UNIVERSITY TRANSPORTATION CENTER for HIGHWAY PAVEMENT PRESERVATION

CHPP NEWS

Newsletter Issue 2. October 2015

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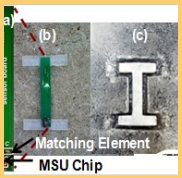

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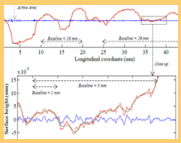

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Transportation and Pavement Preservation Seminar in Miami

A half-day workshop was conducted on June 7, 2015 during the ASCE T&DI conference in Miami, Florida. About forty (40) professionals participated in the event. The workshop provided an overview of recent research and implementation examples on the application of pavement preservation techniques to enhance the pavement sustainability.

From the Director

With the second year coming to a close, the CHPP continues to grow and diversify its research, education and outreach activities. More than fifteen multi-year research projects are underway, already producing close to thirty journal and conference publications. We have worked hard to make sure that the research portfolio encompasses the various themes of the national research road map for pavement preservation and that there is an even split between applied and advanced research. Close to twenty graduate and twenty-five undergraduate students are involved in CHPP projects, and a few of these projects involve high school students. Several preservation-related seminars and symposia have taken place, involving faculty, graduate and undergraduate student researchers, with at least two of these involving joint participation from several of the consortium partners. The faculty associated with several CHPP university consortium partners have either added or enhanced six graduate and undergraduate courses to specifically address pavement preservation.

After a successful year of educational outreach activities involving K-12 students, we have initiated this summer a half-day activity specifically targeting high school and middle school teachers from various States. We also developed two transportation-related short courses for K-12 students.

Through the National Center for Pavement Preservation (NCPP), some twenty transportation infrastructure preservation-focused seminars, symposia and distance-learning short courses have reached more than a thousand professionals. We are now in the planning stage of organizing technical sessions highlighting some of the research findings from CHPP projects in the upcoming 2016 National Pavement Preservation Conference to be held in Nashville, Tennessee, October 9-13.

We are pleased that CHPP has been covered in the media, with five newspaper and three TV on-line articles. Also, CHPP was featured in the August 2015 issue of the USDOT UTC Spotlight Newsletter.

Finally, as the CHPP continues to grow its research and education portfolio we are looking for new ways to communicate and disseminate opportunities, results and information on-line, in a more interactive and responsive approach. In particular, we aim to grow our use of social media to increase our reach to pavement preservation enthusiasts among students, researchers and professionals.

Please feel free to contact us and explore our website for more information on our research, education and outreach activities.

Best Regards,

Karim Chatti, PhD
Director, Center for Highway Preservation (CHPP)

CHPP Advisory Board

The CHPP Advisory Board was formed since the inception of the center. The board involves a group of transportation infrastructure leaders that advises CHPP leadership on research goals, education/workforce development and technology transfer activities. The most significant aspect of the Board is the involvement of stakeholders i.e., preservation practitioners from state, provincial, and local transportation agencies, industry, and academia. The experts will also assist in promoting the center activities at national and international levels, and will assist in identifying collaboration opportunities to support pavement preservation research and practices. We appreciate the involvement of the following members:

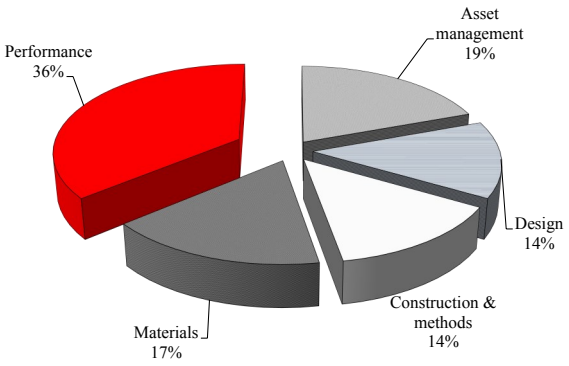
Steve Bower – Michigan DOT
Judith Corley-Lay – North Carolina DOT
James Matsuzaki – City of Honolulu
Magdy Mikhail – Texas DOT
Jim Moulthrop – FP2
Roger Olson – Minnesota DOT
Alicia Pilli – Illinois Toll-way

Additional experts and practitioners have been invited based on their expertise and center needs. The Advisory Board meets annually or whenever the center needs their advice.

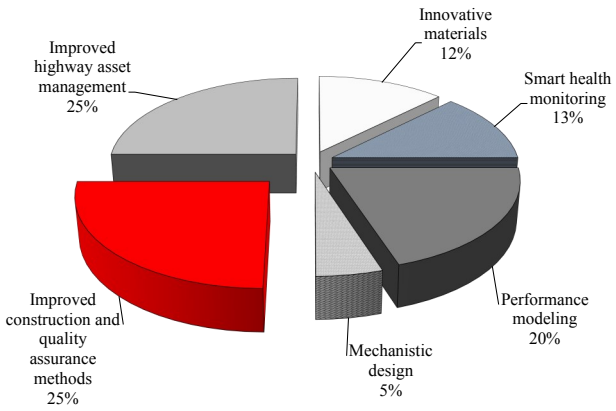
Find us online:

Research Portfolio

A total of nineteen research projects have been selected for funding. During the project identification and selection process, emphasis was given to a balanced portfolio for the research topics. The charts show the distribution of the research topics by the AASHTO Pavement Preservation Roadmap categories and CHPP research themes. It can be seen from the figure that all areas of research are well distributed among various Roadmap categories and CHPP research themes. While some of the topics address more fundamental research, the research findings will be useful in solving pavement preservation challenges in the long-term. On the other hand, some of the research studies involve more practical research to fill in the short-term knowledge gaps.



Roadmap research categories



CHPP research themes

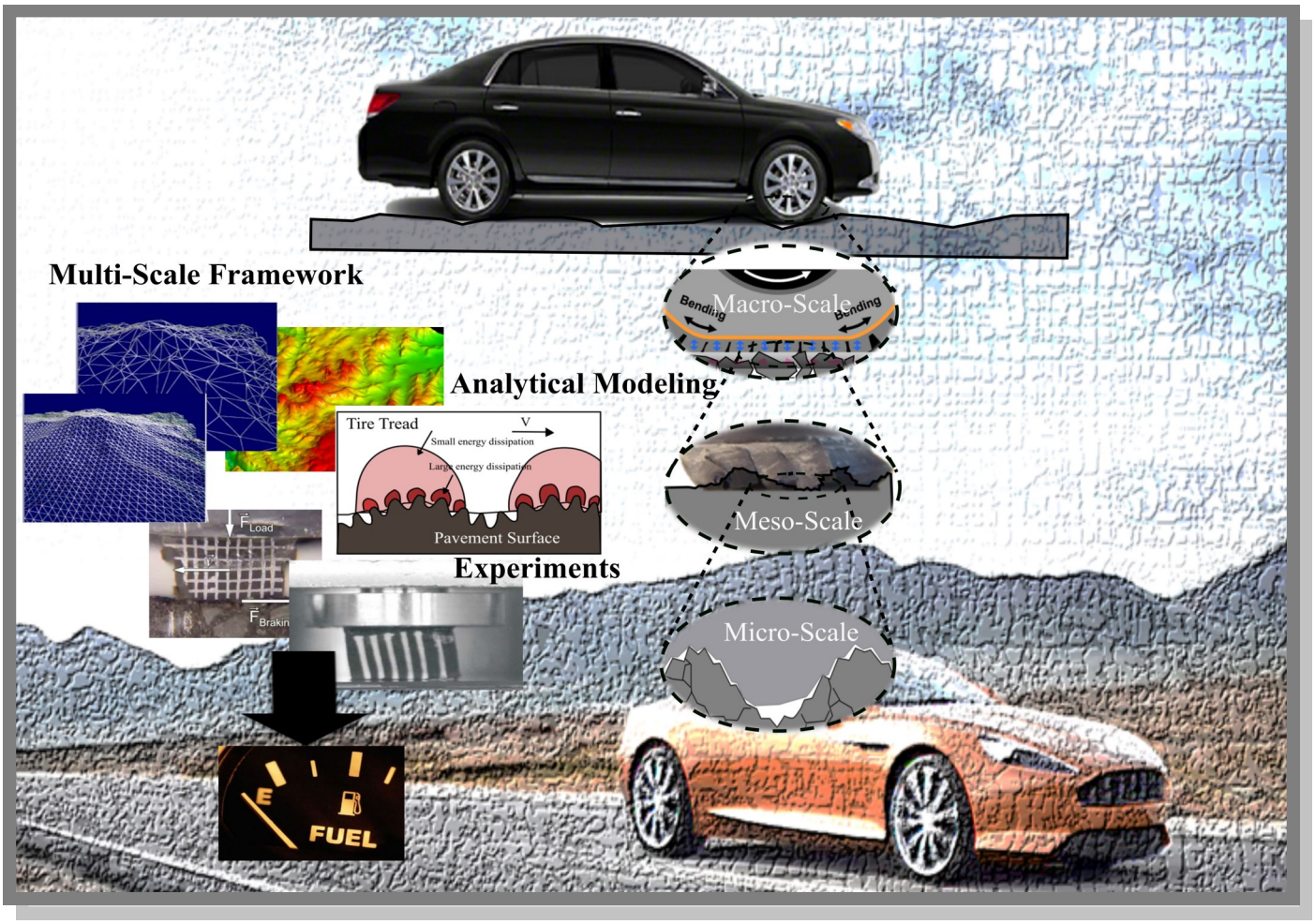
Research Highlights

Pavement Surface Characterization for Optimization of Trade-off between Grip and Rolling Resistance

Roozbeh Dargazany, Karim Chatti and Shabnam Rajei
Michigan State University

Fuel consumption of vehicles has been an issue in the past few decades due to its huge impact on global warming. Rolling resistance plays a substantial role in fuel consumption of vehicles and is a complicated phenomenon which is related to both tire and pavement surface. Understanding the tire-pavement interaction within the contact patch is of great significance for revealing the mechanism of rolling resistance and grip.

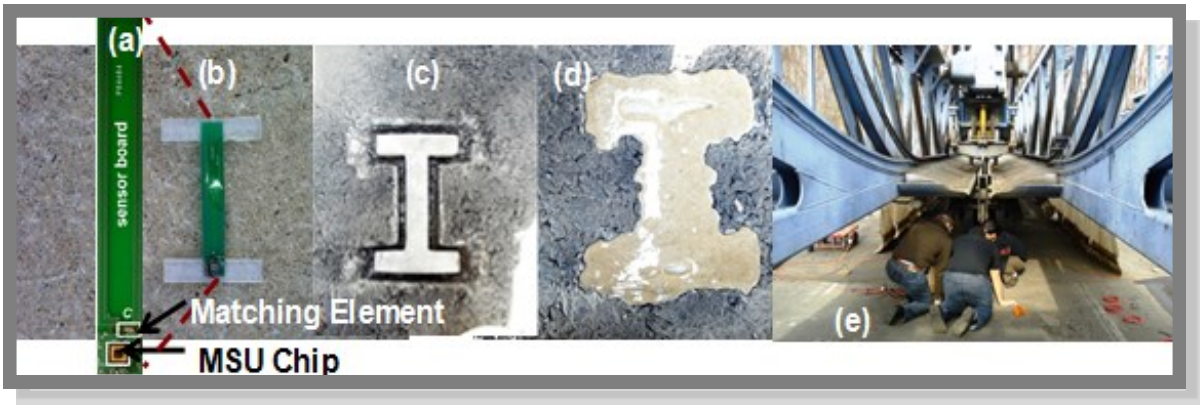
The research is investigating the effect of tire properties and pavement surface characteristics through a hierarchical computer simulation and several experimental analyses to find the roughness spectrum with an optimized rolling resistance-grip performance. Although the aim is reducing rolling resistance, an optimal method should be demonstrated to characterize the surface properties that yield the least rolling resistance without sacrificing grip in the process. In the majority of current studies only the effect of macro-texture on rolling resistance and grip is investigated. Thus, the goal of this study will take the current knowledge to a step further by investigating the effect of micro-texture in both theoretical and experimental context with a multi-scale surface. The surface profile of the pavement is represented as a spectrum of spatial frequencies. Adhesion and hysteresis are considered as the two major elements of friction. Rolling resistance consists of three components of tire deflection and bending (Macro-, mega-, roughness), tread slip (Meso-, micro-) and tread surface deformation (micro-, nano). Velocity can affect the behavior of tires significantly because of viscoelastic properties of rubber; therefore it plays an important role in the modeling of rolling resistance and grip in this study. Rolling resistance and friction models are being developed and the results are being validated using new and existing experiments on different pavement surfaces. Based on the influence of surface texture and velocity, the contribution of hysteresis and adhesion components are found in rolling resistance and friction. The optimum surface texture with the best trade-off between rolling resistance and grip are being investigated. It is noteworthy that the influence of the wheel load and inflation pressure on the deformation of the tire tread is not considered in this study.

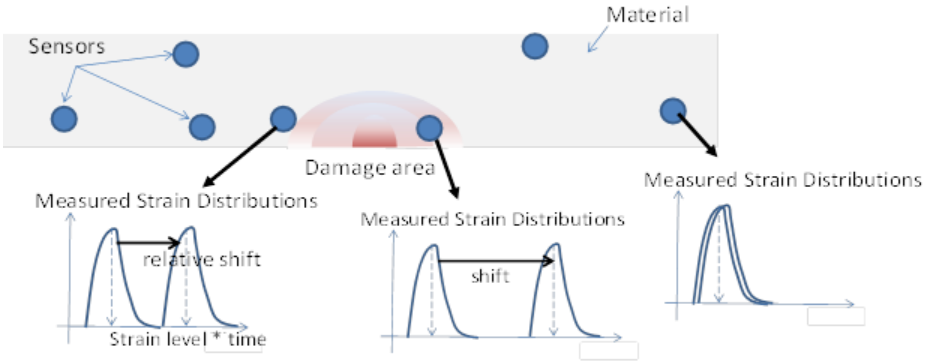


Feasibility of Early Damage Detection by Using Surface Mounted Sensors on Existing Pavements

Nizar Lajnef, Karim Chatti, Amir Alavi, Hassene Hasni, and Moses Pacheco
Michigan State University

Previous work by Michigan State University (MSU) led to the development of an innovative sensing system for continuous health monitoring of pavement structures. The developed self-powered wireless sensor is capable of detecting the progressive accumulation of damage in pavement structures under actual traffic and environmental load history. While the development of new sensors constitutes a major achievement towards the future implementation of autonomous sensor networks for the continuous monitoring of in-service pavements, there are significant hurdles that challenge the acceptance of new technologies into practice by state highway agencies (SHAs).





One of the major challenges is the installation procedure in the field. Most of the currently used sensors and gauges require installation procedures that can be typically used only in specific pavement sections for research purposes. Such procedures demand considerable care during construction and are time consuming. Furthermore, new pavement construction projects are negligible when compared to the extent of the exiting pavement network. It is thus more critical for SHAs to adopt monitoring techniques that can be adapted to existing pavements. This project investigates the feasibility of surface mounting installation procedures on existing pavements without major interference with regular maintenance activities. In addition, this work will investigate the formatting and integration of the generated data with the existing pavement management and preservation systems. This integration is critical for a successful adaption of any developed technology, understanding that just a new stream of unformatted data can be useless unless it is integrated with and accepted as a support to the existing management systems.

Successful proof-of-concept for the proposed installation procedures could dramatically transform the economics of pavement preservation/management and ultimately improve the serviceability of pavements. The system will consist of a network of low cost sensors easily installed on existing pavements. Each sensor node is self-powered and capable of continuously monitoring and storing the dynamic strain response levels. The strain data is stored on-board the small-scale sensor electronics. The data from all the sensors are periodically uploaded wirelessly to a central database. The sensor can be read through standard radio-frequency (RF) transmission using a RF reader that is either manually operated or mounted on a moving vehicle. The roads can be frequently monitored to detect changes in structural integrity that may not only indicate a potential for future crack/distress manifestation, but also allow for more accurate scheduling of preservation actions.

The investigators recognize that any existing technology will have to go through major improvements before its wide acceptance. The improvements proposed in this project will constitute a step forward toward eliminating several key hurdles.

Evaluation of Pavement Surface Micro – and Macro –Texture

J. Prozzi, University of Texas at Austin

According to the Federal Highway Administration (FHWA), in 2008, more than 19,000 people were killed in roadway departure crashes in the United States. Poor roadway conditions, especially wet pavements, have been identified as a major contributing factor in roadway departure crashes. It is estimated that about 70% of wet pavement crashes can be prevented or minimized by improving pavement friction. Pavement surfaces should be designed, constructed, and maintained in order to provide durable and adequate friction properties to the drivers.

Pavement surface texture is influenced by many factors, such as aggregate type and size, mixture gradation and texture orientation, among others. The surface texture of an aggregate plays a leading role in providing high friction to a pavement surface. It is the property in charge of defining the skid resistance. Micro-texture and macro-texture are the two key pavement surface characteristics to provide good skid resistance. Micro-texture, or aggregate texture, refers to the small-scale texture of the pavement aggregate component (which controls the contact between the tire rubber and the pavement surface). Macro-texture, or pavement surface texture, refers to the large-scale texture of the pavement as a whole due to the aggregate particle arrangement (which controls the displacement of water from under the tire and hence the loss of skid

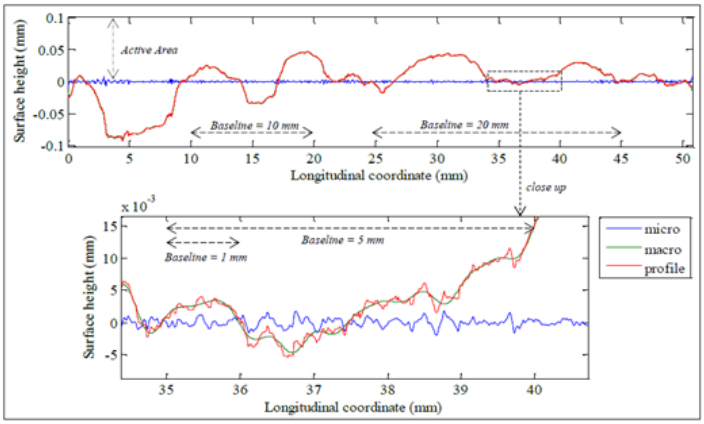


Figure 2 Decomposition of micro– and macro-textures

resistance with increased speed).

The effects of the aggregate texture (micro-texture) and the texture of the compacted hot mix asphalt (macro-texture) on the skid resistance of a highway surface are well recognized. However, there is a lack of fundamental understanding of the individual effect that each of these two components, micro and macro-texture, have on the final skid properties of the road. Most research studies in this regard have been based on theory, assumptions and sound engineering judgement. The individual effects have not been quantified and their contribution to skid under different conditions of moisture, speed and highway conditions are not well understood. Recent developments in optics, laser technology and computer speed have allowed the collection of high definition 3-D images of the surface of the highway pavement. In particular, it is now possible to quantify micro-texture in the field in an effective and efficient manner. This can be done with the use of laser-based technology that allows measurements below 0.5 mm.

This research is exploring different methods to characterize the micro-texture of pavement surfaces with the main objective of quantifying the effect of accounting for both the micro and the macro components of the texture. Friction and texture data were collected from 28 different asphalt pavements in service in Texas,

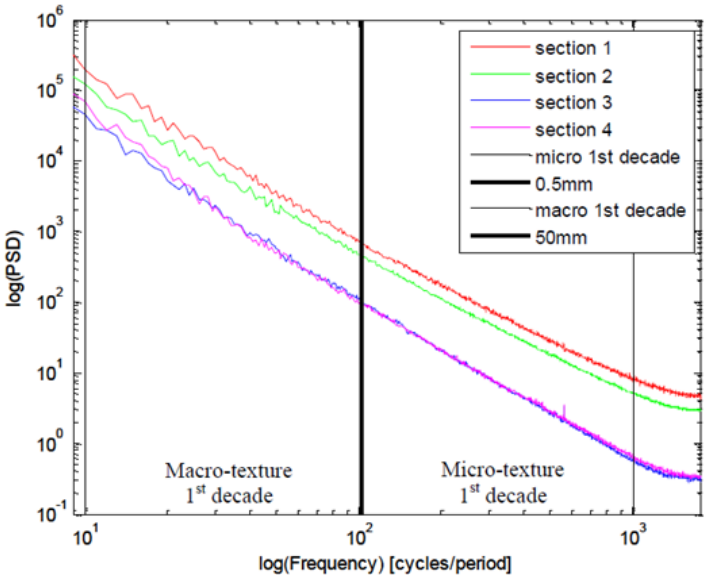


Figure 1 Power Spectral Densities

which presented different aggregate gradations. The site selection was based on criteria to obtain a wide range of friction coefficients values and different cases for each possible combination of fine and coarse macro-texture and smooth and rough micro-texture.

Measurements of texture and friction before and after applying texturing treatment were analyzed. The friction was characterized under wet conditions and in the direction of traffic using the British Pendulum Tester (BPT) (ASTM E 303). The macro and micro-texture were characterized by the Circular Track Meter (CTM) (ASTM E 2157) and a laser texture scanner (LTS), respectively. The Mean Profile Depth (MPD) values were calculated using the data collected from each device. In order to characterize the pavement surface micro-texture, the data collected with the LTS were analyzed in the spectral/frequency domain, and in the spatial domain. In the first case, the Discrete Fourier Transform (DiFT) was applied to separate macro and micro-texture by isolating the different wavelength ranges. Using the Power Spectral Density (PSD), the micro-texture was characterized using the slope and the y-intercept of a linearized PSD. It was observed that the greater the intercept, the greater the surface friction, while the slope did not significantly affect it. Initial findings suggest that baseline shorter than 10 mm result in a better prediction of the pavement surface friction. From these preliminary results, it can be concluded that accounting for both the macro- and the micro-texture components of the surface significantly enhances the prediction of friction (in terms of BPN) of flexible pavements as opposed to accounting solely for the macro-texture component. Such improvement will allow transportation agencies to better manage skid resistance and therefore improve road safety.

Environmental and Factional Benefits and Trade-offs of Hot In-Place Recycling Treatment Techniques

I. Al-Qadi, H. Ozer, I. Abuawad, and P. Singhvi
University of Illinois at Urbana Champaign

Despite the widespread use of in-place recycling, limited information is available on the in situ and laboratory properties of materials undergoing in-place recycling. In-place recycling techniques, including hot and cold in-place recycling, are often considered the most cost and environmentally friendly techniques because they do not require the acquisition and transport of materials to job sites. The objective of this study is to characterize the lab and field performance of hot in-place recycling techniques and optimize mix design and construction procedures. The study will provide guidance on improving the performance of pavements rehabilitation using various techniques of hot in-place recycling.

Potential benefits of this study are the improvement in the HIR procedures for optimized performance. This will include process selection (surface recycling, repaving, and remixing), material selection, mix design, construction procedures, and site selection.

The methodology includes test site evaluation and laboratory characterization of samples collected from the field trials. Test site evaluations include monitoring of construction, materials sample collection, pavement structural condition assessment using profiling and Falling Weight Deflectometer (FWD) before and after construction.

As part of this ongoing study, three test sites were selected and evaluated so far. A comprehensive laboratory characterization program is developed to understand fundamental engineering characteristics of asphalt mixtures prepared using in -place recycling technique. Mixes will be tested to determine mix properties, including aggregate gradation, binder type and content, and effect of rejuvenators used. More sites will be selected in different climates to represent the local construction practices and materials.

Multi-Functional Concrete Pavement Inlays

J. Roesler, S. Sen, and D. King
University of Illinois at Urbana Champaign

The project Multi-Functional Concrete Inlays for Pavement Preservation looks at combining several concrete technologies to develop a rapid, durable and sustainable concrete pavement preservation strategy that meets the performance requirements of multiple stakeholders. Principles of self-consolidating concrete (SCC) with synthetic macro-fibers are combined with photo-catalytic cement containing titanium dioxide (TiO2) nanoparticles to achieve these goals. This enhanced Flowable Fibrous Concrete (FFC) allows for efficient placement and construction and has been shown in laboratory tests to have the desired strength and fracture properties required.

Innovative methods to calculate albedo and other thermal properties of this concrete are under development, which will be used to demonstrate its ability to mitigate the Urban Heat Island through long-term pavement thermal modeling. Bench-scale air quality tests are being conducted to assess the photocatalytic efficiency of the concrete in mitigating vehicular emissions of NOx, one of the most prevalent air pollutants in the near-road environment that results in human health hazards. Together, these benefits add a durable and sustainable pavement preservation option to the pavement engineer's toolkit.

Research Publications

CHPP researchers prepared and produced several conference and journal papers based on the research being conducted as part of the center. In addition, to disseminate the research findings, presentations were also made at various appropriate venues and meetings. The following is the list of publications and presentations related to different CHPP research projects during this period.

1. *Impact of Site Factors on the Effectiveness of Flexible Pavement Preservation Treatments, Syed W. Haider, Ronell J. Eisma, Karim Chatti, Gilchrist Ireland, and Nicholas McDonald, paper accepted for presentation and publication at the Airfield & Highway Pavement Conference, June 7-10, Miami, 2015.*
2. *Impact of Diamond Grinding on Rigid Pavement Performance, Syed W. Haider, Karim Chatti, Ronell J. Eisma, Imen Zaabar, and Tyler Frederick, paper accepted for presentation and publication at the Airfield & Highway Pavement Conference, June 7-10, Miami, 2015.*
3. *Structural and Environmental Benefits of Concrete Inlays for Pavement Preservation, Sushobhan Sen, Daniel King and Jeff Roesler, paper accepted for presentation and publication at the ASCE T&DI International Airfield & Highway Pavements Conference, Miami, FL, June 7-10, 2015.*
4. *Invited presentation: Performance Characterization of Hot In-Place Recycled Mixtures, Imad Al-Qadi and Hasan Ozer, ASCE T&DI Pavement Specialty Conference in June 2015, Miami, FL.*
5. *Seminar Presentation: Quantitative Ultrasonic Array Evaluation of Concrete Structures, L. Khazanovich, University of Palermo, Italy, May 21, 2015.*
6. *One day training course on conventional and roller compacted concrete pavements, L. Khazanovich, Riga Technical University, Riga, Latvia, May 26, 2015,*
7. *Presentation: Composite, or Thermally Insulated Concrete Pavements, L. Khazanovich, ISCP Concrete Pavement Technology Transfer Workshop, June 25, 2015.*
8. *Extended Synthetic Aperture Focusing Technique for Ultrasonic Imaging of Concrete, Hoegh, K. and L. Khazanovich, accepted for publication in NDT & E International.*
9. *Performance-Related Specifications for Pavement Preservation Treatments, Karim Chatti. Workshop on Sustainability Through Pavement Preservation, ASCE T&DI Airfield & Highway Pavement Conference, Miami, June 7-10, 2015.*
10. *Preservation for and with concrete pavements, Jeffery Roesler. Workshop on Pavement Preservation, ASCE T&DI International Airfield & Highway Pavements Conference, Miami, FL, June 7-10, 2015.*
11. *Introduction to Pavement Preservation, Imad L. Al-Qadi. Workshop on Pavement Preservation, ASCE T&DI International Airfield & Highway Pavements Conference, Miami, FL, June 7-10, 2015.*
12. *Construction and Inspection of Seal Coats in Texas, Jorge A. Prozzi. Workshop on Pavement Preservation, ASCE T&DI International Airfield & Highway Pavements Conference, Miami, FL, June 7-10, 2015.*
13. *Preservation Techniques for Asphalt Pavements, Hasan Ozer. Workshop on Pavement Preservation, ASCE T&DI International Airfield & Highway Pavements Conference, Miami, FL, June 7-10, 2015.*
14. *Life Cycle Cost Analysis and Life Cycle Assessment for Pavement Preservation, John Harvey. Workshop on Pavement Preservation, ASCE T&DI International Airfield & Highway Pavements Conference, Miami, FL, June 7-10, 2015.*
15. *Towards A More Mechanistic Approach To Pavement Preservation, Karim Chatti, Invited Lecture, The Kent Seminar Series, University of Illinois at Urbana-Champaign, April 30, 2015.*
16. *Overview of Research Projects at the UTC Center for Highway Pavement Preservation, Invited presentation for the TRB Committee AHD18 on Pavement Preservation, Karim Chatti, 93rd Transportation Research Board Conference, January 10-15 2015, Washington DC.*
17. *Towards a More Sustainable Approach to Road Infrastructure Preservation, Karim Chatti, NATEG Days 2015, July 24-25, 2015, Djerba, Tunisia.*
18. *Pavement preservation with a twist: A look at some innovative research being conducted at MSU-CHPP, Karim Chatti, Invited Lecture, The University of Pisa, Italy, July 13, 2015.*

Education News

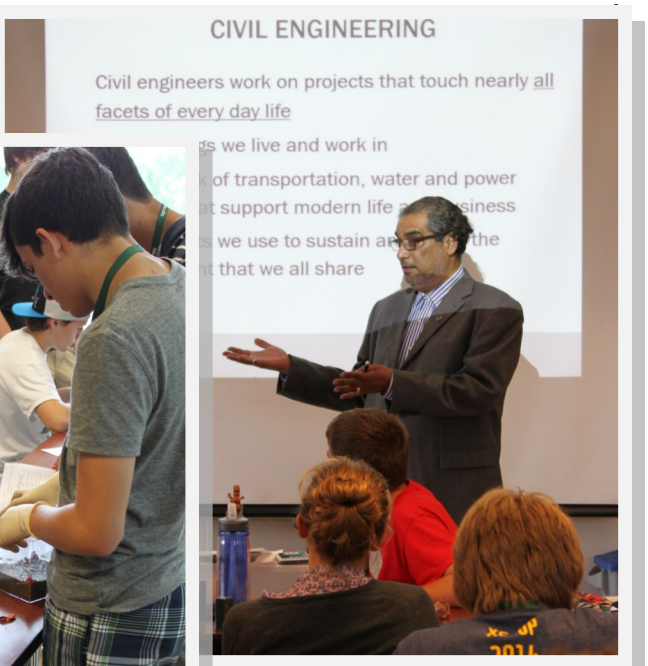
K-12 Outreach

MSU High School Engineering Institute– June 23 & 30 and July 14, 2015

Three sessions for High School Engineering Institute were conducted on June 23&30, and July 14, 2015 at Michigan State University.

Each session involved forty three (43) international and national high school students. The program was designed to give in-depth experiences in civil engineering majors.

The CHPP focus was to encourage these students to pursue a college degree in a transportation-related area. Students spent a half day with an engineering faculty member, graduate and undergraduate students, and participated in short lectures, demonstrations, hands-on experiments, team-based problem solving, and tours. The class lectures emphasized social and environmental relevance of basic science and engineering. It is known that minorities and women have a lower representation in the science and engineering programs in universities. Several reasons suggested for this disconnect are lack of knowledge and emphasis on the social value and relevance of science, mathematics and engineering subject matters as well as the lack of multi-disciplinary project teams. These potential reasons have been shown to affect the retention of women in engineering. CHPP believes that the strong societal impact and creation of multi-disciplinary teams is crucial to attract female and under-represented minorities to the STEM field.

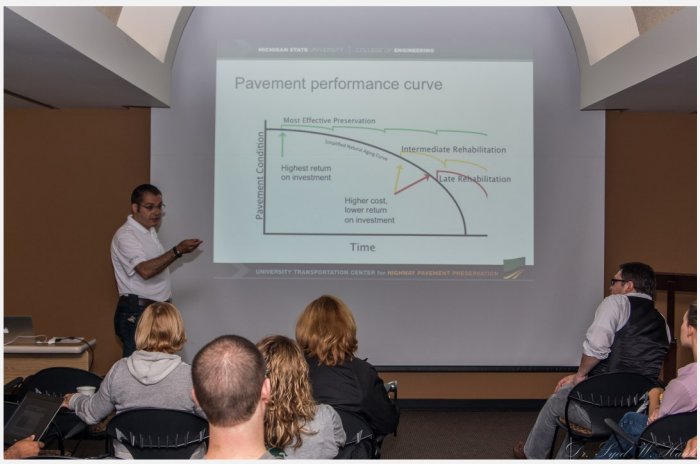


Participating students worked on projects such as:

- Building a sample of asphalt pavement cross-section using crumb rubber (Road in a box),
- Using smart materials (piezoelectric sensors) to generate voltage as a measure of deflection,
- Measuring the permeability of different pavement materials (Sand and clay).

NGSS Compliant Introduction to Engineering Teacher Workshop—July 1, 2015

The workshop was conducted on July 1, 2015 at Michigan State University. Fifteen (15) school teachers from all over the US participated in this event. The main objective of the workshop was to enhance the integration of the CHPP activities into school curriculum. School teachers were engaged in lectures related to pavement preservation concepts and CHPP research activities. The teachers were exposed to pavement and transportation engineering through laboratory tours and hands-on experimental activities. CHPP joined forces with the MSU research experience for teachers (RET) coordinators to present ways in which such activities can be used in the Next Generation Science Standard (NGSS) aligned engineering curriculum.



The agenda for the workshop included:

- Lecture: *Towards a More Mechanistic Approach to Pavement Preservation*
  Presenter: Karim Chatti, Center Director
  "A forward looking approach to pavement preservation, based on mechanistic principles and a scientific understanding of pavement systems behavior and how they deteriorate over time was explained. The presentation focused on how this approach to pavement preservation will allow for taking proactive preventive measures that are supported by a sound understanding of the deterioration mechanisms and a more mechanistically based prediction of pavement performance."
- Lab tour: *Advanced Asphalt Characterization Laboratory (AACL)—Part I*
  Presenter: Salih Kocak, CHPP Ph.D. Student
  Advisor: M. Emin Kutay, Center faculty
  "The focus was to introduce pavement engineering to the teachers through hands-on activities in the lab. The different steps of building a road from asphalt mix design to paving were presented. The teachers learned about different materials that can be used in an asphalt mix, and how the asphalt mix samples are compacted in the lab for further testing."
- Lab tour: *Advanced Asphalt Characterization Laboratory (AACL)—Part II*
  Presenter: Ugurcan Ozdemir, CHPP M.S. Student
  Advisor: M. Emin Kutay, Center faculty
  "The teachers learned about the center research related to Chip seals. They were also educated about innovative ways of testing the performance of mixes in real time through image analysis."
- Lab tour: *Computational Sensor Laboratory*
  Presenter: Amir Alavi, CHPP Ph.D. Student,
  Advisor: Nizar Lajnef, Center faculty
  "The tour introduced the teachers to a new approach for the continuous health monitoring of asphalt concrete pavements based on the self-powered wireless sensor data. The teachers learned about the piezoelectric effect used in these self-powered sensors and how this linear electromechanical interaction between the mechanical and the electrical state in crystalline materials are useful in detecting the damage progression.

Metro Detroit Youth Day with a Transportation and Pavement Theme—July 15, 2015

The Metro Detroit Youth Day, the largest youth event in the State of Michigan, was formulated to bring together Metro Detroit area youth from all walks of life for a day of sports, fun, and constructive activities. On July 15, 2015, the CHPP showcased not only transportation and pavement-related research but also all aspects of the STEM field (e.g., Science, physics and mathematics). The activities introduced approximately 34,000 children to innovative and inspiring engineering designs and projects through hands-on experiments. These activities included:

- VEX robotics
- VEXIQ robotics
- Bottle rocket launch
- Robotic Fish
- Aluminum foil boat building and testing
- Cardiovascular mechanical systems
- Renewable energy using LEGO Ecolab kits
- Pavement in a box for all ages

Twelve STEM teachers teamed up with the CHPP outreach team during the event. The teachers institutions are:

- Robotics Engineering for Better Life and Sustainable Future Math and Science Center at MSU,
- Cass Tech High School,
- East Lansing McDonald Middle,
- Haslett Middle School,
- Kalamazoo Area Math and Science Center,
- Pershing High School, and
- Regina High School

More photos from the event can be viewed here.

Workforce Development

Summer Research for Undergraduates — July 22, 2015

CHPP offered 10 weeks (May to July) summer research opportunities for high-achieving undergraduates. The intent of this interdisciplinary program is to encourage students from all consortium partners (MSU, UT-Austin, UIUC, NCA&T, and UH) to pursue graduate degrees in Engineering. In addition, the training will provide them with an early chance to become involved in research related to pavement preservation. The students worked full-time on a faculty-guided research project and participated in professional development activities, including attending weekly seminars and completing periodic writing assignments. On July 22, 2015, the students presented posters summarizing their research results. The students had opportunities to engage in engineering research, interact with faculty and other students from across the country, and develop essential skills for success in graduate school.

CHPP Student Research Symposium at Michigan State University—July 22, 2015

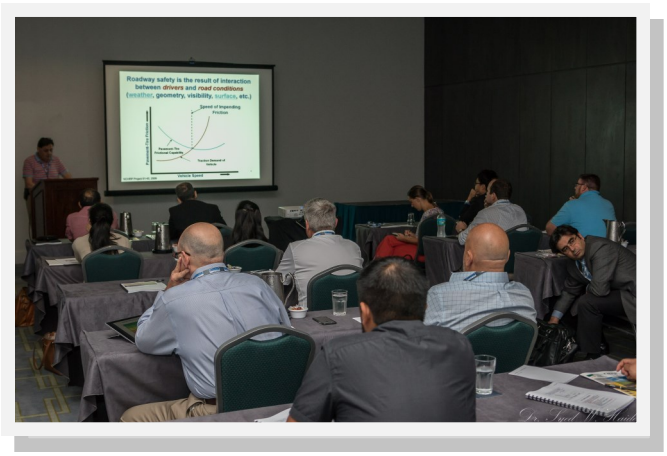
An undergraduate/graduate student symposium was held at Michigan State University on July 22, 2015. The symposium was a full day event. Each student had a poster and a podium presentation for the CHPP related research projects. The symposium is an important activity for the students from the consortium partners to interact and exchange pavement preservation knowledge. The titles of the presentations included:

- "Continuous Health Monitoring of Pavement Systems Using Smart Sensing Technology", **Amir H. Alavi**, Hassene Hasni, Nizar Lajnef, and Karim Chatti, Michigan State University.
- "Pavement Surface Characterization for Optimization of Trade-off between Grip and rolling Resistance", **Shabnam Rajaei**, Karim Chatti, and Roozbeh Dargazany, Michigan State University.
- "Impact of Diamond Grinding on Rigid Pavement Performance", **Ronell Joseph Eisma**, Syed Waqar Haider, Karim Chatti, and Imen Zaabar, Michigan State University.
- "Development of an Acceptance Test for Chip Seal Project", **Ugurcan Ozdemir** and M. Emin Kutay, Michigan State University.
- "Laboratory Performance Characterization and Field Evaluation of Hot In-Place recycled Asphalt Mixtures", **Punit Singhvi**, Hasan Ozer, Imad Al-Qadi, University of Illinois Urbana Champaign.
- "Mechanistic Characterization of Thin Asphalt Overlays for Pavement Preservation using Finite Element Modelling Approach", **Heena Dhasmana**, Hasan Ozer, and Imad L. Al-Qadi, University of Illinois Urbana Champaign.

- "Multi-Functional Concrete Inlays for Pavement Preservation", **Sushobhan Sen**, Daniel King, and Jeffery Roesler, University of Illinois Urbana Champaign.
- "Development of Objective Methods for Determining Damage Accumulation in Pavements Prior to Visual Distress Becoming Apparent", **Katelyn Freeseman** and Lev Khazanovich, University of Minnesota.
- "Laboratory Batching Procedure with a Correction for Fines to Enhance HMA Durability", **Jose Corrales-Azofeifa** and Adrian Ricardo Archilla, University of Hawaii at Manoa.
- "Fractal Modeling of Pavement Surfaces", **Asha Patel**, Shabnam Rajaei, and Roozbeh Dargazany, Michigan State University.
- "Pavement Surface Measurement and Characterization for Optimization of Trade-off between Rolling Resistance and Grip", **Lance Roth**, Shabnam Rajaei, and Roozbeh Dargazany, Michigan State University.
- "Pavement Surface Characterization for Optimization of Trade-Off between Grip and Rolling Resistance: Investigating Friction", **Miguel Labrador**, Shabnam Rajaei, and Roozbeh Dargazany, Michigan State University.
- "Impact of Diamond Grinding on Rigid Pavement Performance", **John M. Gondek**, Syed W. Haider, Imen Zaabar, and Ronell J. Eisma, Michigan State University.
- "Impact of Thin Overlay on Ride Quality and Expected Flexible Pavement Performance", **Haibin Yu**, Syed W. Haider, and Ronell J. Eisma, Michigan State University.
- "Impact of Load Transfer Efficiency on Faulting Performance of Rigid Pavements", **Sebastian Muniz**, Syed W. Haider, and Ronell J. Eisma, Michigan State University.
- "Evaluation of Chip Seal Treatment on Pavements Using Image Processing", **Derek Hibner**, Ugurcan Ozdemir, Sudhir Varma, and M. Emin Kutay, Michigan State University.
- "Developing Smart Sensors for Health Monitoring of Pavement Systems", **Sahira Melo**, Nizar Lajnef, Amir H. Alavi, Hassene Hasni, Michigan State University.

Transportation and Pavement Preservation Seminar at the National Level

A half-day workshop was conducted on June 7, 2015 during the ASCE T&DI conference in Miami, Florida. About forty (40) professionals participated in the event. The workshop provided an overview of recent research and implementation examples on the application of pavement preservation techniques to enhance pavement sustainability.



The workshop covered the following topics:

- Introduction to pavement preservation
- Preservation techniques for asphalt pavements
- Construction and inspection of seal coats in Texas
- Preservation with and for concrete pavements
- Performance-related specifications for pavement preservation treatments
- Life cycle cost analysis and life cycle assessment for pavement preservation

The workshop combined well established best practices as well as some recent research findings. The instructors of the workshop were:

- Imad Al-Qadi, University of Illinois at Urbana-Champaign
- Jorge Prozzi, University of Texas at Austin
- Karim Chatti, Michigan State University
- Jeffery Roesler, University of Illinois at Urbana-Champaign
- Hasan Ozer, University of Illinois at Urbana-Champaign
- John Harvey, University of California, Davis

Upcoming Events

Transportation Safety Seminar

CHPP in collaboration with ITE will invite a guest speaker for a seminar on road safety at Michigan State University on October 2, 2015 entitled "Forgiving Highways" . This seminar focuses on methods to identify and treat dangerous roadside hazards. Mike Dreznes, Executive Vice President of the International Road Federation (IRF) has made presentations on the concept of "Forgiving Highways" in over forty countries around the world. Dreznes uses the presentation to explain the significance of the AASHTO Roadside Design Guide and NCHRP 350/MASH. He emphasizes the need for highway engineers to act responsibly and to understand today's technology in order to use products correctly to make highways safer around the world and to meet the challenge of the United Nations Decade of Action for Road Safety.

CHPP Preview Day

The day will be planned with different activities and sessions for different age groups. Hands-on displays and demonstrations will be aimed at prospective high school students. The event will feature special displays, designed and built to facilitate the communication of basic concepts related to materials, structures, and sensor technology.

MSU Middle and High School Design Day at Michigan State University (Fall)

The focus is to involve students and teachers in hands-on and experiential engineering education. It will introduce participants to innovative, challenging and inspiring engineering designs and projects. The students and teachers will work on projects such as:

- Building a sample of asphalt pavement cross-section using crumb rubber,
- Measure the surface texture depth of the samples using laser scanners, and
- Measure the surface friction of the samples using British Pendulum.

Center for Highway Pavement Preservation

A UTC under the USDOT Theme of State of Good Repair

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UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

MICHIGAN STATE UNIVERSITY

THE UNIVERSITY OF TEXAS AT AUSTIN

North Carolina Agricultural and Technical State University

UNIVERSITY OF MINNESOTA

UNIVERSITY of HAWAI'I MĀNOA

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