
# CPATT NEWS

## Message from the Director

We are very pleased to be sending this, our third CPATT newsletter. In an effort to better communicate our news to you, our stakeholders, we publish this newsletter three times annually. We try our best to highlight some of the key on-going initiatives and keep you up-to-date on our activities. The last several months have been busy with cleaning out our CPATT Test Track trailer and garage ready for our relocation within the Waterloo's Waste Management Facility. We also completed a number of tests at the CPATT Test Track during the summer. Some of these tests include: SurPro testing, rut depth, skid resistance, and distress measurements.

The CPATT equipment in the Pavement and Structures lab are busy with testing various types of innovative concrete and asphalt materials.

We are also looking forward to completing the 2011 TAC Pavement Asset Design and Management Guide this fall. It has been a great effort and undertaking and we are very proud of the work completed.

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

Sincerely,

Susan L. Tighe, PhD., PEng.

## Contents

# Feature CPATT Faculty Member
# Scott Walbridge, PhD, PEng. Alberta
# Assistant Professor

## *Education*

Dr. Walbridge joined the Department of Civil and Environmental Engineering at the University of Waterloo (UW) as an Assistant Professor in 2006, shortly after being awarded his Ph.D. in Structural Engineering from the Swiss Ecole Polytechnique Fédérale de Lausanne (EPFL). Prior to that, he completed his B.Sc. and M.Sc. in Civil and Structural Engineering both at the University of Alberta, in 1996 and 1998. Between his M.Sc. and Ph.D. studies, he worked as a structural design EIT/engineer for 2.5 years at an engineering/architectural consulting firm in Edmonton (The Cohos Evamy Partners) and as a research engineer for 2 years in the EPFL Steel Structures Laboratory (ICOM).

*Scott Walbridge, PhD. PEng. Assistant Professor, Civil and Environmental Engineering, University of Waterloo.*

## *Research Highlights*

Since arriving at UW, Dr. Walbridge has expanded the scope of his research beyond his graduate work on gusset plates and tubular truss bridges to the more general study of "metal structure assessment and repair". Specifically, Dr. Walbridge and his research group have made contributions in the following areas:

- *Fatigue Design, Assessment, and Retrofitting of Highway Bridge Welds.* This research has investigated: 1) the fatigue retrofitting of bridge welds by post-weld treatment, 2) the fatigue design of aluminum highway bridge welds, and 3) the fatigue retrofitting of bridge welds using prestressed CFRP strips.
- *Assessment and Retrofitting of Corroding Bridge Structures.* This research has investigated: 1) the assessment and retrofitting (by metalizing) of corrosion-damaged weathering steel girders, and 2) the assessment and repair of reinforced concrete bridge girders with exposed flexural reinforcing.
- *Temporary and Rapidly-Installed Highway Structures.* This research has investigated: 1) shear connectors for composite bridge girders with precast decks, and 2) modular road plate systems.

Planned future research activities of Dr. Walbridge's research group will include projects in the following areas:

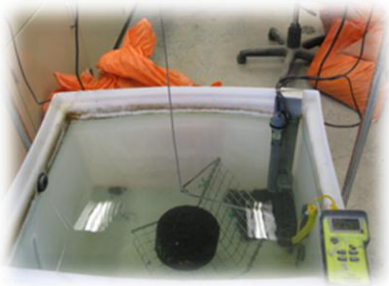
- The modelling of steel structure inspection and repair in bridge management systems (BMSs),
- The use of system identification techniques in the fatigue assessment of steel bridge structures, and
- The assessment of impact-damaged steel girders and design of heat straightening repairs.

## *Professional Activity Highlights*

- CSA Canadian Highway Bridge Design Code – Technical Committee for Chapter 17 – Aluminum Structures (active member responsible for fatigue and fracture sections of this new code chapter)
- ASCE/SEI Fatigue and Fracture Committee (active participant, official member starting on October 1, 2011)
- European Convention for Constructional Steelwork (ECCS) – Technical Committee 6 – Fatigue, Working Group A – Assessment of Existing Structures (corresponding member).

## Research Focus – John J. Carrick Pavement Laboratory

Consolidating beam end specimens for concrete with Recycled Concrete Aggregate (RCA)



Bulk relative density test on Recycled Asphalt Shingles (RAS)

### Laboratory Updates

Some of the on-going testing and projects in the laboratory include: Examining the usage of Recycled Concrete Aggregate (RCA) in concrete, testing of perpetual pavements, continued testing of the effects of Recycled Asphalt Shingles (RAS) in hot mix asphalt, and evaluations of Hot Mix Asphalt (HMA) versus Warm Mix Asphalt (WMA).

Some testing has been completed and more is on-going for the Ontario Tire Stewardship.

# Research Focus – Other CPATT Field Work

Marking pavement for SurPro testing

Temperature Sensors being installed for the City of Hamilton Pervious Concrete Project

Placing Emulsion Mix in the Town of Markham

Placing GeoMat on Emulsion for SAMI application in the Town of Markham

## Field Work

The City of Hamilton is improving the parking facilities at Courtcliffe Park in Carlisle. Courtcliffe Park is used by many local residents for various activities. The rehabilitated parking facilities include two innovative, sustainable pavement alternatives; pervious concrete pavement and grass pave. The City of Hamilton attained CPATT to partner on this pervious concrete pavement project as it is one of the initial uses of the material in the city.

Another project is currently looking at evaluating the Town of Markham road network status in terms of a gap analysis of types of roads, distresses, age, severity/density and rehabilitation/maintenance. Also there is a survey developed and sent out to the municipalities and infrastructure management companies across Canada to study the current state-of-the-practice in pavement distress and condition evaluations.

# Research Focus – CPATT Test Track

Measuring Rut Depth

Friction Testing Using British Pendulum

Portable Falling Weight Deflectometer (FWD) Testing

SurPro Profile Testing

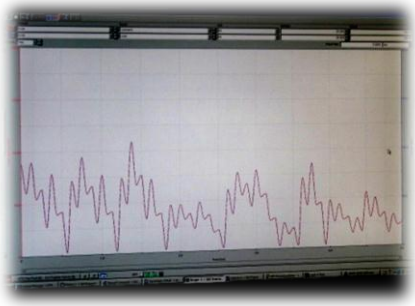
## Test Track Updates

On Sunday June 5, 2011 many of the CPATT graduate students, co-op students, Laura Bland and Jodi Norris all met at the University of Waterloo to go to the CPATT Test Track for a day of pavement performance testing. They arrived at the Test Track at 8am and got straight to work. The testing that took place that day included: friction measurement using the British Pendulum Tester, deflection measurements using the Portable Falling Weight Deflectometer (PFWD), Surface Distress Evaluation and SurPro Testing. All the testing was completed by 1pm. A performance report will be prepared shortly as the Test Track has almost been in service for ten years.

We greatly appreciate the co-operation of the Region of Waterloo who allowed us access during a Sunday so we could complete testing without live traffic present.

# Research Focus – Structures & Concrete Lab

Fatigue specimens for UIT Study



Variable amplitude loading history simulating in-service loading near the support for a 15 m single span bridge under Ontario highway traffic

ACPD Probes for measuring fatigue crack growth at four critical locations for fatigue on cruciform weld specimen

## Structures Laboratory Update

Testing related to two MTO-HIIFP projects on the fatigue assessment and strengthening of welds in steel highway bridge girders is currently underway in the UW Structures Laboratory.

The first project involves structural health monitoring and repair of distortion fatigue cracks near web stiffener ends. The large photograph above shows a web stiffener fatigue test in progress (note that steel girder is oriented horizontally for fatigue testing). Several fatigue cracks have been initiated in the "as-received" specimens. Various repairs will now be tested, including: hole drilling, grinding, and rewelding, needle peening, and strengthening with fibre-reinforced polymer (FRP) materials.

The second project involves quality control of bridge welds retrofitted by ultrasonic impact treatment (UIT). For this project, fatigue tests will be performed on cruciform specimens with various parameters related to the treatment quality varied.

In both cases, fatigue crack growth is being monitored by custom made AC potential drop (ACPD) probes.

Dr. Scott Walbridge can be contacted for further details on either projects.

# Announcements

## Congratulations

**Vimy Henderson** (PhD Candidate, Susan Tighe) – accepted a fulltime position at Golder Associates Ltd. and will complete her thesis shortly.
**Shirley Ddamba** (MASc student, Susan Tighe) – completed her MASc
**Amma Wakefield** (MASc student, Susan Tighe) – completed her MASc
**Shahram Vaziri** (PhD Student, Carl Haas) – completed his PhD
**Alondra Chamorro** (PhD Candidate, Susan Tighe) – accepted a position as Assistant Professor at the Department of Construction Engineering and Management at the Pontifia Universidad Católica de Chile (Catholic University of Chile), in Santiago, Chile.
**Alan Mak** (MASc Candidate, Scott Walbridge and Susan Tighe) – accepted a position as a Project Engineer at MDH/SNC Lavalin in Saskatoon, SK

## Welcome New Students

**Doubra Charles Ambaiowei** (MASc Candidate)
**Mohammad Hegazi** (MASc Candidate)
**Alex Kivas** (MASc Candidate)
**Jonathan Boone** (part-time MASc Candidate)

CPATT's newest member was born on June 14, 2011. A beautiful, healthy, baby boy, ***Jeramus Kwasi Wakefield.*** Jeramus proud parents, Amma (MASc Candidate) and Brent are enjoying their new bundle of joy!
*WELCOME TO THE WORLD Jeramus!*

## UPCOMING EVENTS

**October 28, 2011**

CPATT Board of Advisor's Meeting, University of Waterloo

Student Poster Symposium, University of Waterloo

**November 15-19, 2011**

8th International Conference on Managing Pavement Assets, Santiago, Chile

**January 22-26, 2012**

Transportation Research Board 91st Annual Meeting

# May 2011 Highlights
# Feature Student – Mohab El-Hakim

Mohab Y. El-Hakim is a PhD candidate under the supervision of Dr. Susan Tighe. Mohab received his BSc in 2004 from Alexandria University, Alexandria, Egypt. He then moved on to receive his MASc from the University of Waterloo and is currently pursuing his PhD at the University of Waterloo.

Mohab's work experience includes a quality control engineer at Archirodon Construction Overseas (Edku, Egypt), Design Engineer at African Consultant Office (Alexandria, Egypt) and research and teaching assistant at both the University of Waterloo and Alexandria University. Mohab's research is based on perpetual pavements, which is described in detail below.

## Feature Project – Perpetual Pavements

Perpetual pavements are thick high quality pavements that are designed and constructed for 50 year design life. They eliminate crack propagation and resist the bottom-up fatigue cracking due to freeze-thaw cycles and traffic loads.

Surface asphalt layer is replaced every 20 years to treat top-down cracks. This maintenance is vital for maintaining acceptable skid resistance and tire asphalt noise levels. Perpetual pavement is an environmental and economic alternative for conventional pavements, especially on heavy trafficked highways. They are constructed over sound subgrade material and the soil should be stabilized or a base layer is installed in natural soil in the site is not stiff enough to support the perpetual pavements own weight. Some pictures of this research are shown below. Also this work has recently featured in the Professional Engineers Ontario Engineering Dimension July/August 2011 issue article on embracing innovation. A quote from Susan Tighe in the issue states "In Ontario, our economy is so reliant on highway infrastructure through the transportation of goods and services. We also have harsh winters and lots of freeze thaw cycles. All of this takes a toll on our highways. If we can design long-lasting pavements that are more sustainable, require minimal maintenance and are more cost-effective, then that's a huge innovation."

# CPATT Test Track Trailer Relocation

As discussed in the previous newsletter, the CPATT office/trailer at the Region of Waterloo's Waste Management Facility sits within the footprint of waste cell NE-4. The Region of Waterloo has decided that this waste cell will be developed in 2012. Therefore, the CPATT office/trailer will be relocated to another location at the Waste Management Facility. Some of the graduate students and co-op students assisted Jodi Norris with the clean-up of the trailer and garage in order for the move to take place in the next few weeks. Below are some pictures of the clean-up.

Dom Hu (visiting scholar) emptying the trailer

Andrew Northmore, Mehran Kafi Farashah and Jodi Norris cleaning out the garage

Disposing of old samples

All CPATT equipment loaded into storage containers and moved to the new location to await the buildings

# CPATT Test Track Trailer Relocation Cont'd

Garage empty after many hard days of work

Loading the containers

Moving very heavy barrels of sand

New location being prepared

# Speakers Corner – International Student Perspective

## From an international student/visiting scholar perspective, what do you find most interesting about Canada's roadways and infrastructure?

**Alondra Chamorro**, PhD Candidate – Santiago, Chile

There are many aspects that are interesting about Canada's roadways and infrastructure. First is the fact that Canada is the second largest country in the world, so it needs to be effectively connected to provide access and mobility to its population, as well as being an internationally competive economy. Secondly, because of its level of development, extent, and location, Canada presents a variety of scenarios affecting the performance of road assets, such as climates, soils, traffic and geographies. Finally, and most challenging, is that despite its extent, Canada presents a very low level of population and, therefore, a low density. This can be discussed under two perspectives. On one hand the amount of road experts and professsionals in charge of the network is reduced, compared to the huge network they have to design, construct an manage. Because of this, they have to be innovative and practical when solving problems. On the other hand, few people live in this network, so roadway projects have to be efficiently prioritized and valuated so that they are economically viable and socially beneficial. Consequently, the overall importance of road networks and their role in the country's progress needs to be clearly understood and has to be objectively assessed in order to "compete" for funding with other government sectors.

**Zaid Alyami**, MASc Candidate – Saudi Arabia

What I find interesting is the collaborative effort between the public, private sectors and research institutions across the country to produce the most efficient and effective infrastructure networks in an innovative and sustainable way. For example, the use of recycled materials, introducing environmental incentives, and implementing innovative contract delivery methods.

# Speakers Corner – International student Perspective – Cont'd

## From an international student/visiting scholar perspective, what do you find most interesting about Canada's roadways and infrastructure?

**Xiomara Sanchez**, MASc Candidate – Bogota, Columbia

For me the most interesting aspect about Canada's roadways and infrastructure it the management system. As I have seen in these four months since arriving in Ontario, the road infrastructure is in a good general state, even despite the winter season, which tends to affect significantly pavement. I find you can barely see serious distresses on the surface or lack of signage, and the commitment of the governmental agencies and private contractors to keep it in the appropriate conditiion for user safety is notable. I have also noticed the maintenance treatments used on the streets are well thought-out and the correct treatment is placed at the correct time, which shows a well run infrastructure management program.

**Xudong (Dom) Hu**, Visiting Scholar – China

My first impression of Canadian roadways is that the road system is sound, either expressway or country roads are convenient for masses or people. The pavement design and application of materials fully shows the sustainable concept. CPATT's research projects are very significant and I was able to benefit from some field and laboratory work on several projects with the graduate students.

# News and Awards

## Publications, Papers and Presentations

- Fatigue Retrofitting of Welded Steel Cover Plates using Pre-stressed CFRP Strips – Structural Engineering International – **S. Walbridge, K. Soudki, F. Vatandoost**
- Fatigue testing and analysis of peened highway bridge welds under in-service variable amplitude loading conditions – International Journal of Fatigue – **K. Ghahremani, S. Walbridge**
- Fatigue Correction Factors for Welded Aluminum Highway Structures – Canadian Journal of Civil Engineering – **R. Coughlin, S. Walbridge**
- Innovative Infrared Crack Repair Method – Transportation Association of Canada – **L. Uzarowski, V. Henderson, M. Henderson, B. Kiesswetter**
- Development of an Approach for Assessing the Level of Safety of a Highway Network Associated with Pavement Friction – Presented at Transportation Association of Canada Conference – **A. Halim, S. Tighe**
- Quantification of Recycled Concrete Aggregate (RCA) Properties for Usage in Bridges and Pavements: An Ontario Case Study – Presented at Transportation Association of Canada Conference – **L. Butler, J.S. West, S. Tighe**
- Weigh-In-Motion Sensors' Installation and Calibration Efforts on Highway 401 Perpetual Pavements, Woodstock – Presented at Transportation Association of Canada Conference – **S. Vaziri, C. Haas, R. Haas, L. Rothenburg, J. Ponniah**
- Implementing a Pavement Management System for Low Volume Roads: Challenges and Successes – Presented at Transportation Association of Canada Conference – **L. Whiteley-Lagace, K. Helali, J. Dietz**
- Upgrading Surface Treated Roads to Asphalt Concrete Pavements – Is this a Cost Effective Strategy? – Presented at Transportation Association of Canada Conference – **A. Halim, A. Dalziel, L. Whiteley-Lagace, G. Moore, R. Andoga.**
- 2011 PADMG Workshop – Hosted by **Project Consortium Team** at the Transportation Association of Canada Conference

## CPATT

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# News and Awards

## Awards – Congratulations to all the TAC Scholarship Winners!

- Waterloo Alumni – **Leanne Whiteley-Lagace** – PhD Civil Engineering Pavement Management Systems
- Canadian Council for Independent Laboratories – **Mohab El-Hakim** – PhD Civil Engineering Structural Evaluation of Perpetual Pavements
- 3M Canada Company – **Mehran Kafi Farashah** – M.Sc. Civil Engineering
- Canadian Provinces/Territories – **Andrew Northmore** – M.Sc. Transportation
- Canadian Provinces/Territories – **Samantha Pinto** – M.Sc. Transport Engineering
- Canadian Council of Motor Transport Administrators – **Amir Ghods** – PhD. Traffic and Safety Analysis
- Delcan Corporation – **David Duong** – PhD. Transportation Planning
- Morrison Herschfield Limited – **Daniel Baggio** – M.Sc. Civil Engineering
- Canadian Provinces/Territories – **Matthew Casswell** – BA Sc. Civil Engineering

## Student Poster Symposium

**Friday October 28th, 2011 12:30pm – 3:00pm**
**E5-1014 Student Design Centre Area**

Lunch will be provided
Please **RSVP** by **October 14th, 2011** to:
Laura Bland – lbland@uwaterloo.ca (Administrative Assistant) or
Susan Tighe – sltighe@uwaterloo.ca (Professor, Director of CPATT)

Join industry members and CPATT faculty members for a graduate student poster symposium, where students will be showcasing their current research projects. This is a great event to mingle with industry partners and learn about current research projects.

Parking: TBD

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