Session 1 - Welcome and FHWA Program Updates

RPUG 2013 Speakers Bios and Abstracts

SESSION 1-0: STEVE KARAMIHAS (UMTRI) - MODERATOR

SESSION 1-1: MARIO JORGE (TXDOT SAN ANTONIO DISTRICT ENGINEER) - WELCOME - 1

BIOS
N/A

SESSION 1-1: JAMES TRAVIS (FHWA ASSET MANAGEMENT ENGINEER - WELCOME -2"

BIOS
N/A

SESSION 1-2: CHRIS CHANG (FHWA) - FHWA MAP–21 UPDATE

BIOS

Chris Chang is from the Office of Infrastructure of the FHWA. He has been involved with performance measure rulemaking since October 2012. Prior to joining the Office of Infrastructure, he led in maintaining the pavement management system for the National Park Service at the Eastern Federal Lands Highway Division of the FHWA.

ABSRACT
N/A

SESSION 1-3: ROBERT ROZYCKI (FHWA) - MAP-21-INDUCED CHANGES FOR HPMS PAVEMENT DATA REPORTING

BIOS

Native and current resident of Virginia. Academic background in Civil Engineering and Planning from Villanova University and the University of Virginia, respectively.

Currently serving over 23 years for the FHWA, mostly in the Highway System Performance Monitoring (HPMS) Division of the Office of Highway Policy Information as a Transportation Specialist with primary responsibilities relating to data quality review and data product development and analysis. Corollary duties include a specialized knowledge of HPMS-reported pavement data and coordination with internal and external customers and data providers.

ABSRACT

As a result of recent MAP-21 legislation and associated rule-making, the Highway Performance Monitoring System (HPMS) pavement data item reporting requirements are being modified. A brief overview followed by a detailed description the new HPMS requirements will be given in support of the new FHWA performance monitoring and management effort

SESSION 1-4: ANDY MERGENMEIER (FHWA) - IMPROVING THE QUALITY OF PAVEMENT SURFACE DISTRESS AND TRANSVERSE PROFILE DATA COLLECTION AND ANALYSIS – NEW POOLED FUND STUDY COMING SOON

BIOS

Mr. Mergenmeier is a Senior Pavement and Materials Engineer with the FHWA's Resource Center. His primary responsibilities include materials acceptance and pavement design and construction. He came to this position in 2007 after 7 years as Virginia DOT's State Materials Engineer. At VDOT he was responsible for overseeing the Materials Division which included preliminary engineering and construction functions, such as, pavement design and materials acceptance programs. Before VDOT, Mr. Mergenmeier worked for the FHWA for 15 years in various locations throughout the country.

Mr. Mergenmeier is a Civil Engineering graduate from the University of Kansas, and a Registered Professional Engineer.

ABSRACT N/A

Session 2 - Profile Measurement and Analysis

RPUG 2013 Speakers Bios and Abstracts

SESSION 2-0: ERIC PRIEVE (CODOT) - MODERATOR

SESSION 2-1: CHRIS BACCHI (TRIMAT) - IRI TESTING IN NORTH CAROLINA

BIOS
Mr. Bacchi is the co-founder and vice president of Trimat Materials Testing, Inc. in Raleigh, NC. Trimat is a materials testing and inspection firm that specializes in testing, evaluation, and design of asphalt and concrete pavements. Before starting Trimat, Mr. Bacchi spent 7 years working at the NCDOT as the State Asphalt Design engineer. In his time at the NCDOT and Trimat, Mr. Bacchi has worked on FHWA and NCDOT research projects and has provided consulting on hundreds of roadway projects in the southeast and abroad.

Mr. Bacchi received his BSCE from West Virginia University and his MSCE from North Carolina State University. Mr. Bacchi's current research includes warm mix asphalt, binder modification for RAP mixes and IRI specification implementation on secondary roads.

ABSRACT
In January 2012 the North Carolina Department of Transportation Standard Specifications adopted the use of inertial profiling for ride quality acceptance for specific projects. To be considered for inertial profiling, certain criteria including speed limit, length of project, and number of new asphalt lifts must be met. In addition, all new concrete pavements must be tested. The current specifications require the contractor perform the profile testing and submit the raw ProVAL files to the NCDOT for review and incentive calculations. As of summer 2013, six NCDOT projects have been tested under these new specifications by Trimat Materials Testing performing both Quality Control and Quality Assurance ride quality.
The purpose of this report is to present the NC findings from each of these projects and what has been learned working together with the contractors and the NCDOT. Also discussed are pay adjustments achieved by the contractors and any future changes to the specifications.
Based on the testing performed on the 6 projects, it is possible for the NC contractors to achieve adequate ride quality and meet the current MIRI criteria of 55 to 70 in/mi. It is recommended that where multiple lifts are being placed that the initial lifts also be evaluated for correction prior to final paving. Future

discussions with the NCDOT and Contractors will address the localized roughness specification and how to properly apply, and if it needs to be adjusted.

SESSION 2-2: GARY HIGGINS (EARTH ENGINEERING) - ADDRESSING LOCALIZED ROUGHNESS AT THE PROJECT LEVEL

BIOS

Mr. Higgins obtained a Bachelor of Science degree in Geology from Colorado State University in 1996. Mr. Higgins has worked for private geotechnical and material testing firms for the past 15 years as an engineering geologist.

Prior to 2007, his experience with roadway construction had been isolated below the riding surface and focused on support characteristics of the underlying subgrade soil. Since 2007 and in addition to his geologist duties, Mr. Higgins has been manager and operator of Earth Engineering Consultants, Inc. high speed profiling department. His quest for knowledge and understanding of the physical world paired with his interest in the inertial profiler system lends a scientific approach to the high speed inertial profiler operation.

ABSRACT

How effective have we been at addressing localized roughness at the project level? Recent data provided by the Colorado DOT allows an indication of the success at addressing localized roughness as defined by the state of Colorado and AASHTO R54 specification at the project level.

Localized roughness as defined by AASHTO R54 is used as a guideline for the standard in Colorado for defining roughness which requires corrective action. By compiling data from various 2012 asphalt paving projects and various Colorado certified profiler units we can get a general look into the effectiveness of the Localized Roughness specification as currently defined.

The Colorado data indicates that localized roughness up to a level of approximately 175 HRI is rarely successfully addressed for corrective action and only about half of the localized roughness features between 175 HRI to 200 HRI

are being successfully addressed. While localized roughness features over the 200 HRI level appears to be consistently and effectively addressed for corrective action.

A disconnect between the current Colorado Localized Roughness specification and the actual project level results is apparent. Are there identifiable factors causing this apparent disconnect? Is it possible the current Colorado DOT and AASHTO R54 suggested localized roughness thresholds are set too low? Do Colorado certified inertial profiler operators have the tools to accurately locate roughness features and are they educated in proper grinding strategies/best practices? Are project level engineers and contractors knowledgeable with inertial profiling equipment, software and project results affecting roughness?

This presentation aims to provide insight to the processes and procedures used at the project level to address localized roughness. In addition, show that it is possible to accurately locate and correct localized

SESSION 2-3: MAHESH AGURLA (ENGINEERING & SOFTWARE) - LONG TERM PAVEMENT PERFORMANCE (LTPP) AUTOMATED FAULTING MODEL

BIOS

Mahesh Agurla is currently working as a Data/Research Analyst for Engineering & Software consultants, Inc., an on-site contractor for Long Term Pavement Performance (LTPP) program at Turner-Fairbank Highway Research Center (TFHRC), McLean, VA. He has four plus years of work experience in data analysis and modeling. He has master's degree in civil engineering from the University of North Carolina at Charlotte and worked as a graduate research assistant during his master's program.

ABSRACT

Pavement Performance (LTPP) program profile data collected by the program’s profilers. This study evaluated two existing AASHTO R-36 automated faulting models (AFM): ProVAL (Method A) and Florida Department of Transportation (FDOT) PaveSuite (Method B). Also a new LTPP AFM was developed using LTPP profile data. The LTPP AFM uses an automated algorithm to identify joint locations and to determine faulting in order to replicate the manually collected faulting data using a Georgia Faultmeter (GFM) which has been used on LTPP test sections since the program’s inception.

The study compares the LTPP manual faulting measurements (MFM) collected using the GFM with the ProVAL AFM and LTPP AFM using LTPP profile data. Similarly, the FDOT GFM measurements were compared to the FDOT PaveSuite AFM and the LTPP AFM using the same FDOT profile data.
The initial results for five LTPP test sections show that the LTPP AFM can identify joint locations with a joint detection rate (JDR) ranging from 95% to 100%, whereas, ProVAL's JDR ranged from 58% to 99% for the same five LTPP test sections. Similarly, for the one FDOT test section available, the LTPP AFM’s and FDOT PaveSuite's JDR are around 96%. This presentation will outline the LTPP AFM algorithm, discuss the comparison of the three AFM procedures, and recommend future research needs in this area.

SESSION 2-4: RICHARD WIX (ARRB) - THE NAR NAR GOON VALIDATION SITE

BIOS

Richard joined the ARRB Group (formerly known as the Australian Road Research Board) in 1990 and since then has been involved in automated pavement data measurement, both as an equipment developer and in the collection of pavement condition data.

During this time, Richard has contributed to the development of Australian standards for automated pavement data collection and has had a keen interest in the verification of automated systems used to collect pavement condition data in Australia and overseas. Additionally, he has overseen many large scale automated data collection projects for each of the Australian State Road Authorities and a variety of international projects too, most recently in Malaysia and Vietnam.

He is presently a member of the ARRB's technical advisory group which is responsible for future developments in pavement data collection. Richard is a frequent visitor to the RPUG and once again looks forward to being part of this year's meeting.

ABSRACT

ARRB recently set up a test site for validating laser profilers and other pavement condition monitoring technologies. This presentation will highlight some of the problems that are often associated with site selection and detail the methods used to acquire the necessary ground truth measurements against which the various

devices will be validated. The presentation will also include details of a new tool for validating the transverse profiles from 3-D systems like the LCMS.

Session 3 - 3D Scanning

SESSION 3-0: NEIL MASTIN (NCDOT) - MODERATOR

SESSION 3-1: KELVIN WANG (OSU) - NETWORK LEVEL 3D DATA COLLECTION AT 1MM RESOLUTION AND AT 60MPH

BIOS

N/A

ABSRACT

In the recent years, the pavement community has embraced the 3D laser imaging technology for surface surveys. The OSU and WayLink team has delivered several operational systems based on PaveVision3D Ultra, or 3D Ultra to end users since 2011. The 3D Ultra technology can acquire pavement surface data at true 1mm resolution in all three dimensions at 60MPH data collection speed. The team has developed software solutions to extract usable information from the 3D pavement surface for various pavement engineering purposes. This presentation discusses network level surveys conducted by the team for state DOTs and the capabilities of the software solutions at this stage.

SESSION 3-2: JOHN LAURENT (PAVEMETRICS) - USING 3D TRANSVERSE PROFILES (4000 POINTS) VERSUS MULTIPLE SINGLE POINT LASERS AND HOW THE SPECIFICATIONS AND METHODS COMPARE FOR MEASURING (RUTTING, MACRO-TEXTURE, IRI, TRANSVERSE, AND LONGITUDINAL)

BIOS

N/A

ABSRACT

This presentation will compare the specifications and the measurement methods of 3D transverse profilers (4000 points) versus using multiple single point lasers for measuring rutting, macro-texture, IRI, transverse and longitudinal profiles. It will show the differences, advantages and problems in both methods. The presentation will show that in the past profiling technologies have been developped around single point 3D lasers however today transverse profiling technology has reached the point where the potential to measure both transverse and longitudinal profiles and macrotexture has arrived to the point where tradition and standards based on older technology is now holding back the advancement of current measurement technologies. This presentation will show results comparing both these technologies versus each other for rutting, texture and IRI.

SESSION 3-3: LI NINGYUAN (MTO, CANADA) - VALIDATION OF AUTOMATED PAVEMENT DISTRESS DETECTION, EVALUATION AND REPORTING PROCESSES – CANADIAN EXPERIENCE

BIOS

Dr. Li Ningyuan is currently employed with Ontario Ministry of Transportation as senior pavement management engineer. He has over 30 years of experience in highway engineering and pavement management in the areas of pavement data collection, evaluation, performance modeling and investment planning. Dr. Li has served a few TRB sub-committees over the past 10 years, including Monitoring and Evaluation, Pavement preservation and Maintenance. He is also a board member of Road Profiler User Group.

ABSRACT

Ontario Ministry of Transportation has started to plan for implementing a full scale of automatic high-speed pavement condition data collection, evaluation and reporting processes that support operational management of the provincial pavement network. The data collection system is equipped with Pavemetrics' Laser Crack Measurement System (LCMS) in addition to longitudinal and transverse profilers that measure pavement roughness and wheel path rutting on pre-defined road sections. The data collected in the field can be processed through Fugro Roadware's Vision software that can be customized to meet the Ontario provincial pavement performance evaluation and rating requirements, including International Roughness Index (IRI), Surface Distress Index (SDI) and overall Pavement Condition Index (PCI). To ensure quality of the automated pavement condition assessment, a series of comparative measurements in the field were conducted to verify whether each of the stages has been accurately processed, such as pavement

distress detection, classification, severity rating and density calculating, condition evaluation and reporting.

The core objective of this study is twofold: 1) to examine the precision and accuracy of the automated process of pavement condition evaluation results in comparison with the ground truth data conducted manually in the field, 2) to perform the impact analysis of the fully automated process of pavement condition data collection and evaluation results on the current pavement management operation systems in terms of performance evaluation, pavement maintenance and rehabilitation programming and investment planning.

Some of the significant results and conclusions resulting from the study include: 1) comparability analysis summary of the automated pavement surface distress evaluation versus the traditional manual assessment, 2) extended applications of the automated pavement distress detection, rating and evaluation to performance specifications for pavement rehabilitation and maintenance contracts, 3) validation and calibration of pavement performance indices calculated from the automated data collection system to the ground truth measurements, 4) development of the quality assurance of data collection program and procedure applied to Ontario pavement management system at network level.

SESSION 3-4: PHILLIP HEMPEL (TXDOT) - DEVELOPMENT AND FIELD EVALUATION OF A TEXTURE MEASUREMENT SYSTEM ON CONTINUOUS PROFILES FROM A 3D SCANNING SYSTEM

BIOS

Mr. Todd Copenhaver earned his AOS from Southwest Institute of Technology; Austin Texas. He is currently an automated equipment systems integrator and a large scale multifaceted project coordinator. Todd’s primary areas of expertise are automated equipment design and test, semiconductor test equipment, human interface development, training, and data base development. Todd gained his expertise through twelve years in the semiconductor industry maintaining and managing a High End R&D test floor and two years working on strategic counter measures for Tracor Aerospace.

Since 2002, he has been working for the Texas Department of Transportation. He oversees the development of new technologies used for non-destructive pavement surface analysis, including 3D rutting, 3D texture, and 3D crack detection. He also assists with overseeing the annual Texas roadways Pavement Management Information Systems (PMIS) data collection, in the areas of resource allocation, training, equipment support, data base administration and data integrity. In 2010, he received the “Albert H. Pollard” award for recognition of outstanding contributions made in these areas. Todd recently collaborated on a publication with Robin Huang and Phillip Hempel entitled “3D Transverse Profiling System for High-Speed Rut Measurement,” in which they documented the creation and verification of the accuracy and repeatability of a 3D rut measurement systems. Todd can be contacted at Todd.Copenhaver@txdot.gov, PH: 512-465-3065

ABSRACT

Pavement texture is an important indicator of road serviceability. Pavement texture is directly linked to the pavement and tire skid resistance and traffic safety to the public. Therefore, most transportation agencies across the nation require texture data for their Pavement Management Information System. Current pavement texture measurement methods of using high speed distance sensor or 3D line scan devices experienced limitations on data stability. Problems caused by vehicle vibration, bad data from optical sensors and most importantly, speed dependency related to the sensor sampling time or exposure time make texture result either unreliable or suffering noticeable errors. This paper reports a study to the speed influence on network level texture data collection, and the development of a high speed and high precise 3D texture system. Experiment confirmed that improper selection of a sensor with large exposure time will result in speed dependency on measured texture data. As the system developed in this study adopted a very small exposure time for each sampling, it can produce accurate texture data largely independent from vehicle speed.

Session 4 - Friction

SESSION 4-0: FRICTION MEASUREMENTS (ILDOT) - MODERATOR

SESSION 4-1: SAMER KATICHA (VTECH) - HARMONIZATION OF FRICTION MEASURING DEVICES USING ROBUST REGRESSION METHODS

BIOS

Samer is a senior research associate at the Virginia Tech Transportation Institute. He has over Twelve years of experience in pavement engineering and asphalt materials characterization. In 1999, Samer graduated with a BE in civil engineering from the American University of Beirut and went on to obtain a Master of Science and Ph.D. from Virginia Tech in 2003 and 2007, respectively. His research over the last 5 years has mainly concentrated on pavement structural and functional evaluation, specifically in finding improved methods for pavement evaluation data analysis and interpretation to be used for pavement management decision making.

ABSRACT

In this paper, we present the Measurement Error Models (MEM) regression method to harmonize two skid testing devices. Because measurement error affect both devices, the use of simple linear regression as currently practiced to harmonize friction measuring devices leads to biased estimate of the true model parameters. These estimates are not unique and depend on the choice of how device measurements are assigned to the dependent and independent variable before the regression is performed. Furthermore, the use of the International Friction Index (IFI) method of converting measurements to a reference speed and device introduces errors into the measurements which further increase the bias of the estimated model parameters obtained from simple linear regression. On the other hand, MEM regression results in a practically unbiased (asymptotically unbiased) estimate of the true regression parameters whether the IFI method is used or not. Computational examples are provided for regression models developed between repeated measurements from the same device, computer simulated data from different devices, and measurements obtained from two different skid testing device. The main objective of this paper is to show that simple linear regression is not the best method to use to harmonize friction measuring devices and that MEM should be used instead.

SESSION 4-2: DON HALLIDAY (HALLIDAY) - RT3 FRICTION MEASUREMENT TECHNOLOGY

BIOS
N/A

ABSRACT
N/A

SESSION 4-3: LARRY SCOFIELD (IGGA) - FRICTION TESTING

BIOS
N/A

ABSRACT
N/A

SESSION 4-4: JOHN ANDREWS (MD SHA) - A MODIFIED APPROACH TO FRICTION DATA COLLECTION

BIOS
John graduated from the Johns Hopkins University with a Physics degree and a minor in Electrical Engineering. He spent most of his working life designing, manufacturing, or managing these activities in the fields of instrumentation, automated machinery, and heavy machinery. For semi-retirement, 14 years ago he changed direction again and joined the Maryland State Highway Administration with the responsibility for highway condition data collection. His section has two multi-parameter survey vehicles, two skid testing units, two inertial profilers, an FWD with GPR, and a coring rig to deploy for this purpose.

He has also been a member of several national groups involved in improving data collection and standards writing.

ABSRACT
N/A

Session 6 - RPUG Past, Present and Future

SESSION 6-0: LADONNA ROWDEN (ILDOT) - MODERATOR

SESSION 6-1: RICHARD WIX, STEVE KARAMIHAS (ARRB, UMTRI) - HISTORY OF RPUG

BIOS
N/A

ABSTRACT
N/A

SESSION 6-2: RUDY BLANCO (PATHWAY), DAVE HUFT (SDDOT), KEVIN MCGHEE (VDOT) AND BOB ORTHMEYER (FHWA) () - A VISION FOR THE NEXT 25 YEARS OF RPUG

BIOS
N/A

ABSTRACT
N/A

SESSION 6-3: EDGAR DE LEÓN IZEPPI (VTECH) - PROFILER CERTIFICATION PROCESS AT THE VIRGINIA SMART ROAD

BIOS
Edgar de León Izeppi: Dr. de León has worked in the areas of pavement management and transportation engineering for over 20 years. He is currently a Senior Research Associate at the Center for Sustainable Transportation Infrastructure at VTTI working for the Pavement Surfaces Consortium and other multidisciplinary research projects that address end-result and performance oriented specifications for hot-mix asphalt (HMA). He completed doctoral research using non-contact methods to identify non-uniformities in HMA. He has performed extensive data collection for pavement structural and functional

performance, as well as pavement life cycle cost analysis, pavement design and geometric design. He is a member of the Management of Quality Assurance (AFH20) TRB Committee since 2009.

ABSTRACT

Road roughness is considered to be one of the most important indicators of the performance of the pavements and is also a major determinant of road user costs. Most longitudinal road profile measurements are summarized using the International Roughness Index (IRI) which was developed by the National Cooperative Highway Research Program (NCHRP) and the World Bank. A laser-based inertial profiler is the most common instrument used to measure longitudinal profiles at highway speeds. These profiles are then used to compute the IRI at project and network levels.

The primary objective of this presentation is to report the process that has been followed to develop a certification site for verification of inertial profilers on the Virginia Smart Road. This effort has been part of the Annual Rodeo equipment comparison made by the Pavement Surface Properties Consortium since 2006. This consortium is a joint effort between the FHWA and six states (Connecticut, Georgia, Mississippi, Pennsylvania, South Carolina, and Virginia).

In May 2013, eight different profilers were used to obtain profile measurements to compare them to the reference measurements made with two ICC SURPRO devices, using the AASHTO R56–10 Standard for Certification of Inertial Profiling Systems. Based on the general requirements set forth by the specifications, five test sections were chosen. Profiles from all inertial profilers are compared to both reference profile measurements. Good agreement was found between the reference devices and each of the profilers IRI for most of the test sections. Grade, grooves, grinding, and other conditions affected different equipment with different capabilities resulting in mixed values of cross-correlations for reproducibility with the reference profiles. Some alternatives to improve the process in the standard based on the results are suggested.

SESSION 6-4: PAUL TOOM (CHERRY SYSTEMS) - DEVELOPMENT OF A NEW LASER REFERENCE PROFILER AND TESTING AT MNROAD 2013

BIOS

Paul is professional electrical engineer registered in British Columbia Canada. He received his engineering degree from the University of British Columbia in

Vancouver in 1975 and his MBA from Queen's University in Kingston Ontario in 2001. His broad ranging career interests have included analog and digital electronic design, software, road testing instrument design and utility power system design. He has worked for power utilities, for Olympic organizing committees and for his own company, Cherry Systems, based in Vancouver BC. Paul was the Energy Director for the Vancouver 2010 Olympics, and unlike Super Bowl 2013, made sure there were no power outages at any of the venues over the 17 days of competition and ceremonies.

He has developed surface profiling instruments since the late 80's and holds several US and Canadian patents in the associated technologies. Paul works closely with ICC in the development of reference profiling products, most notably the SurPRO. He likes to develop and prove the concepts and then hand over the product to ICC's expert manufacturing team to implement as a final professional product.

ABSTRACT

This presentation details the development and testing of a new reference profiler. A laser is used in combination with accelerometers to produce a profiling instrument that is capable of measuring from the FHWA-mandated short waveband limit of 76 mm (3 inches) to infinity. It provides repeatability and accuracy cross-correlations of around 94% in short waveband and above 99% in all other wavebands.

The new measurement method and apparatus will be presented. The performance results will be compared with design goals to determine the success of the new profiler development. The new profiler will be compared with a reference profiler employing only accelerometers. Power spectral density will confirm the extended frequency response. The ability of the new profiler to resolve discrete short wavelength features such as small bumps and dips will be graphically presented. The use of an optical target sensor on a reference profiler to provide very high accuracy DMI measurements to support short wavelength measurement capability will also be discussed.

Test results of the new laser reference profiler on six different pavement types at MnRoad on 14-15 May 2013 will be presented. Issues associated with profiling longitudinally ground and tined pavements will be discussed. This test period had record high temperatures which provided a unique opportunity to collect high resolution profiles on curling concrete slab pavements. The challenges of achieving IRI goals and comparative testing of profilers in these conditions will be reviewed. The issues of pavements changing during profile data collection and the

operating speed required to achieve reference grade results will also be covered. Finally, further enhancements will also be discussed in the context of price and performance.

Conclusions will cover the overall development of the new laser reference profiler, theoretical performance results, MnRoad testing performance results, and the challenges of testing profilers against reference devices on concrete pavements while temperature is rapidly changing.

Session 7 - Profile Certification - I

SESSION 7-0: KEVIN MCGHEE (VDOT) - MODERATOR

SESSION 7-1: EMMANUEL FERNANDO (TTI) - NEW TXDOT PROFILER CERTIFICATION TRACKS

BIOS

Emmanuel Fernando is a registered Professional Engineer in the State of Texas. Over the years, he has actively worked with TxDOT engineers in developing and implementing smoothness specifications based on inertial profile measurements. In support of TxDOT's long-term efforts to implement profile-based smoothness specifications, Emmanuel established a facility at Texas A&M's Riverside campus for evaluating surface profilers, and oversees the operation of the equipment and inertial profiler operator certifications within the Texas A&M Transportation Institute. He is actively involved in research efforts related to developing construction and pavement management applications of inertial profiler data, smoothness specifications, and test protocols.

ABSTRACT

N/A

SESSION 7-2: ABEDNOUR NAZEF (FDOT) - HIGH-SPEED INERTIAL PROFILER PRECISION ON ASPHALT PAVEMENTS

BIOS

N/A

ABSTRACT

The Florida Department of Transportation conducted a field study to assess the precision and accuracy of its High-Speed Inertial Profilers (HSIPs) used for evaluating the smoothness of asphalt pavements. Eight HSIPs all using single point laser height sensors and six asphalt test sections including three dense-graded and three open-graded were included in the study. Profiler agreement in terms of repeatability and reproducibility was rated using the International Roughness Index (IRI). Profiler agreement in terms of repeatability, reproducibility, and accuracy was also assessed using the profile cross-correlation method. A SurPro 3500 was used as a reference device to evaluate the HSIPs accuracy. The results show the

HSIP repeatability expressed as the maximum variability in IRI a 95% confidence level within a single HSIP unit was less than 3.5 inch/mile for open-graded and , and 2.0 inch/mile for dense-graded pavements. The maximum IRI variability at a 95% confidence level between any two HSIPs, representing reproducibility, was less than 5.8 inch/mile for open- graded and 3.8 inch/mile for dense-graded pavements. The HSIPs repeated and reproduced each other's IRI measurements well for all test sections and surfaces. The HSIPs achieved the highest profile repeatability, reproducibility, and accuracy on the dense-graded medium-smooth surface with an average IRI cross-correlation of 95%, and the lowest results on the open-graded medium-smooth surface with an average IRI cross correlation of 64%. The maximum IRI cross-correlation between any HSIP unit and SurPro was 88% on the dense graded medium smooth section, while the lowest was 64% on the open-graded medium smooth section.

SESSION 7-3: SAMER KATICHA (VTECH) - USE OF PROBE VEHICLES TO MEASURE ROAD RIDE QUALITY

BIOS

Samer is a senior research associate at the Virginia Tech Transportation Institute. He has over Twelve years of experience in pavement engineering and asphalt materials characterization. In 1999, Samer graduated with a BE in civil engineering from the American University of Beirut and went on to obtain a Master of Science and Ph.D. from Virginia Tech in 2003 and 2007, respectively. His research over the last 5 years has mainly concentrated on pavement structural and functional evaluation, specifically in finding improved methods for pavement evaluation data analysis and interpretation to be used for pavement management decision making.

ABSTRACT

In this paper, we compare roadway roughness measured using a probe vehicle to roadway roughness calculated from the measured profile using an inertial profiler. Roughness is characterized as vehicle body vertical acceleration and mean international roughness index (MIRI), which approximates the international roughness index (IRI) of a full car (rather than a quarter car). The reason the MIRI is used rather than the IRI is that acceleration measurements obtained from a probe represent the response of the full car rather than a quarter car. An important aspect of this paper is that the same physical quantities are compared rather than obtaining a correlation between two different physical quantities. The results suggest that roughness calculated from probe vehicle measurements is comparable to roughness calculated from the measured profile however; the investigation also revealed that

data sampling frequency and quarter car parameters, specifically suspension damping and tire stiffness, can have a significant effect on the measured MIRI.

Session 8 - Profile Certification - II

SESSION 8-0: JOHN ANDREWS (MD SHA) - MODERATOR

SESSION 8-1: STEVE KARAMIHAS (UMTRI) - IMPLEMENTATION OF CROSS CORRELATION FOR PROFILER ACCURACY AND REPEATABILITY TESTING

BIOS
N/A

ABSTRACT
N/A

SESSION 8-2: DAVE HUFT (SDDOT) - SURVEY OF PROFILER CERTIFICATION METHODS

BIOS

Dave Huft is the Research Program Manager and Intelligent Transportation Systems Coordinator for the South Dakota Department of Transportation (SDDOT). SDDOT's Office of Research addresses a broad range of research topics in transportation design, construction, operations, maintenance, planning, administration, and market research. Dave has been active in national research activities and is a past chair of the American Association of State Highway & Transportation Officials (AASHTO) Research Advisory Committee. He is currently a member of the AASHTO Standing Committee on Research and the AASHTO Technology Implementation Group, and was co-chair of the International Scan on Research Program Management. Dave is a recipient of AASHTO's President's Award for Research and Alfred E. Johnson Award for Outstanding Achievement as well as the Transportation Research Board's W.N. Carey, Jr. Distinguished Service Award. He was named to the South Dakota Transportation Hall of Honor in 2009.

ABSTRACT
N/A

SESSION 8-3: BOB BRIGGS (DYNATEST), BOB OLENOSKI (ICC), DAREL MESHER (EBA), PETER VACURA (CALTRANS), MARK SWANLUND (FHWA) AND EMMANUEL FERNANDO (TTI) () - PANEL DISCUSSION ON REGIONAL/NATIONAL PROFILER CERTIFICATION

BIOS
N/A

ABSTRACT
N/A

Session 9 - Asset Management

SESSION 9-0: JAMES WATKINS (MSDOT) - MODERATOR

SESSION 9-1: DAMION ORSI (FUGRO) - GETTING THE BEST RIGHT-OF-WAY IMAGE

BIOS

Damion Orsi is a Professional Engineer and Project Management Professional from Toronto, Canada who has worked on product development for over 10 years. He is currently working as Fugro Roadware's Product Manager helping to develop the next generation ARAN automated collection vehicles as well as Vision and iVision processing/viewing software. Damion has extensive knowledge in Global and North American standards being a member of several organizations and committees. He has worked on many North American projects and has specific expertise in automated laser and camera based detection systems.

ABSTRACT

Right-of-way (ROW) cameras are an important component of any mobile mapping solution, for the qualitative assessment of road conditions and the quantitative measurement of ancillary, local scene geometry, including, but not restricted to, communication devices, lane widths, tunnel heights, sidewalks and shoulders. A calibrated camera is, in effect, a low-power, low-cost, passive angle-finder, which, when supplied correlated image points across subsequent frames, can extract positions and dimensions to a high degree of accuracy. Our ARAN developers focus on the challenges of developing a right-of-way solution that maximizes the utility of the qualitative assessment, by producing pleasing (high-quality) images, and the precision of the quantitative assessment, by the accurate metrology of scene assets.

The choice of camera requires balancing the engineering trade-offs between dynamic range, spatial resolution, optical quality, synchronization, frame-rate, image bandwidth, and compression. Mechanisms for achieving high dynamic range are critical as the illumination of a typical outdoor environment can vary greatly by geography, season and the time of day. A saturated sensor captures nothing of interest, and a noisy sensor is ineffective for quantitative analysis. Key factors influencing dynamic range performance include sensor technology (CMOS vs. CCD), optics (polarization, filtering) and compensation mechanisms such as auto-exposure, auto-gain, auto-iris and auto-white balance.

Camera resolution is frequently quoted as a fundamental metric and is assumed to be defined by the pixel count of the imager. In reality, the spatial resolution of a camera is a function of not just the pixel count, but also the pixel pitch, sensor configuration (3CCD vs. Bayer) and the optical quality of the lens (field of view and point spread effects). Frame-rate, triggering, image compression and storage mechanisms are important considerations to ensure that image capture happens at an adequate interval (frame-rate), is geo-tagged precisely (synchronization), meets the storage requirements of the platform (bandwidth) and preserves the features of interest (compression).

By expressing the benefits and drawbacks of major design decisions, we encapsulate Fugro Roadware's extensive experience in deploying camera technologies over the years, and why Fugro, given the present availability of camera technology, has settled on high-performance 3CCD video cameras as the overall best-in-class solution for right-of-way (ROW) cameras and asset extraction.

SESSION 9-2: RAYMOND MANDLI (MANDLI) - INTEGRATING LIDAR INTO PAVEMENT MANAGEMENT SYSTEMS

BIOS
N/A

ABSTRACT
The continuing development of three-dimensional technology in the pavement analysis industry has enhanced the capabilities of pavement management systems. As mobile collection systems continue to adopt 3D sensors the resulting opportunities for attribute extraction and dataset integration will increase.

Recent 3D developments have included the ability to collect range data when gathering pavement information, an important step in the transition to fully automated distress analysis. In the past, with two-dimensional imaging, any black areas of a pavement photo would be equated to a crack in the automated distress software, creating false positives. Range information prevents the identification of these false positives and provides a more accurate view of the distress information.

Other three-dimensional data collection technologies, such as LiDAR, can be utilized to create a more complete picture of the pavement and surrounding environment. The point cloud created from collected LiDAR data is capable of

displaying road and shoulder geometric information such as curve and grade, and allows for easy identification of pavement striping and markings. It also allows for the precise calculation of pavement width and surface areas, providing a measure of the material that is in the field.

Combining the collected LiDAR data with 3D pavement data, such as distress range information, produces a detailed dataset that provides a thorough view of the pavement along with the effect of the environment on the roadway. This combined dataset will only become more valuable as these technologies continue to increase in accuracy and popularity.

SESSION 9-3: FENG HONG (TXDOT) - USE GROUND PENETRATING RADAR TECHNOLOGY TO EVALUATE RUTTING IN AN ASPHALT OVERLAY

BIOS

Feng Hong earned his Ph.D. degree from the University of Texas in 2007. He has been working at Texas Department of Transportation since then. He has over 13 years of professional and research experience in pavement engineering. His work mainly includes pavement testing and evaluation, analysis and design, application of statistic modeling in transportation infrastructure problems. Before coming to the United States, Feng Hong received his B.S. and M.S. degrees in transportation engineering from Southeast University, China.

ABSTRACT

Rutting poses potential hazard to vehicles running on a pavement due to hydroplaning during wet weather conditions. To mitigate or remedy rutting on a pavement, it is of critical importance to identify the causes and sources of the permanent deformation. Traditional method relies on a trench to approach to this issue. Despite its accuracy, it is labor-intensive and inefficient, not mentioning the destructive characteristic. To improve on these, this study discusses the feasibility of potential use of a non-destructive technology with Ground Penetrating Radar (GPR) to estimate the permanent deformation in an asphalt overlay on top of an existing concrete pavement. A GPR antenna mounted on a moving vehicle can detect pavement layer thickness at a fast speed. It also provides a full coverage on the pavement along the driving direction. The permanent deformation is estimated by comparing the layer thickness between the right wheel path and in the lane center. In particular, the results can reveal permanent deformation involving the following three critical aspects: 1) in which layers the permanent deformation

occurred; 2) where is the permanent deformation located along the driving direction; and 3) how significant the permanent deformation is.

SESSION 9-4: AMY SIMPSON (AMEC) - RUTTING AS A PERFORMANCE INDICATOR

BIOS
N/A

ABSTRACT
The most recent transportation bill, commonly referred to as MAP-21, has created the requirement for using a performance-based approach to managing our nation's transportation assets. Prior to the passage of this important legislation, the FHWA initiated a study "Improving FHWA's Ability to Assess Infrastructure Health." One objective of this study was to define a consistent and reliable method of assessing infrastructure health with a focus on bridges and pavements on the Interstate Highway System. A variety of indices were identified for this purpose based on the data collected for the Highway Performance Management System (HPMS).

A pilot study was conducted to review the various indices as well as to identify the potential impact of different data sources. The pilot study consisted of the portion of Interstate 90 through the States of South Dakota, Minnesota, and Wisconsin. Data collected along the corridor included pavement management data provided by the States, data from the Highway Performance Management System (HPMS), and data collected specifically for the study. The rutting data collected for the study showed a bias between the various data sets.

In follow-on work to the study, an effort was made to identify the cause of the bias and to develop the necessary standards for collection of rutting data. Work performed during the study included review of the data collection, data processing, quality control, data storage, and condition rating using these data. A field validation exercise was performed to review the condition rating portion of the recommendations.

The presentation will concentrate on the portion of this work associated with rutting and its use as a condition indicator.

Session 10 - General Surface Characteristics

SESSION 10-0: BOB ORTHMEYER (FHWA) - MODERATOR

SESSION 10-1: BOB BABCOCK (HYUNDAI/KIA) - THE EFFECT OF ROAD SURFACE PROPERTIES ON VEHICLE COAST DOWN TESTING

BIOS

For nearly the last 20 years, I have been employed for the at Hyundai-Kia America Technical Center, with my current position being the Director of Certification and Compliance Affairs. I am responsible for all communications with federal and state government agencies related to certification and compliance issues related to both emissions and safety matters. I have a total of over 35 years of automotive experience, including past employment with the US Environmental Protection Agency.

ABSTRACT

N/A

SESSION 10-2: STEVE KARAMIHAS (UMTRI) - AN UPDATE OF THE BENCHMARK PROFILER EXPERIMENT

BIOS

N/A

ABSTRACT

N/A

SESSION 10-3: RICHARD SOHANEY (TRANSTEC) - DEPENDENCY OF COEFFICIENT OF ROLLING RESISTANCE ON PAVEMENT SURFACE CHARACTERISTICS

RPUG 2013 Speakers Bios and Abstracts

BIOS

Rich is a project manager at The Transtec Group in Austin, TX. In this role he prepares project quotations, plans testing, conducts field tests, performs data analyses, and writes reports. His main focus is with conducting pavement texture measurements, tire-pavement noise, and other pavement surface characteristics. Rich is also involved with development of Transtec's measurement and data acquisition systems.

Dr. Bernard Izevbekhai, a registered professional engineer in the State of Minnesota possesses more than 20 years of materials engineering expertise gathered in the private and public sector, nationally and internationally. Currently as the research operations engineer for concrete research, geotechnical research and pavement surface characteristics studies in MnDOT, he initiates, conducts and manages numerous research projects most of which involve sustainable objectives.

ABSTRACT

In the fall of 2011, coefficient of rolling resistance (CRR) measurements were conducted on the test cells at the MnROAD research facility. The CRR data from that effort are combined with pavement surface characteristics for the same MnROAD test cells into a single database. In addition to the usual surface characteristic metrics such as macrotexture depth (MPD) and roughness (IRI), the database contains a wealth of other metrics including texture in longitudinal and transverse directions, statistical texture quantities (rms, skew), texture level in third-octave wavelength bands, and roughness level in third-octave wavelength bands. The database is used to perform multivariable linear regression analyses to investigate which pavement surface characteristics contribute to CRR and are candidates as variables for use in a predictive model. This presentation describes the CRR measurement method and equipment, the various surface characteristic metrics in the database, and results of the multiple linear regression analyses. Regression results include how many surface variables and which combinations yield best linear models for CRR and the associated coefficients of determination (r-squared values).

SESSION 10-4: ROHAN PERERA (SME) - COMPARISON OF MPD VALUES OBTAINED FROM HIGH SPEED LASER MEASUREMENTS WITH VALUES OBTAINED FROM TWO STATIONARY DEVICES

BIOS

Rohan Perera is a Senior Project Engineer at Soil and Materials Engineers, and has over 20 years of experience in working with profile data. He has provided technical support to the Federal Highway Administration in implementing AASHTO standards related to pavement smoothness. He has also been providing technical assistance to the LTPP program in the area of road profiling for over 15 years.

ABSTRACT

The Federal Highway Administration (FHWA) recently took delivery of four Ames Engineering profile/texture units to collect data for the Long-Term Pavement Performance (LTPP) program. Each profile/texture unit is equipped with three profile sensors to collect data along the two wheelpaths and the middle of the lane, and two texture lasers to collect macrotexture data along the two wheelpaths. The macrotexture data are collected using 62.5 kHz LMI-Selcom Optocators, and mean profile depth (MPD) values are computed from this data according to the procedure described in ASTM Standard E1845. The devices have the ability to collect macrotexture data at 0.5 mm intervals at highway speeds. The MPD values computed from the data collected by the four LTPP profilers, the Circular Texture (CT) Meter and Ames Engineering Texture Scanner on two dense graded asphalt concrete pavements, a chip seal pavement and a transversely tined concrete pavement are presented. Both the CT Meter and Ames Engineering Texture Scanner are stationary devices. Procedures that have been adopted to perform quality control checks on the texture lasers to ensure the quality of the collected data are described in the presentation. Issues that are encountered when computing the MPD that are not addressed in the ASTM E1845 standard are described. These include addressing single spikes in the data and detection of outliers.

SESSION 10-5: BOB ORTHMEYER (FHWA) - POOLED FUND STUDY TPF-5(063) AND FHWA SURFACE CHARACTERISTICS PROGRAM UPDATE

BIOS

Experience:
- Began working in field in 1978
- Nine years with North Dakota State Highway Department
- Consultant in the private sector for 14 years
- Joined FHWA in 2001

Education:
- B.S.C.E., North Dakota State University
- Licenses and Registrations:
- P.E., North Dakota
- P.E., Minnesota

Areas of Expertise:
- Construction, Pavements, Pavement management, Asset management

Examples of recent projects done in support of the Division Offices
- Established and administering a $1.9 million pooled fund study, "Improving the Quality of Pavement Profile Measurement," with support from 21 State agencies, the Office of Pavement Technology, Federal Lands and Division offices that will assist in building smooth roads; the study will provide a definition for a reference profile, build a reference profile device, supply a localized roughness module for ProVAL, and assist with strategies for verification sites.

ABSTRACT

N/A

Session 11 – Ride Measurements

SESSION 11-0: GEORGE CHANG (TRANSTEC) - MODERATOR

SESSION 11-1: JOHN FERRIS (VTECH) - INSTANTANEOUS IRI

BIOS

John B. Ferris is an Associate Professor in the Mechanical Engineering Department at Virginia Tech, where he directs the Vehicle Terrain Performance Laboratory. Dr. Ferris conducted research in vehicle dynamics and chassis development in the automotive industry for 15 years before becoming a faculty member at Virginia Tech in 2005. His research expertise is in system dynamics and vibration, vehicle dynamics, design for reliability, stochastic modeling, physical system modeling, terrain characterization, and virtual proving grounds development.

ABSTRACT

For many years the standard measure for road roughness has been the International Roughness Index (IRI). It is simple, based on historical engineering methods, and provides a suitable measure of the suspension travel of a passenger car. Currently, the use of the IRI is limited to average roughness estimates over some stretch of road. More localized estimates of roughness are not possible since there is an inherent delay between the excitation from the road and the dynamic response of the vehicle due to that excitation. Since the IRI is not a Linear Time-Invariant function of suspension travel, tools such as superposition cannot aid in developing an instantaneous IRI.

In this work the instantaneous IRI is developed in two steps. First, the contribution to the IRI from each suspension response is calculated. This response happens as a result of the previous road excitations. The second step, therefore, is to calculate the contribution of each of these previous excitations to this single suspension response. In this way the mapping form the excitation to the suspension response to the IRI is established. One constraint in the development of the instantaneous IRI is that the average of the instantaneous IRIs converges to the IRI for the entire length of road. If the instantaneous IRI at every horizontal location were, say, 5m/km, then the IRI for a long stretch of this road must be 5 m/km. A simple form of the instantaneous IRI is possible when a consistent velocity is used throughout a complete run, but a more complex form can be used when varying velocities are necessary. This development of an Instantaneous IRI (IIRI) allows much finer

detail in defining the localized roughness, aiding in the development of smoother roads and better riding vehicles.

SESSION 11-2: STEVE KARAMIHAS (UMTRI) - PROFILE MEASUREMENT ERRORS DUE TO HORIZONTAL ACCELERATION

BIOS

N/A

ABSTRACT

N/A