Workshop-2 Program
Shaping a sustainable future for asphalt pavements

July 15, 2021

Time: 9:25 - 12:25 GMT

Click the Zoom link to join this Workshop

Contact Email: p.lin-2@tudelft.nl

Preface

The footprint of the transportation sector on the environment, economy, and society has become an integral part of developing new policies and strategies to promote a sustainable future for these essential infrastructures. More specifically, this consideration is also valid for asphalt pavements. The construction, operation, maintenance, and rehabilitation process of roads is highly energy demanding and requires enormous natural and non-renewable resources. Such a situation solicits prompt action from academia, industry, and transportation authorities to develop innovative analysis methods, novel materials, advanced design solutions, and revolutionary construction technology. Workshop 2 "Shaping a sustainable future for asphalt pavements" aims to provide a global view on the ongoing cutting-edge research in road and pavement engineering toward sustainability and resiliency, also with a perspective in the future technology. The event includes seven presentations from different countries, research viewpoints, and institutions, making it scientifically, geographically, and contextually inclusive and diverse.

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09:25 - 09:30 (GMT) **11:25 - 11:30 (CET)** **17:25 - 17:30 (CST)** **14:55 - 15:00 (IST)**	**Welcome** Dr. Augusto Cannone Falchetto, Aalto University, Finland
09:30 - 09:50 (GMT) **11:30 - 11:50 (CET)** **17:30 - 17:50 (CST)** **15:00 - 15:20 (IST)**	**Effects of the repeatedly recycling for asphalt pavement in Japan** Dr. Atsushi Kawakami, Public Works Research Institute, Japan
09:50 - 10:10 (GMT) **11:50 - 12:10 (CET)** **17:50 - 18:10 (CST)** **15:20 - 15:40 (IST)**	**Sustainable asphalt pavements using bio binders** Dr. Chiara Riccardi, TU Braunschweig, Germany
10:10 - 10:30 (GMT) **12:10 - 12:40 (CET)** **18:10 - 18:30 (CST)** **15:40 - 16:00 (IST)**	**Evaluating the effect of remixing on modified asphalt mixtures: Preliminary results** Dr. Daniel Castillo, Aalto University, Finland
10:30 - 10:50 (GMT) **12:30 - 12:50 (CET)** **18:30 - 18:50 (CST)** **16:00 - 16:20 (IST)**	**Conceptual design of self-powered pavement- e-Road** Dr. Zixuan Chen, Chang'an University, China
10:50 - 11:00 (GMT) **12:50 - 13:00 (CET)** **18:50 - 19:00 (CST)** **16:20 - 16:30 (IST)**	**Coffee break**
11:00 - 11:20 (GMT) **13:00 - 13:20 (CET)** **19:00 - 19:20 (CST)** **16:30 - 16:50 (IST)**	**Fibre-reinforced asphalt materials: towards to a sustainable and durable asphalt pavement** Dr. Di Wang, TU Braunschweig, Germany
11:20 - 11:40 (GMT) **13:20 - 13:40 (CET)** **19:20 - 19:40 (CST)** **16:50 - 17:10 (IST)**	**Challenges of recycling techniques in asphalt mixtures: the cases of recycled plastics and the proper use of asphalt rejuvenators** Prof. Silvia Caro, Los Andes University, Colombia
11:40 - 12:10 (GMT) **13:40 - 14:10 (CET)** **19:40 - 20:10 (CST)** **17:10 - 17:40 (IST)**	**Towards more sustainable asphalt materials: the U.S. perspective** Dr. David J. Mensching, Federal Highway Administration (FHWA), U.S. Dr. Heather Dylla, Federal Highway Administration (FHWA), U.S.
12:10 - 12:25 (GMT) **14:10 - 14:25 (CET)** **20:10 - 20:25 (CST)** **17:40 - 17:55 (IST)**	**Discussion**

Moderators Augusto Cannone Falchetto & Di Wang. Click the **Zoom link** to join the workshop

Workshop Chairs

Dr. Augusto Cannone Falchetto research focuses on infrastructure materials and pavement engineering and combines experimental research, advanced analysis and modelling. His interests include materials modelling and performance, mix optimization, pavement structural behaviour, fatigue, healing, hot and cold recycling, and Digital Image Processing. Dr. Cannone Falchetto has made outstanding contributions to the field throughout his career, which is evident in his widely published and cited work. As an active RILEM member, he has been involved in several Technical Committees and contributed to State-of-the-Art Reports, technical papers and recommendations. Based on the sound application of scientific principles, his research has developed solid practical relevance and attracted recognition through numerous awards, such as the prestigious Robert L'Hermite.

Dr. Di Wang is currently a Post-doc researcher at the Technical University of Braunschweig, Germany. He received his bachelor's and master's degree in pavement engineering from Chang'an university, and the Ph.D. degree at the Technical University of Braunschweig, Germany. His research interests focused on the areas of asphalt pavement, especially in performance properties of bituminous materials, rheological properties of asphalt binder and mixtures, green and circular materials used in asphalt pavement, and intelligent infrastructure. He participated in 6 European, German and RILEM projects and published more than 60 scientific contributions in the past five years. He also served as conference organization member, scientific committee, and session chair in more than 10 international conferences world widely in the areas of pavement and waste management. Currently, he is serving in several sector associations, such as the CEN Task Group, RILEM, NRS, COTA, and IACIP. Furthermore, he is also serving as young editors, guest editors, and reviewers in more than 30 scientific journals. Besides, he is the inventor of 17 Chinese national patents.

About the speakers

Presentation: Effects of the repeatedly recycling for asphalt pavement in Japan

Dr. Atsushi Kawakami is a senior researcher at the Public Works Research Institute (PWRI) in Japan. He works within the pavement research team and road technology research group. Dr. Kawakami received B.Eng and Dr.Eng in Civil Engineering from the Nihon University, Japan. His research in pavement covers several aspects. In the first phase of his career, he worked for the Road Environment Division, PWRI, Ministry of Construction, devoting his effort to research the natural environment assessment for road structure. Then, he served for the Research Planning Division, National Institute for land, infrastructure and management (NILIM), Ministry of Land, Infrastructure, and transport. Later, Dr. Kawakami was a visiting researcher at the Swiss Federal Laboratories for Materials Science and Technology Empa. Currently, his research focus is on pavement recycling, rolling resistance, and life-cycle CO_2 analysis.

Abstract:

In Japan, asphalt pavement has been practiced for over 40 years. Today, the recycling rate of asphalt pavement is as high as almost 100%. Furthermore, the RAP contents in the asphalt mixture exceed 50% on a national average. On the other hand, there are concerns about the effects on bitumen and asphalt mixture properties due to the repeated recycling of asphalt pavement. Therefore, PWRI has been studying the impact of repeated recycling of asphalt pavement. As a result, it was found that when asphalt was repeatedly recycled with a rejuvenator, the softening point increased, and the ductility decreased. This trend was observed even if the degree of needle penetration was the same. Furthermore, it was clarified that this tendency differs depending on the components of the rejuvenator. Such an effect becomes more remarkable in the saturated than in the aromatic components of the rejuvenator. In addition, it was found that the mixture test showed brittle properties at high temperature, which the cantabro test can evaluate.

Presentation: Sustainable asphalt pavements using bio binders

Dr. Chiara Riccardi gained her Bachelor's degree in Civil and Environmental Engineering in 2009 and her Master's degree in Hydraulic, Transport and Environmental Engineering in 2012 in University of Pisa, Italy. She then joined the research group of Prof. Massimo Losa at the University of Pisa and Prof. Michael Wistuba at Braunschweig Pavement Engineering Centre, Germany. She received her Ph.D. degree in 2017 at both institutions. Then, she started a postdoctoral fellowship at Braunschweig Pavement Engineering Centre, TU-Braunschweig and now she is a Senior researcher at the same institute. Her main research interests include the characterization and modeling of bituminous materials in all the different scales, the use of waste and bio-materials in road construction and the use of sensors in asphalt pavement. She has published more than 70 scientific articles in journals and international conferences.

Abstract:

As stated in the European strategic energy and climate targets for smart, sustainable, and inclusive growth, *the climate and resource challenges require drastic action. Strong dependence on fossil fuels such as oil and inefficient use of raw materials expose European consumers and businesses to harmful and costly price shocks, threatening economic security and contributing to climate change*. In particular, the pavement construction sector depletes massive amounts of raw materials. More than 26 million tons of fossil-based binder and more than 2 billion tons of natural aggregates are consumed every year in EU and US. The demand for these materials is still continuously increasing, which will further inflict a scarcity of natural resources. To mitigate environmental problems and to stimulate the transition to a circular and bio-based economy, it's necessary to find new solutions for designing innovative versatile civil engineering materials from biomass and wastes only, pushing in the direction of "Zero Waste" philosophy. It's within this context that in the last decade some research efforts were devoted to investigating the feasibility of using biomaterials, locally produced from biomass sources, to partially or totally replace the fossil-based binder in asphalt mixtures. Some of these research efforts will be presented during this speech, going in more details with the results obtained at TU-Braunschweig using the bio binders in combination with high amount of Reclaimed Asphalt Pavement (RAP). The overall results showed that if properly engineered, the bio binder can have comparable or better performances to the conventional fossil-based binders; and thanks to their rejuvenating effect, high percentage of RAP can be used in asphalt mixtures.

Presentation: Evaluating the effect of remixing on modified asphalt mixtures: Preliminary results

Dr. Daniel Castillo is a postdoctoral researcher at Aalto University (Finland). He works in the Department of Civil Engineering within the Mineral-based materials and mechanics research group. Over the years, his research has focused on modeling the complexity of asphalt mixtures, including heterogeneity in material properties, geometry, and mechanical behavior of its phases. More recently, Dr. Castillo has been gaining experience in evaluating the behavior of recycled materials, particularly modified asphalt mixtures. Previously, he has worked as a researcher at the University of Illinois at Urbana-Champaign (USA), Texas A&M University at Qatar, and Universidad de Los Andes (Colombia).

Abstract:

Hot-in-place recycling of surface asphalt layers, also called remix, is a common rehabilitation approach in Finland. It is a cost-efficient treatment with environmental and economic advantages, which have led transportation agencies to apply it for several years. Simultaneously, as more roads are constructed with different types of alternative asphalt mixtures, agencies are interested in discovering the effect of the remix process on these 'new' materials and how they differ from the remix of traditional asphalt mixtures. These alternative mixtures include modified mixtures and mixtures with very soft bitumen or mixtures where industrial wastes have partially replaced conventional aggregates. The objective of this project is, therefore, to study the effect of remixing modified asphalt mixtures. For this purpose, we are finding ways to evaluate this effect, assessing the change in properties before and after remix for the different materials.

Presentation: Conceptual design of self-powered pavement- e-Road

Dr. Zixuan Chen is currently working in the School of Highway at Chang'an University as an Assistant Professor. Her research areas of interest are construction materials and their multiscale behaviors. She has published over 10 journal papers in Construction and Building Materials, Journal of Cleaner Production, Polymers, Journal of Testing and Evaluation and other domain well-known journals and conferences. In addition, she has been awarded two patents and presided or participated in five national-level research projects.

Abstract:

The concurrent crises in energy supply and environmental degradation have led to an urgent need to develop and utilize renewable energy sources. As an important component of infrastructure worldwide and a promising energy conversion locale, the potential for using regenerated energy from road traffic has been a hotspot. In this context, the proper application of piezoelectric, thermoelectric and photoelectric could be reasonably expected to produce a considerable amount of generated power. In this presentation, a new concept of e-Roads, which integrating two or more energy harvesting technologies, is proposed and defined in detail. In this manner, some attempts were made from various aspects to realize the application and optimization of different harvesting modes. Different piezoelectric materials prepared to improve the generating efficiency and also the durability in the pavement will be briefly introduced. Meanwhile, according to the conceptual design of e-Road, the stored energy can be supplied to wireless charging systems and an in-door experimental device will be presented to explain the investigation on the transmission efficiency in wireless power transfer systems. Also, it is expected that a future e-Road system will both generate sustainable energy for grid use and serve as a complete intelligent roadway system.

Presentation: Fibre-reinforced asphalt materials: towards to a sustainable and durable asphalt pavement

Dr. Di Wang is currently a Post-doc researcher at the Technical University of Braunschweig, Germany. He received his bachelor's and master's degree in pavement engineering from Chang'an university, and the Ph.D. degree at the Technical University of Braunschweig, Germany. His research interests focused on the areas of asphalt pavement, especially in performance properties of bituminous materials, rheological properties of asphalt binder and mixtures, green and circular materials used in asphalt pavement, and intelligent infrastructure. He participated in 6 European, German and RILEM projects and published more than 60 scientific contributions in the past five years. He also served as conference organization member, scientific committee, and session chair in more than 10 international conferences world widely in the areas of pavement and waste management. Currently, he is serving in several sector associations, such as the CEN Task Group, RILEM, NRS, COTA, and IACIP. Furthermore, he is also serving as young editors, guest editors, and reviewers in more than 30 scientific journals. Besides, he is the inventor of 17 Chinese national patents.

Abstract:

Existing transport infrastructures are facing critical challenges to maintain a reliable performance of the road network, which is being threatened by the increase of heavy traffic, the opening of new freight corridors and the effect of climate change, among others. Maintaining a satisfactory service level currently implies frequent roadworks that generate significant environmental, economic and societal impacts, reducing at the same time mobility and reliability of the road network and increasing the travel time. Therefore, fostering the implementation of innovative solutions, like the addition of fibres in asphalt mixtures that improve their mechanical performance and durability and, consequently, the service life of the whole pavement, is indispensable. During this speech, the experimental results obtained by a CEDR project entitled 'Fostering the implementation of fibre-reinforced asphalt mixtures by ensuring its safe, optimized and cost-efficient use (FIBRA)' will be reported. The overall results showed that if the mixture design and fibre type are carefully selected, the fibre could improve the performance properties of the bituminous materials, and thanks to their reinforced effect, a high percentage of RAP up to 50% can be used in the binder layer.

Presentation: Challenges of recycling techniques in asphalt mixtures: the cases of recycled plastics and the proper use of asphalt rejuvenators

Prof. Silvia Caro obtained her BS and MSC degree from Los Andes University in Colombia, and her PhD degree from Texas A&M University. She is currently a full professor of the Department of Civil and Environmental Engineering at Los Andes University and Associate Dean for Academic Affairs of the School of Engineering. She is currently the past-president of the Academy of Pavement Science and Engineering (APSE), chair of the AKM40 committee in asphalt mixture evaluation and performance of the Transportation Research Board (TRB), associate editor of the journal Road Materials and Pavement Design and member of the editorial board of the International Journal of Pavement Engineering. Her main research interests include the advance experimental and computational modeling of the performance and degradation of asphalt materials, the evaluation of new sustainability approaches in asphalt pavements, and the assessment of coupling mechanical and environmental effects in the response and durability of asphalt mixtures.

Abstract:

Among the different sustainability-related techniques that are currently being explored in the area of flexible pavements, the use of recycled materials —from the same industry or produced by other industries— continues being a main area of interest. This work presents some recent advancements in the experimental characterization of asphalt mixtures fabricated with two recycled materials: 1) PET plastic, as a replacement of mineral aggregates in asphalt mortars and asphalt mixtures, and 2) high contents of reclaimed asphalt pavement (PAV) materials with new vegetable oil rejuvenators. A main objective of the work is to raise awareness about multiple aspects that should be considered when including recycled materials and other additional components in asphalt mixtures, in order to secure the quality and durability of the new materials.

Presentation: Towards more sustainable asphalt materials: the U.S. perspective

Dr. David Mensching is the Asphalt Materials Research Program Manager for the Federal Highway Administration (FHWA). He is the director of Turner-Fairbank Highway Research Center's Asphalt Binder and Mixture Laboratory and has research interests in automation and data science, connected pavements, resilience, and performance specifications. He is the chair of the Transportation Research Board's Standing Committee on Binders for Flexible Pavement and an active member of the Association of Asphalt Paving Technologists. Dr. Mensching holds Bachelors and Masters degrees from Villanova University and a Ph.D. from the University of New Hampshire. He is a licensed professional engineer in the Commonwealth of Virginia.

Dr. Heather Dylla is a Sustainable Pavement Engineer for the Federal Highway Administration, where she manages the FHWA Sustainable Pavements Program and the Pavement Policy. In this role, she is leading an effort to incorporate principles of life cycle thinking into the design and decision-making process that include the three pillars of sustainability: economic, environmental, and social impacts. Heather obtained her doctorate from the Louisiana State University, where she focused on quantifying the environmental impacts of photocatalytic concrete pavements.

Abstract:

With renewed focus on climate change mitigation, economic strength, equity, and safety, incorporating principles of sustainability into our engineering and design of pavements is critical. This presentation will highlight some of the upcoming challenges engineers will face and identify what tools and resources are available.

Workshop Secretary

Dr. Peng Lin works as a postdoctoral researcher at the Pavement Engineering Section in the Delft University of Technology. He graduated from Department of Civil Engineering in Chongqing University in 2013. In 2016 and 2020 he received his Masters's and Doctor's degree in Tongji University, respectively. His main research interests are the experimental and numerical characterization of polymer modified bitumen. He is recently working on recycling asphalt pavement materials to improve the circular economy and reduce raw materials consumption and CO_2 emissions. Research topics include developing innovative rejuvenators for high-performance recycling of polymer modified asphalt mixture and high-quality cold in-place recycling techniques. He has published 32 peer-reviewed journal or conference articles, consisting of 16 SCI papers as first/corresponding author. He also serves as a young editor for a technical journal and the reviewer for 12 SCI journals. He was awarded the National Scholarship for Doctoral Student, Excellent Graduates in Shanghai and Science and Technology Progress Award in Guangzhou. He is the fundraising/young committee member of IACIP, TRC and IFRAE, and the member of TRB, AAPT, RILEM and APSE.

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