PacTrans

PacTrans at 2015 TRB Annual Meeting

University Transportation Center Newsletter

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IN THIS ISSUE

ABOUT US

The Pacific Northwest Transportation Consortium (PacTrans) is the Region 10 University Transportation Center (UTC). PacTrans is a coalition of transportation professionals and educators from Oregon State University (OSU), the University of Alaska, Fairbanks (UAF), University of Idaho (UI), University of Washington (UW), and Washington State University (WSU). With a focus on transportation safety, PacTrans serves as an engine and showcase for transportation research, education, and workforce development in the Pacific Northwest.

PacTrans joined over 12,000 people for the world's largest gathering of transportation professionals at the Transportation Research Board (TRB) 94th Annual Meeting. Held from January 11 – 15, the conference met at the Walter E. Washington Convention Center in Washington, D.C and included more than 5000 presentations and 750 sessions and workshops.

With researchers, practitioners, and representatives of government, industry, and academia present from around the world, the 2015 TRB annual meeting represents an important opportunity to demonstrate PacTrans' research and educate upcoming transportation professionals. PacTrans researchers from the five consortium universities (Oregon State University, University of Alaska, Fairbanks, University of Idaho, University of Washington, and Washington State University) presented more than 100 academic papers and talks. Many of these talks reported on research from projects funded in the 2012 – 2013 and 2013 – 2014 academic years.

To foster student learning and transportation leadership development, PacTrans provides travel funds to support student attendance at the TRB annual meeting. Many students received travel support packages to attend the conference to present papers, attend workshops and sessions, and interact with transportation professionals.

"At TRB, you can learn what is going on, what is going to happen, and long-term goals; it includes, very broadly, everything within transportation," said Dr. Yinhai Wang, PacTrans director. "I support students going to TRB because

(Shown from left) Tami Noble, Ahmed Abdel-Rahim, Kristian Henrickson, Yinhai Wang, and Maria Bayya.

Kristian Henrickson Named PacTrans Student of the Year

University of Washington PhD student Kristian Henrickson was honored with the PacTrans Student of the Year award during the Annual Council of University Transportation Centers (CUTC) Awards Banquet.

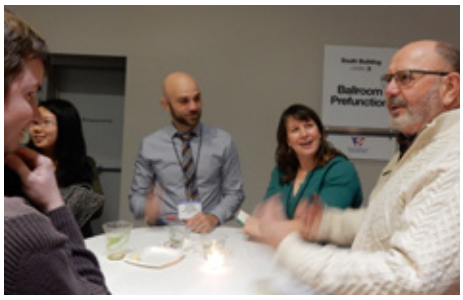
Each year at the TRB annual meeting, the US DOT honors the most outstanding student from each participating University Transportation Center for his or her achievements and promise for future contributions to the transportation field. Students of the Year are selected based on the accomplishments in such areas as technical merit and research, academic performance, professionalism, and leadership.

Kristian Henrickson (center) receives the Student of the Year award with Shashi Nambisan, CUTC President (left), and Greg Winfree, assistant secretary, OST-R (right).

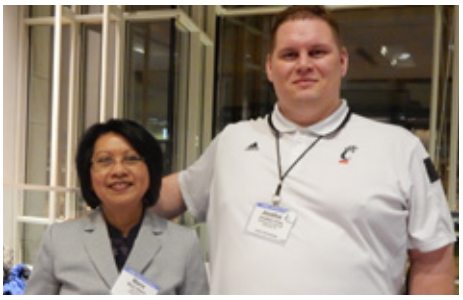
Region 10 Reception Brings Transportation Professionals Together

On January 12, TRB annual meeting attendees gathered at the Region 10 reception, hosted by PacTrans in partnership with the Center for Environmentally Sustainable Transportation in Cold Climates and the National Institute for Advanced Transportation Technology. The new conference location, the Walter E. Washington Convention Center, provided an excellent reception venue for professionals, researchers, students, and public officials to meet and interact.

At the reception, the Michael Kyte Region 10 Outstanding Student Award was given to Jennifer Warner, Oregon State University MS student. Established in honor of University of Idaho Professor of Civil Engineering Michael Kyte, the award recognizes outstanding research, scholarship and professional leadership in transportation studies.



Ken Casavant (right) and Kim Willoughby share a laugh



Maria Bayya, PacTrans associate director, poses with Michael Corey.

Erika Miller, UW graduate student, and Kate Bradbury

2014 Michael Kyte Outstanding Student of the Year Award

Jennifer Warner, second year MS student at Oregon State University, was presented with the 2014 Michael Kyte Outstanding Student of the Year award at the PacTrans Reception during the 94th Transportation Research Board annual meeting. A photo capturing the award presentation includes members of the PacTrans universities from left to right: Maria Bayya (UW), Ahmed Abdel-Rahim (UI), David Hurwitz (OSU), Jennifer Warner (OSU), Billy Connor (UAF), and Yinhai Wang (UW).

Each year, Federal Region 10 UTCs give out the Michael Kyte Outstanding Student of the Year Award to awardees based on accomplishments in three areas: technical merit and research, academic performance, and professionalism and leadership.

"Jennifer Warner has worked tirelessly to achieve excellence in her professional endeavors, and I could not be more proud to count her as a member of the transportation engineering graduate program at Oregon State University," said Dr. David Hurwitz, Jennifer's adviser.

OSU Student Awarded Best Oral Presentation

Oregon State University graduate student Dylan Anderson received the Best Oral Presentation award at the 2015 Transportation Research Showcase as part of the Dwight David Eisenhower Transportation Fellowship Program. Dylan received the award for his presentation, "Platform Edge Detection and Protection Effects on Platform-Train Interface Safety."

TRB STUDENT SPOTLIGHT

The TRB annual meeting offers one of the leading educational and professional opportunities in the transportation field, and PacTrans was proud to provide travel support to many students. Students were invited to share about their TRB experiences with us.

> *"Dr. Hauer... led an interesting discussion on regression modeling to a standing-room-only audience."*

John Ash

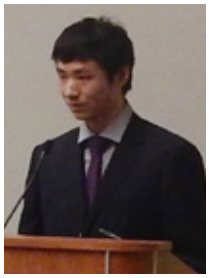
This year marked my third visit to TRB, but my first as a student at the University of Washington. Overall, it was a great experience at which I learned a lot, saw some old friends, and met several new ones. For most of the conference, I attended workshops and lectern sessions on topics aligning with my research interests, namely traffic safety and connected vehicles. Perhaps my favorite session was a brief lecture and discussion given by Dr. Ezra Hauer, arguably one of the most influential people in the field of traffic safety. Dr. Hauer, who is currently over the age of 80, led an interesting discussion on regression modeling to a standing-room-only audience. Additionally, I particularly enjoyed a session on new and innovative research on traffic signals. Finally, I was happy to be able to attend a session in which a paper I helped write about safety treatments for at-grade trail crossings was presented.

Besides all of the sessions at the conference itself, it was also quite fun to attend some of the receptions to talk with other students, professors, researchers, and practitioners in the field. I attended a reception hosted by my former university (the University of Wisconsin), as well as the PacTrans reception, and a reception for young professionals within industry or academia. It was great to catch up with people from Wisconsin, socialize with others from the Northwest, and meet some new people in a similar situation to me at the young professionals reception. Similar to past experiences, this year's TRB was an excellent learning opportunity. I am very grateful to have gotten the chance to attend and am already looking forward to next year's conference!

TRB STUDENT SPOTLIGHT

Wenbo Zhu

Going to the TRB Annual Meeting 2015 was really a great experience for me. During the four days, I went to different lecture and poster sessions and learned a lot about the most cutting edge research. I also learned that what we are doing at UW, including traffic platform, pedestrian sensing and big data, is actually the most promising research areas. The PacTrans reception on Monday provided a good opportunity for me to communicate with transportation professionals. In all, thanks a lot to PacTrans for funding me this travel to TRB and preparing such a wonderful reception, it helped me a lot in developing myself as a young professional.



Ruimin Ke

This is my first time attending the Transportation Research Board Annual Meeting. Thanks for the support from PacTrans. This is a great opportunity for me to learn more about what is going on in the most advanced transportation research fields.

At the meeting, I attended some lecture sessions, poster sessions, and company exhibitions. I think the transportation world is changing quickly. The hottest topics nowadays are connected vehicles, autonomous vehicles, and big data. In my opinion, many institutions and research groups are trying to explore in these fields but the technology as well as research methods is far from mature, which also shows the big opportunities in the near future.

I gave a lecture titled "Roadway surveillance video camera calibration using standard moving objects" about extracting information from images. In the session I presented, an interesting thing I noticed was that two out of four speakers talked about images taken from unmanned aerial vehicles (UAV), which probably pointed to a direction of transportation applications of image processing technology.

Peng Chen

This is my first time participating in the TRB conference. I presented my research "Estimating Land Use and Road Environment Effects on Cyclist Injury Severity" in the poster session. I was lucky to be supported by UW Department of Civil & Environmental Engineering and PacTrans for such a great event. I spent most of my time in auditing the seminars, symposiums and viewing the posters. I made a lot of friends and knew people from the other universities sharing similar research interests. I did also attend some receptions to talk to professors I admired for a long time. It was a very exciting experience. I have some suggestions for students who plan to participate in the next year. You are more likely to make a presentation if your study is theoretical or methodological, and show a poster if it is empirical. Be cautious about the size you can make for your poster, and please control the time of your presentation. Definitely I will prepare a new study to participate TRB in the next year.

Benjamin Wright

I had an amazing experience attending the Transportation Research Board Annual Meeting in Washington D.C. with the support of PacTrans. As an undergraduate student, this was my first time travelling to a research conference. With over 10,000 transportation researchers and professionals in attendance, it was easy to feel overwhelmed at first by the long list of sessions available, but I made the most of it by carefully planning my schedule. TRB was an excellent opportunity to present my research work: The Impact of Incidents on the Reliability of Freeway Travel Times. I had many interesting discussions with those that visited my poster to ask questions and give feedback on my research work. The conference allowed me to sharpen my presentation and networking skills and learn from professionals and researchers from all over the world. I also attended several lecture and poster sessions on topics including travel time reliability, transportation economics, and light rail implementation. I am eager to return to this conference in the future and take further advantage of all it has to offer.

POSTERS AND LECTERN SESSIONS

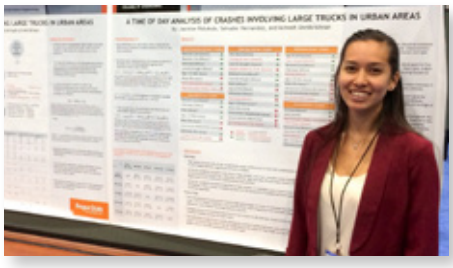
PacTrans researchers were active in showcasing the center's research at TRB lectern, poster, and workshop sessions. Here is a sampling of academic talks and papers presented.

Lectern Session: Distraction, Attention, and Driver Performance

Driver's Behavior in Road Tunnels: Association with Driver Stress and Performance

Erika Miller, ***University of Washington*** **• Linda Boyle,** ***University of Washington***

Complex traffic environments can negatively impact driver workload and driving performance. Driving through tunnels can be particularly stressful and these segments have been associated with higher crash rates. However, constraints of the natural environment (mountains, waterways) often restrict the flexibility to make major modifications in tunnels. Recognizing where drivers may experience higher workload and how driving performance may be affected can provide insights on road and tunnel design improvements. The purpose of this study was to evaluate stress as drivers traversed along an interstate route with tunnel and non-tunnel segments, as well as a 75-meter transition period prior to the tunnels. Data from 50 drivers was collected, including information from electrocardiogram (ECG) recordings such as heart rate and standard deviation of RR interval series (SDNN). Driving performance measures included vehicle speed and braking. Multivariate and univariate analysis of variance (MANOVA and ANOVA) were used to identify increases in driver's stress during several road segments: the transition to a tunnel entrance, within a tunnel, and open road segments. The largest variations in performance measures were observed within tunnels followed by the periods within the transition segments. Evaluation of continuous speed profiles along the route suggests that drivers tend to decrease speed prior to entering a tunnel and increase speed just before exiting a tunnel. Measures of stress indicated that drivers experienced highest workloads along the transition segments, followed by the tunnels.



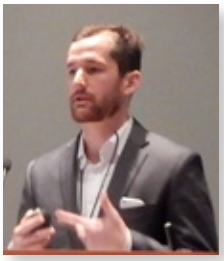
Poster Session: Truck and Bus Safety

Time-of-Day Analysis of Crashes Involving Large Trucks in Urban Areas

Jasmine Pahukula, ***Oregon State University*** **• Salvador Hernandez,** ***Oregon State University***

Previous studies have looked at different factors that contribute to large truck-involved crashes, however a detailed analysis considering the specific effects of time of day is lacking. Using the Crash Records Information System (CRIS) database in Texas, large truck-involved crashes occurring on urban freeways between 2006-2010 were separated into five time periods (i.e. early morning, morning, mid-day, afternoon and evening). A series of log likelihood ratio tests were conducted to validate that five separate random parameters logit models by time of day were warranted. The outcomes of each time of day model show major differences in both the combination of variables included in each model and the magnitude of impact of those variables. These differences show that the different time periods do in fact have different contributing factors to each injury severity further highlighting the importance of examining crashes based on time of day. Traffic flow, light conditions, surface conditions, time of year and percentage of trucks on the road were found as key differences between the time periods.

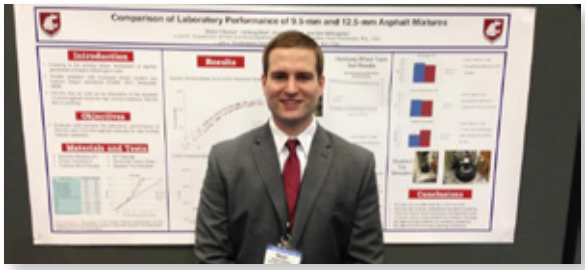
Lectern Session: Traffic Data Collection and Analysis



Flexible and Robust Method for Missing Loop Detector Data Imputation

Kristian Henrickson, ***University of Washington*** **• Yajie Zou,** ***University of Washington*** **• Yinhai Wang,** ***University of Washington***

This work is primarily focused on missing traffic sensor data imputation for the purpose of improving the coverage and accuracy of traffic analysis and performance estimation. Missing data, whether attributable to hardware failure or error detection and removal, is a constant problem in loop and other traffic detector datasets. As the rate of missingness increases, the treatment of missing values quickly becomes the controlling factor in overall data quality. Previously, a number of imputation approaches have been developed for traffic data. However, few studies aim at handling the traffic data with large blocks of missing values for network-wide implementation. A proven predictive mean matching multiple imputation method is introduced and applied to loop detector volume data collected on Interstate 5 in Washington State. Using the iterative multiple imputation by chained equations approach, the spatial correlation between nearby detectors is considered for prediction and the presence of missing data in all predictors is effectively dealt with. The proposed methodology is shown to perform well on a range of missing data patterns including missing completely at random, missing days, and missing months. After applying the imputation method to 20-second data and performing post-imputation aggregation, the results in this study suggest that the proposed method can outperform elementary pairwise regression and produce reliable imputation estimates, even when entire days and months are missing from the dataset. Thus, the predictive mean matching multiple imputation method can be used as an effective approach for imputing missing traffic data in a range of challenging scenarios.

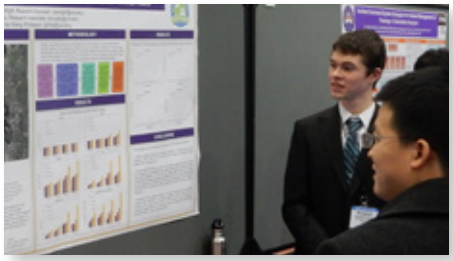


Poster session:

Comparison of Laboratory Performance of 9.5-mm and 12.5-mm Asphalt Mixtures

Skyler Chaney, ***Washington State University***

The standard asphalt mixture used in Washington State is a 12.5 mm nominal maximum aggregate size. The literature indicates that reducing the aggregate size will increase the asphalt binder content in hot mix asphalt (HMA) mixtures (FHWA, 2011). This can increase wear resistance (Fromm and Corkill, 1971), specifically in regards to fatigue cracking. In order to determine the benefit of decreasing the aggregate size, the standard 12.5 mm PG 70-28 with 4.9 percent binder was compared with a 9.5 mm PG 70-28 with 5.4 percent binder. Test results are compared for these two mixes, including IDT Modulus, creep compliance, thermal cracking, fatigue cracking, Hamburg Wheel Tracking Test, and studded tire wear resistance using the studded tire simulator developed at Washington State University.



Poster session: Incident Management

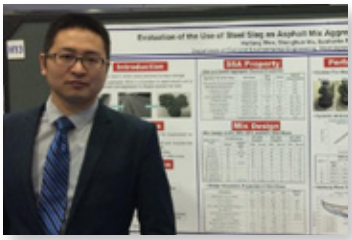
Impact of Traffic Incidents on Reliability of Freeway Travel Times

Benjamin Wright, ***University of Washington*** **• Yajie Zou,** ***University of Washington*** **• Yinhai Wang,** ***University of Washington***

Travel time reliability is a key measure of a freeway system's performance. Traffic incidents are one of the more important factors affecting travel time reliability, since traffic incidents reduce the capacity of a freeway section and generate a temporary bottleneck. In this study, an empirical travel time reliability analysis was conducted using four years of travel time and incident data collected on Interstate 5 and Interstate 405 in the Seattle metropolitan area. The incident data used for this study is notable for its breadth of information, which includes the incident type, specific incident location, time of occurrence, affected portion of the roadway, the time at which the incident was no longer blocking, and other useful information. Three incident types (i.e., shoulder, single lane, and multiple lane incidents) are considered in the data analysis. The results show that traffic incidents can result in both higher travel time variability and higher probability of freeway section traffic breakdown. The results show that among different incident types, multiple lane incidents induce the highest variability in freeway route travel times, while shoulder incidents induce the least variability. Travel time variability during multiple lane incidents increases by an average of 205% when compared to normal conditions (conditions with no incidents). Compared to normal conditions, shoulder incidents can significantly increase the probability of freeway section traffic breakdown. In general, traffic incidents have significant negative effects on travel time reliability. The findings in this study can help shape traffic incident mitigation and management policies for different incident types, especially when aiming to improve travel time reliability on freeway routes.

Poster session:

Evaluation of Use of Steel Slag as Asphalt Mix Aggregate to Mitigate Studded Tire Wear

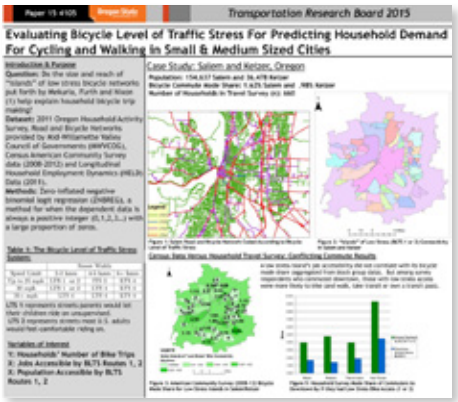


Haifang Wen, ***Washington State University*** **• Shenghua Wu,** ***Washington State University*** **• Sushanta Bhusal,** ***Washington State University***

Studded tire wear leads to severe deterioration of pavement. Therefore, the reduction of studded tire wear is urgently needed to improve asphalt pavement conditions and save repair costs. Steel slag is a co-product of the steel industry and features high hardness, when compared to conventional crushed aggregate, such as granite and limestone. This study evaluates the performance of hot mix asphalt (HMA) that contains steel slag aggregate (SSA) as a surface material to mitigate the studded tire wear. The physical properties of SSA were assessed to determine its suitabiity in HMA. Four percentages (0%, 20%, 40% and 60%) of SSA were used in asphalt mix, and the mix designs for HMA are conducted in accordance with Superpave mix design. The performance of the mixes was evaluated comprehensively in terms of studded tire wear, dynamic modulus, flow number, fracture properties at intermediate and low temperatures, and Hamburg wheel-tracking device testing. The results indicate that the addition of steel slag increases studded tire wear resistance, dynamic modulus values, thermal cracking resistance, and rutting resistance. In addition, the inclusion of SSA had no effect on top-down fatigue cracking resistance, and moisture susceptibility. Based on these laboratory test results, SSA could be especially beneficial in the Northwest region of the United States in surface course where studded snow tires are used and thus extends the service life of the pavement.

Poster Session:

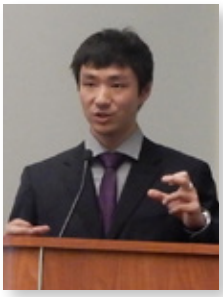
Evaluating Bicycle Level of Traffic Stress for Predicting Household Demand for Cycling and Walking in Small and Medium-Sized Cities



Haizhong Wang, ***Oregon State University*** **• Matthew Palm,** ***University of California, Davis*** **• Yiyi Wang,** ***Montana State University, Bozeman*** **• Rachel Vogt,** ***Oregon State University***

Small or medium-sized cities need publicly acceptable criteria for bicycle infrastructure that encourage bicycle travel behavior. This paper explores the effectiveness of one proposed system of bicycle infrastructure criteria using a state-of-the-art household travel survey, focusing on a small-sized case study of the road network of Salem, Oregon and its adjacent suburb Keizer. Exploring both summary statistics and modeling bicycle and walk trip counts at the household level, the authors find mode choice correlates low-stress connectivity of origins and destinations for bicycle and walk trips even though the criteria was developed for bicycles. The study also finds that households with access to larger "islands" of connected, low stress bicycle infrastructure produce more bicycle and walk trips. Authors suggest small/medium-sized cities and metropolitan planning organizations (MPOs) looking to increase walking and biking can benefit from applying bicycle level of traffic stress to their networks to identify ways of bridging "islands' of low-stress streets to provide greater bicycle accessibility for households.

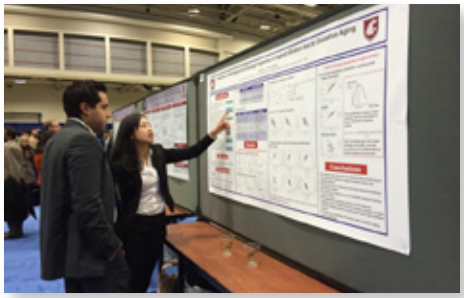
Lectern Session: Extracting Information from Images:
Technology Innovations in Sensing and Detection



Roadway Surveillance Camera Calibration Using Standard Moving Objects

Ruimin Ke, ***University of Washington*** **• Yingying Zhang,** ***Beijing Transportation Research Center, China*** **• Yinhai Wang,** ***University of Washington***

Surveillance video cameras have been increasingly deployed on roadway networks providing important support for roadway management. While the information-rich video images are a valuable source of traffic data, these surveillance video cameras are typically designed for traffic operators to manually verify roadway conditions and are not for automatic traffic data collection. It is clearly beneficial to turn these surveillance cameras into data collection cameras, but a big barrier must be cleared, i.e. a cost-effective method to quickly and easily calibrate surveillance video cameras must be developed so that the surveillance video cameras can be used to collect speed, volume, and vehicle classification data. This paper proposes such a method that calibrates surveillance video cameras using standard moving objects on the road. Standard moving objects refer to traffic objects which are intuitively identifiable and with known dimensions, e.g., shipping containers. Using this kind of object, the traditional camera calibration model can be simplified and camera parameters can be recovered with precise mathematical derivation. Since moving objects like shipping containers are ubiquitous, this method can be utilized and widespread in the field of traffic surveillance camera calibration. With all the camera parameters solved, the 3D object world coordinates can be reconstructed from 2D image coordinates, and thus enable the collection of a variety of traffic data using surveillance camera images.



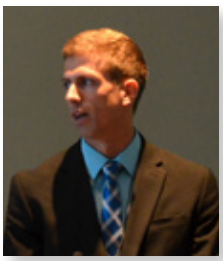
Poster session:

Prediction of Rheological and Damage Properties of Asphalt Binders due to Oxidative Aging

Fang Liu, ***Washington State University*** **• Haifang Wen,** ***Washington State University***

The aging of asphalt binder affects nearly all the critical aspects of hot mix asphalt and thus should be considered for pavement design. Most of the previous studies have focused on the effects of oxidative aging on the rheological properties of asphalt binder. However, aging-related distress mostly involves cracking where the binder is in the damage domain. Therefore, it is necessary to predict the damage properties of asphalt binder as a result of oxidative aging. The objective of this study is to develop a methodology to predict the rheological and damage properties of asphalt binders after aging. Three asphalt binders (one neat and two modified) were aged at four temperatures in a standard atmosphere for different periods. The carbonyl areas of the aged binders were determined using Fourier transform infrared (FTIR) spectroscopy, and the rheological properties and the damage properties were determined using frequency sweep and monotonic tests, respectively. An approximately linear relationship between the carbonyl area and the log of the crossover modulus was found, but it was asphalt-specific. It was also found that the inverse of the log crossover modulus can be characterized using the Arrhenius kinetics model. The relationship between the log crossover frequency and log crossover modulus was linear at each aging temperature. The crossover modulus and crossover frequency were used in the Christensen-Anderson model to predict the complex modulus and phase angle mastercurves of the binders. The predicted complex shear modulus and phase angle of the asphalt binders after aging, based on the carbonyl area, matched well with the measured complex shear modulus and phase angle values, except for the phase angle of the modified binders at a high temperature or low frequency. The complex shear modulus was converted into the shear relaxation modulus, which was found to correlate well with the shear strength and critical strain energy density and has been reported to be a cracking indicator in previous study.

Lectern Session: Rail Transit Safety and Access



Platform Edge Detection and Protection Effects on Platform-Train Interface Safety

Dylan Anderson, ***Oregon State University*** **• Katharine M. Hunter-Zaworski,** ***Oregon State University***

The purpose of this study is to provide background information and examples of best practices relating to platform-train-interface (PTI) safety. This manuscript was adapted from a literature review that was undertaken as part of the Transit Cooperative Research Program (TCRP) project A– 40 that aims to improve platform safety for rail modes of public transportation. The findings come from an extensive literature review, transit operator safety data, input from two workshops, and interviews with various stakeholders. Specifically, information was gathered from transit operators, station designers, station builders, car builders, and accessibility equipment manufacturers. The background research has shown that platform safety is primarily affected by technical factors, operational aspects, and passenger characteristics. This paper identifies possible issues and best practices for the technical design aspects of platform edge safety. It was determined that certain factors are universal between modes and can be grouped together. However, the research suggests that each mode has many factors that should be considered separately when determining potential mitigation strategies. The second part of this paper considers each mode separately.