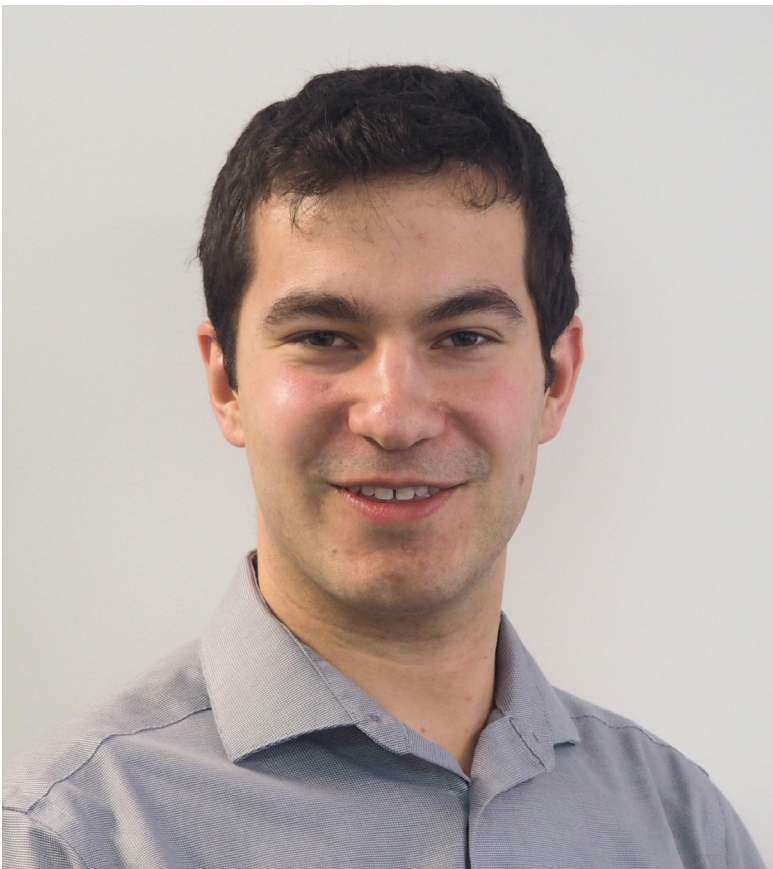


Some of her previous transportation related research has focused on transportation accessibility and city prosperity/competitiveness and sustainable transportation solutions for urban centers. She is currently working on finalizing her Ph.D research area.



# STUDENT FEATURE

## DREW DUTTON, MASc CANDIDATE



Drew is in the second term of study in his MASc working under Dr. Susan Tighe. He completed his BASc in Civil Engineering at the University of Waterloo. Currently, he is completing his coursework requirements. To date he has studied pavement asset management, airport engineering and planning, and statistics in engineering.

His research thesis will focus on developing a correlation for various strength testing methods of unpaved runways. Unpaved runway strength can be highly variable from season to season and day to day. While several different methods have been developed for testing runway strength, each has its own set of advantages and disadvantages. The aim of this research is to allow reliable alternative testing methods when time or circumstance does not allow for more rigorous methods.

Additionally, Drew is working on a submission for the Long-term Pavement Performance (LTPP) International Data Analysis Contest. His paper utilizes data from the LTPP database to identify effectiveness of highway maintenance procedures in dry-freeze climates. The paper will attempt to identify the impact that the choice of maintenance and implementation timeline have on pavement condition.

Drew's additional interests include involvement as a graduate advisor for the Civil, Environmental, and Geological Engineering Society (CEGES) undergraduate student group, and he also enjoys playing hockey, piano, and bass guitar.

# STUDENT FEATURE

## FRANK MI-WAY NI, PhD CANDIDATE

Frank is a PhD student in the Department of Civil and Environmental Engineering at the University of Waterloo, under the supervision of Professor Susan Tighe.

Before pursuing an academic career, Frank served in the Taiwanese Military for one year. Once his service was complete, Frank began his Bachelors of Science degree with the National Cheng-Kung University, Taiwan, in Urban Planning, and completed in 2011. Upon completion of his bachelor's degree, Frank decided to continue with research and academics, and in 2016 received his Masters of Science degree from the National Central University (NCU) in Civil Engineering, Taiwan.

Frank's research focus during his master's degree involved pavement performance modelling, Artificial Intelligence methods for the Taiwan Provincial Highway, and calculated Life-Cycle Cost Analysis for the Highway Bureau. The research concentrated on evaluating the sufficiency of current highway maintenance budgets and providing a forecast for future pavement performance. Aside from his research, Frank also worked as a laboratory staff member in the Quality Assurance Center of Civil Engineering Materials, at NCU. The center runs quality assurance tests (with government certificate specification) for asphalt binders and aggregates received from industries.

During his spare time, Frank enjoys traveling and reading novels.



# STUDENT & FACULTY AWARDS

## TIGHE WINS PRESTIGIOUS RESEARCH & DEVELOPMENT MEDAL

Three professors from Waterloo Engineering - Susan L. Tighe, John Yeow and Lin Tan - were cited for recognition by their peers at a gala that brought together industry innovators, business leaders and policy makers in November.

Dr. Susan L. Tighe, Norman W. McLeod Chair, Director of the Centre for Pavement and Transportation Technology, and a professor in the Civil & Environmental Engineering Department, won a medal for Research and Development.

Tighe, Yeow and Tan are among 10 winners to have been honoured in Mississauga on November 19, 2016 at the 2016 Ontario Professional Engineers Awards (OPEA), which have been running for almost 70 years.



Organized by the Ontario Society of Professional Engineers (OSPE) and Professional Engineers Ontario (PEO), the prestigious annual event showcases the contributions engineers make to economic growth and technological advances through their work as innovators and entrepreneurs.

More information about the awards ceremony and all other award recipients, can be found at the following link: [http://www.peo.on.ca/index.php?ci\\_id=2089&la\\_id=1](http://www.peo.on.ca/index.php?ci_id=2089&la_id=1)

Congratulations to all three University of Waterloo Faculty members!

# STUDENT & FACULTY AWARDS

Ms. Gulfam Jannat (middle) is pictured with her 2016 TAC Best Student Poster Award, alongside her PhD Supervisor, Dr. Susan L. Tighe (right), and Bryan D. Palsat (left), a Pavements and Materials Engineer with Tetra Tech EBA Inc. who were the industry sponsors for this award.



**2016/2017**

## **ONTARIO GRADUATE SCHOLARSHIP**

Mr. Daniel Pickel - Recognizes academic excellence at the graduate level.

**2016/2017**

## **PRESIDENT GRADUATE SCHOLARSHIP**

Mr. Daniel Pickel - Awarded to graduate students who hold major federally and provincially funded competition-based scholarships.

## **2016 SZE MEMORIAL AWARD**

Mr. Daniel Pickel - Awarded for research in the field of experimental stress analysis.

## **2016 BEST STUDENT POSTER AWARD**

Ms. Gulfam Jannat - Awarded at the Transportation Association of Canada conference.

## **2016 BEST STUDENT PAPER AWARD**

Mr. Adam Schneider - Awarded at the Transportation Association of Canada conference.

## **2016 IRENE MARGUERITE MCLEOD AWARD**

Mr. Taha Younes and Ms. Hanaa Al-Bayati - This scholarship has been established by Dr. Norman W. McLeod, FRSC, in honour of his wife, Irene Marguerite McLeod

## **2016 UW AWARD OF EXCELLENCE IN GRADUATE SUPERVISION**

Dr. Susan L. Tighe - This award was established to recognize exemplary faculty members who have demonstrated excellence in supervision.

# CONFERENCES & EVENTS

## TRANSPORTATION ASSOCIATION OF CANADA (TAC)

From September 25-28, 2016, The Sheraton Centre Toronto Hotel welcomed almost 1000 delegates to the 2016 Transportation Association of Canada Conference and Exhibition.

Highlights included several international guest speakers, the first-ever TAC Town Hall meeting, and well-attended events. More than 50 technical sessions, panels and workshops covered a variety of topics, including connected and automated vehicles, applying the science of road safety, roundabout design, and more.

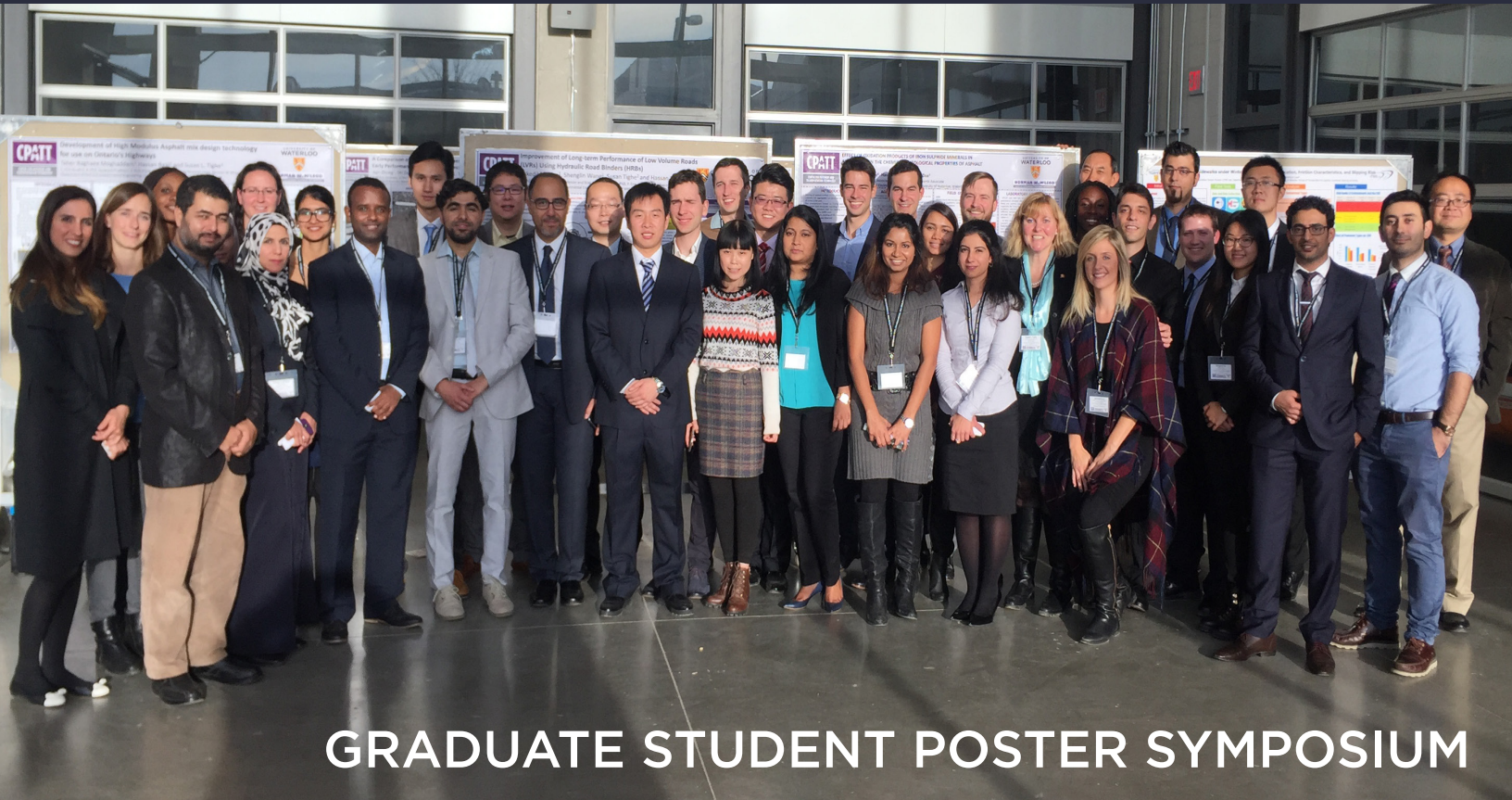
CPATT students also presented their work. Daniel Pickel (PhD candidate), Hanaa Al-Bayati (PhD candidate), Adam Schnieder (MAsc candidate), who won the 2016 Best Student Paper Award and Ms. Gulfam Jannat (PhD Candidate), who won the 2016 Best Student Poster Award, just to name a few. With the support of the Department of Civil and Environmental Engineering, 55 students were able to participate in the TAC Pavements, Soils and Materials Standing Committee meetings as pictured below. This was a terrific opportunity for them to network and learn about the various issues facing the Canadian Transportation Community.

Thank you to the executives of both these committees for assisting in ensuring everyone had a seat to sit on.

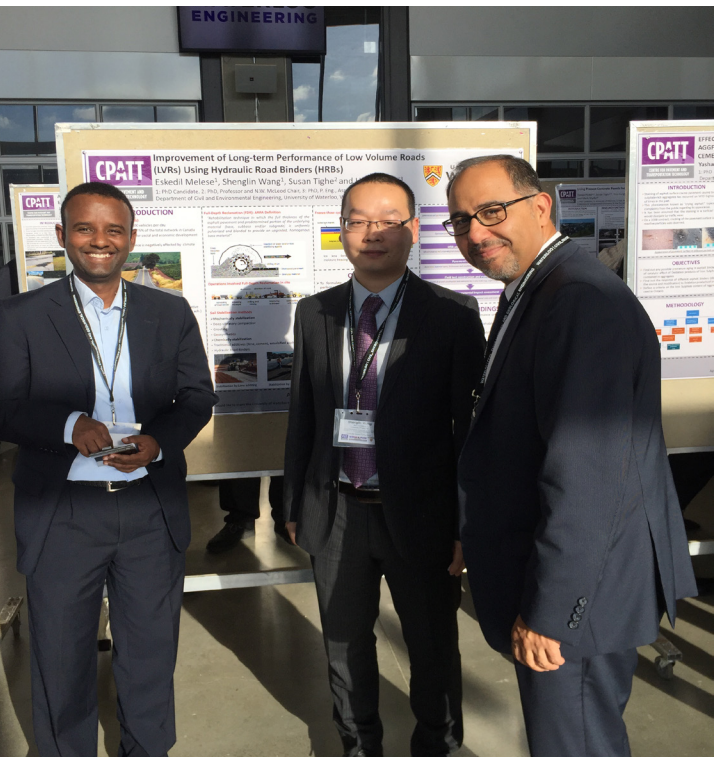
If you are interested in viewing some of the papers presented as part of the conference sessions, they have been made available at the following link: <http://tac-atc.ca/en/conference/papers>



# CONFERENCES & EVENTS



## GRADUATE STUDENT POSTER SYMPOSIUM



On Friday, October 28, 2016 CPATT and the Norman W. McLeod Chair in Sustainable Engineering held the 6th annual Graduate Student Poster Symposium in the E5 Sedra Student Design Centre, at the University of Waterloo.

A total of 34 Graduate students from all areas of Civil and Environmental Engineering were able to showcase their current research to industry members, faculty, staff and fellow students. The symposium allowed students to not only present their work, but also practice their public speaking and network with other faculty and industry personnel.

Thank you to all the students that participated in this event, the industry members who attended, and all the staff and faculty that came out to support our graduate students and their research.

# CONFERENCES & EVENTS

## LUNCH AND LEARN

On Monday, November 21, 2016, CPATT along with the Norman W. Mcleod Chair in Sustainable Engineering, and the Miller and McAsphalt Groups, hosted a Lunch and Learn at the University of Waterloo.

The Lunch and Learn provided graduate and undergraduate students a chance to hear key note speakers from the Miller and McAsphalt groups, such as: Blair McArthur, CEO (Miller Group), Ryan Essex, Vice President (Miller Group), Trevor Moore, Corporate Technical Director (Miller Group), Nicolas Cifelli, Technical Services Manager (Miller Group) and Tony Khucharek, Corporate Technical Director (McAsphalt). The discussion was mainly focused on current projects and providing insight on what it is like working in industry, followed by a Q&A session.

Thank you to the fantastic key note speakers for inspiring our future civil engineers. We are grateful for the time and effort you took to share your thoughts and experiences with us!



CEO of the Miller Group, Blair McArthur, speaking to our graduate and undergraduate students at the 2016 Lunch and Learn.

# FUN & GAMES

## THE “CPATTERS”

This past term, a few of the CPATT graduate students and research assistants (Zaid Alyami, Sergey Averyanov, Ata Nahidi, Cristina Torres-Machi, Donghui Lu, Raha Wafa and Dan Pickel) got together to form a volleyball team, known as “The CPATTERs”. The students played each week, competing against other University of Waterloo teams. After a great deal of hard work and dedication, the CPATTERs came out victorious and won the University Championship!

Congratulations CPATTERs!



## CPATT HOLIDAY PARTY

During the Holiday Season, Professor Tighe graciously opened up her house to host the annual CPATT Holiday Party. An abundance of food, students, kids and fun, were spread throughout! The CPATT group certainly had much to celebrate, as we had a very successful and prosperous 2016.

Thank you to everyone for all of your efforts in making the year such a success!



# RESEARCH FEATURE

## CRISTINA TORRES-MACHI, PhD



Dr. Cristina Torres-Machi is a civil engineer with a PhD from the Universitat Politecnica de Valencia, Spain, and the Pontificia Universidad Catolica de Chile, Chile, and a MSc in Planning and Management in Civil Engineering from the Universitat Politecnica de Valencia, Spain. She is currently working as a Research Associate at the Centre for Pavement and Transportation Technology (CPATT) at the University of Waterloo, Canada. Prior to joining CPATT, she worked as an assistant professor at the Universitat Politecnica de Valencia, Spain, where she taught courses in the field of project and infrastructure management at both the undergraduate and graduate level.

Her main research interest is in the development of optimization and decision-making tools, aimed to incorporate sustainability and long-term analysis in infrastructure asset management. Some of the methodologies developed within her research have been implemented in an Urban Pavement

Management System aimed to enhance the current management of urban pavement networks in Chile. Dr. Torres-Machi has published papers in the Transportation Research Record, the Journal of Civil Engineering and Management and the Journal of Management in Engineering. The contributions derived from her research has recently been recognized by both academia (award to PhD excellence by the Pontificia Universidad Catolica de Chile, Chile) and industry (Abertis International Award on Transportation Research, Spain).

She is very excited to be a part of the CPATT team and working with people from all over the world. In her personal time, Dr. Torres-Machi enjoys hiking, reading and spending time with her husband and 10-months old son.

# RESEARCH FEATURE (cont.)



Dr. Torres-Matchi is currently working on different projects related to pavement sustainability in CPATT. One of those projects is comparing the performance of cold-in-place recycling with emulsion, versus expanded asphalt. As part of this project, pavement cores from different regions of Ontario are being evaluated at the CPATT lab.

She is also working on the development of a decision-making tool aimed to incorporate sustainable aspects in the management of pavement networks.

# HIGHLIGHTS & SEMINARS

## JAMES TSAI, PhD



Dr. James Tsai is a Professor in Transportation Systems Engineering, Smart Cities and Sustainable Communities at Georgia Tech in Atlanta, GA. Before joining the faculty at Georgia Tech, Dr. Tsai worked as a senior research scientist in the GIS center at Georgia Tech. Since 1997, he has led a research team and worked with GDOT pavement engineers, successfully implementing a large-scale Oracle GIS-based pavement preservation and management system for GDOT to effectively preserve and manage its 18,000-centerline miles of highway. A series of models and programs developed by Dr. Tsai, including field pavement condition data acquisition, the annual pavement preservation project prioritization and program development, treatment determination model, cost model, and performance forecasting model, and long-term system performance simulation and optimization, have been successfully implemented by the Office of Maintenance of the GDOT. They have resulted very positive impact on GDOT's operations.

Dr. Tsai came to the University of Waterloo in the Fall term to give a talk on “A sensor-based and spatially-enabled system for next generation Intelligent and sustainable pavement/infrastructure asset management”, hosted by CPATT and the Norman W. McLeod Chair.

**ABSTRACT** Roadway infrastructures, including pavements, bridges, and signs are deteriorating rapidly due to material aging, improper usage, harsh environments, and damages resulting from natural or man-made hazards. With the advancement of sensor technologies, it become feasible to collect the large-scale in-field detailed infrastructure data, such as 3D pavement surface data, using high-performance cameras, lasers, LiDARs, and Inertial Navigation System (INS) to gain better insight understanding of the large-scale in-filed infrastructure behavior. An intelligent sensing system will be presented, using 2D Imaging, 3D Laser, LiDAR, and GPS/GIS Technologies with artificial intelligent and pattern recognition to automatically detect and diagnose pavement surface distress, including rutting, cracking, raveling, etc., using an innovative crack fundamental element (CFE) model that is a topological representation of cracks to support crack classification, diagnosis, and intelligent pavement management. Cases of automatic roadway health condition assessment and innovative pavement preservation technology development using 3D technology will also be presented.

# HIGHLIGHTS & SEMINARS

## CHRISTIANE RAAB, PhD



Dr. Christiane Raab is a Senior scientist and leader of the Road Materials and Pavements team at the Road Engineering/Sealing Components Lab - EMPA Swiss Federal Laboratories for Materials Science and Technology (Switzerland), and an Adjunct Research Professor at Carleton University, in Ottawa, Canada.

Dr. Raab came to the University of Waterloo on October 3rd, 2016 to give a seminar on the “Ageing Behavior of Energy Reduced Pavement”, hosted by CPATT and the Norman W. McLeod Chair.

**ABSTRACT** Nowadays, pavement construction is expected to be more energy efficient and road pavements to be more environmentally and socially friendly. In this context the Swiss Federal Office of Transport FOT, has established a road research program under the title of “Sustainable transport” in order to investigate energy reduced pavements, warm or semi warm pavements concepts allowing to significantly reduce the installation temperature in order to save CO<sub>2</sub> emissions. Although first experiences with these pavement concepts show promising results, there are no long term performance data available and the durability and long term resistance has still to be established. This paper presents results from investigating the ageing behaviour of different energy reduced pavement mixtures. The mixtures were either prepared in the laboratory or taken directly from mixing plant. The study compares the rutting and fatigue behaviour of unaged material in comparison to long term aged material. In order to conduct the long term ageing a special ageing protocol with different heating, cooling and watering cycles had been developed. The investigation revealed a quite controversial rutting behaviour with most aged pavements showing increased rutting while for others reduced rut depths could be found. As opposed to this finding, fatigue and stiffness of all aged pavement samples compared to unaged samples improved significantly. The overall results lead to the conclusion that the ageing of energy reduced pavement concepts is not very critical and that the application of such pavements therefore provide a good solution for saving CO<sub>2</sub> emissions and prolonging the installation season.

# CPATT LAB FEATURE

## CPATT LAB WORK FOCUS

The CPATT lab at the University of Waterloo has undergone a number of changes in the past term, that reflect both a new generation of researchers taking over for the old, and the overall growth of the team. These changes have brought the need to both turn the page to new research and accommodate a larger quantity and variety of lab work that is anticipated in the coming period.

## FLEX LAB SPACE

Due to an increasing volume of lab work and several projects involving the study of asphalt binder, including RAP blending and binder aging, the CPATT Director Dr. Susan Tighe and Associate Director Dr. Hassan Baaj have been working on attaining additional lab space for CPATT at the University of Waterloo. Starting in the Winter 2017 Semester, CPATT has moved in to a FLEX Lab space in the Engineering 2 building. This new space has already gone a long way in clearing up work room in the Carrick Laboratory, but also has allowed the team to think about getting new equipment set up in the future and expand our research capabilities.

Among the binder equipment present in the lab are a fume hood for binder sample preparation, an oven, rotational viscometer, bending beam rheometer (BBR), rolling thin film oven (RTFO) and pressurized aging vessel (PAV). There are also plans on acquiring a penetrometer and direct shear rheometer (DSR) for more binder testing. Also included is a "Core Lock" system for the determination of air voids of asphalt mixture samples without submerging them in water, and an aggregate scanner from Belgium for the digital analysis of aggregate properties.

Featured in the background, is our new Flex Lab space.

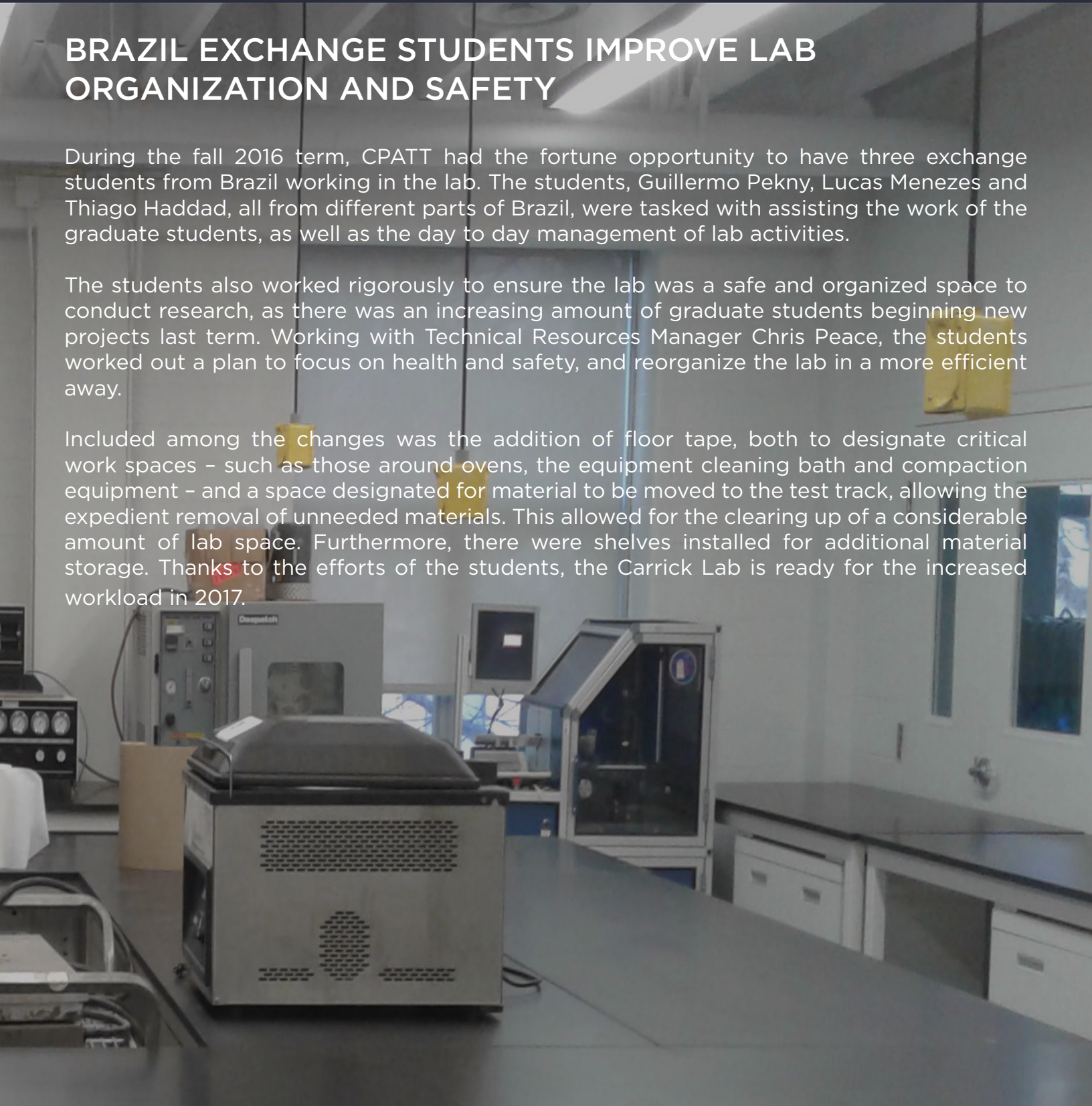
# CPATT LAB FEATURE

## BRAZIL EXCHANGE STUDENTS IMPROVE LAB ORGANIZATION AND SAFETY

During the fall 2016 term, CPATT had the fortunate opportunity to have three exchange students from Brazil working in the lab. The students, Guillermo Pekny, Lucas Menezes and Thiago Haddad, all from different parts of Brazil, were tasked with assisting the work of the graduate students, as well as the day to day management of lab activities.

The students also worked rigorously to ensure the lab was a safe and organized space to conduct research, as there was an increasing amount of graduate students beginning new projects last term. Working with Technical Resources Manager Chris Peace, the students worked out a plan to focus on health and safety, and reorganize the lab in a more efficient way.

Included among the changes was the addition of floor tape, both to designate critical work spaces - such as those around ovens, the equipment cleaning bath and compaction equipment - and a space designated for material to be moved to the test track, allowing the expedient removal of unneeded materials. This allowed for the clearing up of a considerable amount of lab space. Furthermore, there were shelves installed for additional material storage. Thanks to the efforts of the students, the Carrick Lab is ready for the increased workload in 2017.

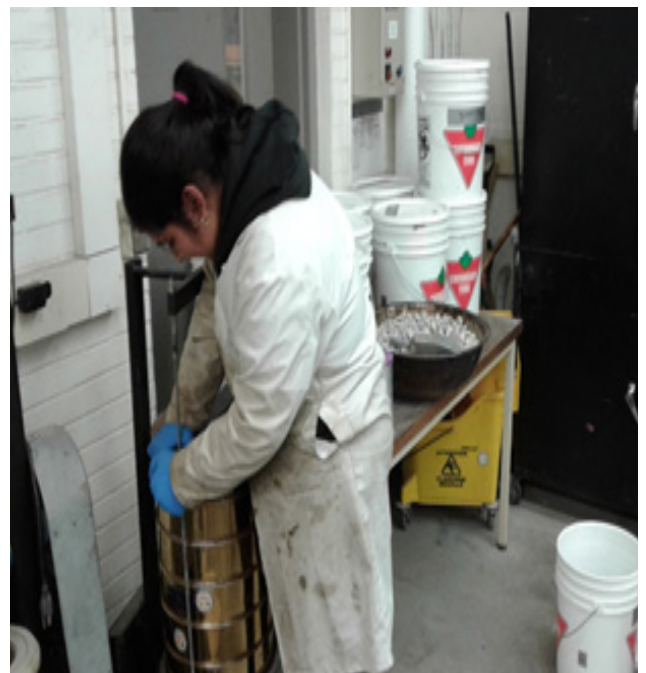


# CPATT LAB FEATURE



Featured here (top left) are three of the CPATT Lab ovens, and shelving space for various research projects (top right).

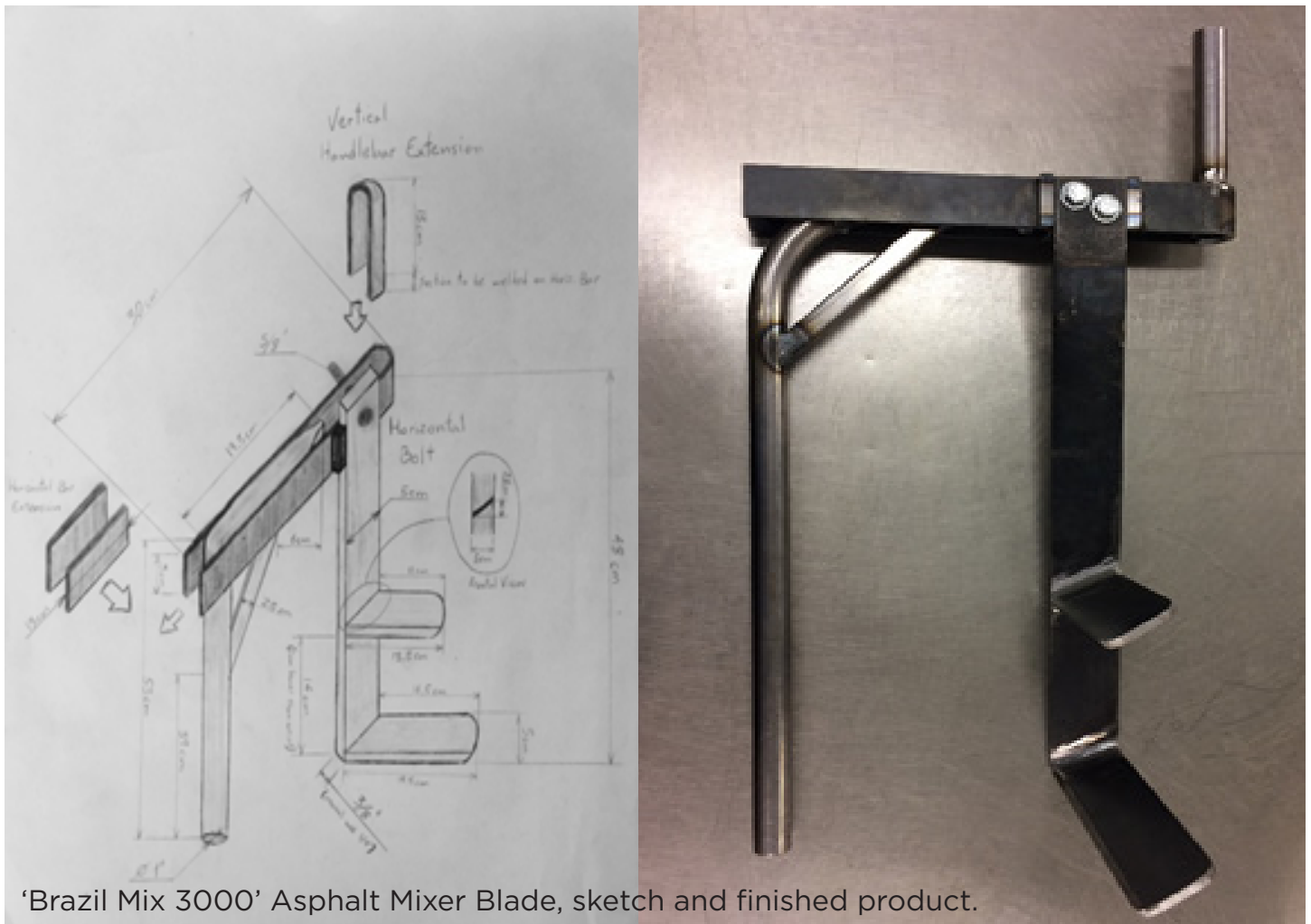
On the bottom left is a picture of our three Brazilian co-op students, and bottom right is the aggregate sieving area, also highlighting one of our Winter 2017 co-op students, Aditi Sharma, who is a 1A Civil Engineering student.



# CPATT LAB FEATURE

## NEW ASPHALT MIXER BLADE DESIGNED IN THE LAB

One of the greater challenges faced by the Brazilian exchange students, was a damaged blade for the asphalt mixer. With the guidance of Research Associate Peter Mikhailenko, the students designed a new blade (known informally as the 'Brazil Mix 3000') based on the experience with the mixer, and had it fabricated at the University of Waterloo Machine Shop. Some of the improvements included a thicker, stronger blade, with a shape that was able to scrape more binder from the mixing drum, and a reduced amount of cleaning needed after mixing. Additionally, a handle was added to allow for easier removal of the mixer blade. The CPATT team prides itself on the quality work of its exchange and co-op students, and the Brazilian exchange team of the Fall 2016 semester, was no exception.



'Brazil Mix 3000' Asphalt Mixer Blade, sketch and finished product.



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# WINTER 2017 ISSUE

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