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Message from the Director

The birds have returned to Creamer's Field, the students have walked across the stage and we're surrounded by the color green. These are all signs that spring has sprung in Fairbanks. It's been a busy semester for CESTiCC, with four research projects concluding, four webinars conducted, and lots of technology transfer, educational and professional outreach.

I hope that you will stay engaged with CESTiCC during your summer. I invite you to visit our website as well as our Facebook page to stay up-to-date with our many activities. Best wishes to you all for a wonderful summer.

Jenny Liu

Research Highlights

Environmental Impact Assessment is one of CESTiCC's five main research thrusts. Both of our featured research highlights for this newsletter are under this thrust.
The Life Cycle Assessment (LCA) Learning Module Series was developed by Liv Haselbach and Quinn Langfitt at Washington State University (WSU) as an educational, research and outreach activity for the CESTiCC. It is a set of narrated, self-advancing slide shows on various topics related to environmental LCA. This research project produced the first 27 of such modules, which are freely available for download on the CESTiCC website. Each module is roughly 15-20 minutes in length and is intended for various uses such as course components, as the main lecture material in a dedicated LCA course, or for independent learning in support of research projects. The series is organized into four overall topical areas, each of which contains a group of overview modules and a group of detailed modules. The A and α groups cover the international standards that define LCA. The B and β groups focus on environmental impact categories. The G and γ groups identify software tools for LCA and provide some tutorials for their use. The T and τ groups introduce topics of interest in the field of transportation LCA. This will include overviews of how LCA is frequently applied in that sector, literature reviews, specific considerations, and software tutorials. Future research is planned to enhance the transportation module group.

Many of the modules have been used in classroom settings. This includes a 3 credit graduate course at WSU in the fall of 2016. The investigators were interested in researching the effectiveness of the modules when played in a classroom setting followed by class discussions. The experiment appears very successful based on surveys taken by the students. The only main suggestion for improvement was to intersperse discussion during the playing of the slideshow. This can be readily done as the modules can be stopped and started at any time. The current modules can be found at http://cem.uaf.edu/cesticc/publications/lca.aspx. The investigators would like to hear from those who use the modules. Please email Liv Haselbach at haselbach@wsu.edu.
An Empirical Model for Optimal Highway Durability in Cold Regions

In cold regions, highways are built with great durability to reduce road wear caused by traffic loadings and weather related factors, such as anti•icing operations during winter months. Durability of highways can be increased by different methods, such as thicker pavements, better pavement materials and drainage, and less•corrosive deicing chemicals. The costs of increasing durability are compensated by a reduction in maintenance costs during the life•time of the highway infrastructure. Therefore, optimal policy making requires answers to the question: What is the optimal highway durability in cold regions? In a recent project funded by CESTiCC and WSU, Dr. Jia Yan, Associate Professor of Economics at WSU, worked with two PhD students – Jiehong Qiu and Xinlong Tan, to develop an empirical model to compute the optimal highway durability in cold regions.

In order to develop their empirical tool, Dr. Yan and his students assembled a data set containing all highway construction and maintenance projects in Arizona and Washington state from 1990 to 2014 to test the model. The data set included information on location, time, type (resurfacing, construction or lane widening), pavement material & thickness, and total cost of these projects. Using this, the team first estimated how highway maintenance costs and duration depend on pavement thickness and traffic loading. They then calibrated the effects of different deicers on highway durability and thus highway maintenance costs. Finally, they demonstrated how the estimated and calibrated model can be used by planners to make optimal decisions on highway pavement and winter operations in cold regions.

The model suggests that the the most significant factor when determining optimal highway durability is pavement thickness. Optimal thickness can minimize life•time total pavement cost ($ per lane mile). The team then constructed the life•time total pavement cost of a highway. The cost includes three components: resurfacing or maintenance cost, the duration of highway, and construction costs. Pavement Thickness impacts all three components: increasing thickness increases duration which reduces life•time maintenance costs, but the cost of construction increases, as well. The research team found that the optimal highway pavement thickness in cold regions is 8-8.5 inches, which is 1-1.5 inches more than the average thickness of highways in warm regions. The model demonstrated that utilizing this optimal pavement thickness in cold regions may yield up to a 33% increase in total lifespan of highway pavement.

The findings from the research project have been presented at a Webinar hosted by CESTiCC and internal workshops attended by faculties, PhD students and visitors in transportation economics and civil engineering at WSU. An academic paper based on the main findings of the project has also been developed and will be submitted to the TRB annual meeting in 2017. For further information, please contact jiay@wsu.edu.
Outreach

2016 Future City Competition
CESTiCC researcher Somayeh Nassiri, assistant professor of Civil Engineering at WSU co-organized the Future City competition, which was held for the first time on the WSU Pullman campus in January, 2016. More than 130 6-8th graders participated in the event, which challenged them to design a city for 100 years in the future along a sustainability theme. This year's theme was "waste not, want not."

Engineering Open House
CESTiCC and the UAF College of Engineering and Mines shared the joys of engineering with the community of Fairbanks on February 27th. The open house was attended by around 550 community members. CESTiCC operated a Hot Wheels RC Derby attraction which made transportation come alive!

Fairbanks Career Expo and Job Fair
CESTiCC's outreach coordinator Joe Alloway joined UAF's Admissions team at the Fairbanks Career Expo and Job fair on March 22nd. Joe interacted with community members of all ages and helped share information about working in the field of transportation.

Spring SWANA Meeting
Sheng Zhao, Joe Alloway and Center student Kannon Lee presented at the spring meeting of the Solid Waste Association of North America (SWANA) in Anchorage on April 15th. The group introduced CESTiCC to the assemblage and discussed potential collaboration on the use of recycled materials in infrastructure construction.

CESTiCC Transports Kids2College Students to the World of Infrastructure
CESTiCC showed the world of transportation to two classes from Ladd Elementary at the annual Kids2College event on April 27th. Sessions included a classroom session which challenged students to consider challenges related to infrastructure construction in Alaska and a tour of our asphalt lab in which students were shown what we use and how we turn raw materials into the roads they live on.
Pearl Creek Transportation Day

CESTiCC presented to 2nd and 3rd graders at Pearl Creek Elementary on Monday, May 9th about roads and transportation issues. After the students wrapped their heads around transportation, they were challenged to create their own roads using a mixture of NeoTracks and asphalt concrete samples which were made in UAF’s labs.

Technology Transfer

CESTiCC Researchers Preside and Present at TRB

The TRB 95th Annual Meeting was held January 10–14, 2016, in Washington, D.C. CESTiCC was glad to showcase the Center’s research and outreach through various venues at TRB such as lectern, poster, workshop sessions, and professional meetings at this important and internationally attended venue.

CESTiCC researchers gave about 20 presentations covering a wide range of topics on environmentally sustainable transportation infrastructure at TRB. Drs. Xiong Zhang, Xianming Shi and their research group’s presentations showcased their substantial effort on advancing innovative sustainable materials and design for transportation infrastructure use in cold regions. Some of examples included Use of Odometer Equipped with High-Suction Tensiometer to Characterize Unsaturated Soils, Dehydration of Roadway Embankment Using a Wicking Fabric, and Electron Probe Microanalyzer Investigation into High-Volume Fly Ash Mortars. Dr. Liv Haselbach’s talk on Nondestructive Method for Estimating Porosity of In-Situ Pervious Concrete represented many studies that concentrated on solutions to better management of stormwater runoff in cold climate. She also presented a talk entitled Temperature-Related Climatic Impacts.
on Surface Infiltration Rates of Pervious Concrete, which showcased CESTiCC’s work on addressing the environmental impact on transportation infrastructures in cold areas.

Other CESTiCC presentations focused on reducing environmental impacts during construction, operations and preservation through effective design, management and preservation strategies. These included Ms. Laura Fay’s Use of Equipment Lighting during Snowplow Operations: Identified Best Practices and Dr. Xianming Shi’s Effectiveness of Salt Removers and Sugar beet Byproduct in Protecting Metals from Corrosion by Magnesium Chloride Deicer and Best Practices for the Prevention of Corrosion to DOT Equipment. In addition, CESTiCC’s young professionals had the opportunity to showcase their research at the TRB meeting. Washington State University Ph.D students Gang Xu and Sen Du presented on the Exploratory Investigation into Upcycling of Coal Fly Ash as Sole Binder for Mortars, and Laboratory Investigation into the Mix Design of High-volume Fly Ash Mortars.

CESTiCC researchers also demonstrated their expertise and leadership in the transportation field by serving as moderators of various events at TRB. Dr. Jenny Liu served as the presiding officer of a workshop on Tools and Techniques for Evaluation of Thermal Cracking Properties of
Asphalt Mixtures, and chaired ASCE Bituminous Materials Committee (BMC) Annual Meeting in conjunction with the TRB 95th Annual Meeting. Dr. Xianming Shi was the presider for a poster session on Geomaterials in Transportation Infrastructure: Deformation, Leaching, and Erosion and the moderator of one technical at the Asia-US Infrastructure Technology Exchange Forum workshop.

Liv Haselbach and Brandon Werner Present at WSU Research Fair

CESTiCC researchers Brandon Werner and Liv Haselbach presented a poster of their research titled Temperature related climatic impacts on the surface infiltration rates of pervious concrete at WSU's research fair on Thursday, March 24th, 2016. The purpose of the research was to determine if the level of infiltration in pervious concrete was significantly impacted with higher viscosities of water occurring during colder temperature events.

Jenny Liu Presents at ASCE CI Summit

Jenny Liu presented at this year's ASCE Construction Institute (CI) summit in Orlando Florida in March. On behalf of ASCE Bituminous Materials Committee (BMC), she chaired a session entitled Advances in Pavement Design, Construction, Preservation and Assessment. The panel, including Dr. Liu, featured industry professionals and academic experts in discussing advancements and developments in the field of pavement.

Webinar Series

Four webinars were hosted by CESTiCC this spring. Three webinars presented research findings and one related to academic and professional development. The presentations for each were recorded and are available on the CESTiCC website.

Sustainability Practices in Highway Winter Operations: A Renewed Perspective

In February, Dr. Xianming Shi presented the findings of his research on the shifting landscape of sustainability practices in highway winter operations. Sustainability is a three pronged approach which considers environment, society and economics. Economic issues related to various transportation modes, particularly with increased freight transport in many of these regions, and
impacts of wintertime maintenance are important. Together with severe weather impacts and environmental changes, economic analyses are needed to support this development. Highway agencies are under increasing pressure to integrate sustainability into their snow and ice control programs while balancing other priorities and constraints. Significant advances have been made both in management and technology domains to enable sustainability practices. This research provided a high-level overview of benefits and emerging challenges in highway winter operations related to traction materials, approaches and management practices, technologies which reduces usage of snow/ice control materials, and development of "greener" products.

Cross USA Lecture of the ASCE Geo•Institute: Observation Method for Bridge Scour
In March, Fairbanks' ASCE, ASPE, and CESTiCC collaboratively welcomed Texas A&M's Jean•Louis Briaud to Alaska for a presentation regarding his proposed Observation Method for Scour (OMS). One bridge collapses every ten days in the USA and 60% of the time it is due to scour. There are approximately 17,000 scour critical bridges, those deemed to have unstable foundations due to scour, in the United States. Briaud argues that the current federal method for assessing scour is too stringent and can reduce the deployment of limited resources to bridges which are not actually scour critical. The proposed OMS uses charts that extrapolate or interpolate observed scour depths at the bridge to predict future depths.

An Empirical Model for Optimal Highway Durability in Cold Regions
In April, professor Jia Yan presented the findings from his CESTiCC sponsored research, An Empirical Model for Optimal Highway Durability in Cold Regions. A "one size fits all" approach to highway maintenance is too simplistic for the myriad environmental challenges to highway maintenance in the United States. Methods devised for warmer climates fail to take into account standard winter maintenance in colder regions, such as the application of deicing chemicals, which impacts highway durability. Yan's research team created an empirical model and gathered 24 years of data from Washington and Arizona State DOTs to test it. They first estimated how highway maintenance costs and duration depend on pavement thickness and traffic loading. They then calibrated the effects of different deicers on highway durability and thus highway maintenance costs. Finally, they demonstrated how the estimated and calibrated model can be used by planners to make optimal decisions on highway pavement and winter operations in cold regions.

Planning and Preparation for an Academic Career
The decision to pursue a career in academia is not one to be taken lightly. There are many factors aspiring professors should take into considering both during and after they've completed their education. In late April, CESTiCC and International Association of Chinese infrastructure Professionals (IACIP) co-hosted a webinar on Planning and Preparation for an Academic Career. A panel composed of renowned professors in civil engineering transportation programs shared their insight on academic jobs and what people need to know as they prepare for academic careers. The group is planning to produce a follow-up webinar in the fall.

Achievements and Accolades
Beaux Kemp Named 2015 CESTiCC Student of the Year

Beaux Kemp, an MS Civil Engineering student at UAF was named the CESTiCC Student of the Year for 2015. The Student of the Year is chosen based on their academic performance, professionalism, leadership and research. Beaux received his award at the annual CUTC Winter Awards Banquet in Washington D.C. on January 11th, 2016.

CESTiCC Student and Faculty Receive Top ASPE Honors

CESTiCC director Jenny Liu and her M.S. Student Beaux Kemp were presented with the Alaska Society of Professional Engineers (ASPE) Fairbanks Chapter Engineer of the Year and Student Engineer of the Year awards for 2016. As is tradition, Jenny received her crown from the 2016 Engineer of the Year and will coronate her successor.

Anthony Mullin and Patricia Ruiz Bowen Defended Their Theses

CESTiCC Receives 2015 Golden Heart Meeting Ambassador Award from the City of Fairbanks, Alaska

On behalf of CESTiCC, Dr. Sheng Zhao received the 2015 Golden Heart Meeting Ambassador Award on February 17th. This award recognizes CESTiCC’s hard work and contributions to the local community for organizing the International Symposium of Systematic Approaches to Environmental Sustainability in Transportation held in August, 2015 in Fairbanks. The award was presented by the Mayor’s Office of the City of Fairbanks.

UAF Steel Bridge Team and Concrete Canoe Stand Strong at Regional Competition

The UAF Steel Bridge and Concrete Canoe teams competed in the Pacific Northwest Regional competition from April 8•10 in Moscow, Idaho. The Canoe team gave a strong showing and the Steel Bridge team won best overall and best display. The Steel Bridge team will go on to the national competition later in May. The teams also produced an excellent video which documented their designs and experience at the competition. CESTiCC is proud to sponsor both teams and wishes them the best of luck!

Upcoming Events

Imagine Tomorrow Competition, May 20•22
CESTiCC is a proud sponsor of the Imagine Tomorrow competition, which challenges 9th through 12th graders to seek new ways to support the transition to alternative energy sources. Students research complex topics related to renewable energy, then innovate technologies, designs, or plans to mobilize behavior. The competition will be held at the WSU Pullman Campus.

Dr. Xiong (Bill) Yu, a Professor of Civil Engineering at Case Western Reserve University will present a webinar about his research into Environmentally Responsive Pavement Materials. Registration is now open for this webinar.

2016 CUTC Summer Meeting, June 6•8
The CUTC summer meeting will be held in Los Angeles in June and hosted by METRANS, the UTC for the University of Southern California and California State University, Long Beach.

2016 Transportation Research Congress Conference (TRC•C), June 6•8
TRC•C will be held in Beijing, China in the National Convention Center. TRC•C aims to provide an international platform for universities, research institutes, industries, associates and
governments to incubate, lead, demonstrate and implement innovations and ultimately evolve into a think tank for transportation innovations. CESTiCC director Jenny Liu serves as the co-chair of the science committee. CESTiCC is pleased to be co-sponsoring and organizing TRC.C.

2016 Gravel Roads Summer Transportation Institute, June 6-9
The Alaska Tribal Technical Assistance Program Center and CESTiCC will host a Summer Transportation Institute in June in Fairbanks, Alaska. This 4-day training workshop will engage participants in lectures, lab tours, and field trips with various topics on transportation infrastructure in a rural and cold environment.

2016 TRB ADC60 Summer Workshop, July 26-29
CESTiCC is pleased to sponsor the 2016 TRB ADC60 Committee on Resource Conservation and Recovery summer workshop, which will be held in Asheville, North Carolina. Topics covered at the workshop include, but are not limited to: waste management, contaminated site assessment, resource efficiency and sustainability.

2016 Annual Meeting in Bozeman, Montana, August 12
CESTiCC will host an annual one-day workshop in August at one of our consortium universities, Montana State University (MSU). The workshop will highlight the work completed through the Center with poster and lectern sessions as well as field trips. Further information about this meeting will be posted on the CESTiCC website. Stay tuned!